# Climate Policy Bias in Recent Newspaper Coverage of Global Warming

## Master's Thesis

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presented by

**Stefan Meier**

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Supervisor:

**Prof. Dr. Vally Koubi**

Department of Economics and Oeschger Centre for Climate Change Research

Co-Supervisor:

**Prof. Dr. Heinz Wanner**

Institute of Geography and Oeschger Centre for Climate Change Research

*Mitigate we might, adapt we must.*

W. D. Nordhaus

*For my Parents*

# Abstract

Global climate change is one of the major challenges humanity is facing in this century and beyond. It is imperative that the policy choices today reflect the consequences for future generations that are potentially irreversible. Today's mass media have the power to shape the people's understanding on environmental issues, and their coverage of global climate change has been crucial in raising public awareness on this imminent problem, as well as on the growing scientific consensus about the issue. Due to the substantial scientific uncertainties associated with the assessment of the actual state of the planetary climate system, as well as in the projections of climate models, the appropriate combination of climate response strategies remains uncertain. Until recently, mitigation options have been the major focus of academic and political debates. This study argues, that the historical policy preference has led to a bias for mitigation strategies in recent newspaper coverage of climate change, and aims to emphasize the crucial importance of adaptation efforts in a future international climate regime. A content analysis of the news coverage of climate change and global warming during the second half of 2008 in six prestige press newspapers from the United States, Germany, and Switzerland was executed, to investigate whether the newspaper coverage featured a bias for mitigation strategies, as well as to assess the accuracy of the print media representation of climate change and global warming in general. In addition, recent developments in national public opinions on climate change and in the domestic climate policy-making were qualitatively analyzed to assess the influence of the newspaper coverage on public opinion, as well as the potential influence of public demand on national climate policy. Although not statistically significant, the surveyed newspaper coverage was observed to feature an obvious bias for mitigation strategies. The results further indicated that the news reporting was predominantly objective, and that the majority of references concerning scientific facts were accurate. Public opinion on climate change was apparently influenced by the media coverage, since the focus on economic issues during the surveyed period has led to a substantial decrease in public concern about global warming in all three countries. However, public demand for action on climate change did not seem to exert a discernible influence on domestic policy-making in Germany and Switzerland. The observed shift from voluntary to more regulatory climate policy meas-

ures in the United States was linked to the election of Barack Obama as US President in November 2008, rather than a general increase in public concern about climate change. While this study provides some insights on recent print coverage of climate change and global warming, further research efforts are required to adequately address the role of mass media for the selection of climate change response strategies, as well as their potential influence on public opinion and subsequent policy decisions.

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# Abbreviations

| | |
|---|---|
| AR4 | Fourth Assessment Report |
| AR5 | Fifth Assessment Report |
| BMU | Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit |
| BRIC | Brazil, Russia, India and China |
| C&C | Contraction and Convergence |
| CCS | Carbon Capture and Storage |
| CDM | Clean Development Mechanism |
| CFC-11 | Trichlorofluoromethane |
| CFC-12 | Dichlorodifluoromethane |
| $CH_4$ | Methane |
| CHF | Swiss Francs |
| CHP | Combined Heat and Power |
| CIESIN | Center for International Earth Science Information Network |
| $CO_2$ | Carbon Dioxide |
| COP | Conference of the Parties |
| CRU | Climatic Research Unit |
| DAI | Dangerous Anthropogenic Interference |
| DETEC | Federal Department of the Environment, Transport, Energy and Communications |
| DSZ | Die Süddeutsche Zeitung |
| DWE | Die Welt |
| ENGO | Environmental Non-Governmental Organization |
| ENSO | El-Niño Southern Oscillation |
| EIA | Energy Information Administration |
| EPA | Environmental Protection Agency |
| ETS | Emissions Trading System |
| EU | European Union |
| FDEA | Federal Department of Economic Affairs |

| | |
|---|---|
| FDFA | Federal Department of Foreign Affairs |
| FOEN | Federal Office for the Environment |
| FÖG | Forschungsbereich Öffentlichkeit und Gesellschaft |
| G5 | Group of Five |
| G8 | Group of Eight |
| GCC | Global Climate Change |
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gas |
| GWP | Global Warming Potential |
| IEA | International Energy Agency |
| IECP | Integrated Energy and Climate Programme |
| IMF | International Monetary Fund |
| IPCC | Intergovernmental Panel on Climate Change |
| IPE | International Political Economy |
| M&A | Mitigation and Adaptation |
| $N_2O$ | Nitrogen Oxide |
| $NF_3$ | Nitrogen Trifluoride |
| NGO | Non-Governmental Organization |
| NOAA | National Oceanic and Atmospheric Administration |
| $NO_X$ | Nitrogen Oxides |
| NYT | New York Times |
| NZZ | Neue Zürcher Zeitung |
| OcCC | Advisory Body on Climate Change |
| PIK | Potsdam Institute for Climate Impact Research |
| PPM | Parts Per Million |
| R&D | Research and Development |
| RD&D | Research, Development and Demonstration |
| REDD | Reducing Emissions from Deforestation and Forest Degradation |
| RFC | Reasons For Concern |
| SBSTA | Subsidiary Body for Scientific and Technological Advice |
| SPM | Summary for Policy-Makers |
| SRES | Special Report on Emissions Scenarios |
| TAR | Third Assessment Report |
| UN | United Nations |

| | |
|---|---|
| UNEP | United Nations Environment Programme |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNFCCC | United Nations Framework Convention on Climate Change |
| US | United States |
| WAP | Washington Post |
| WBGU | German Advisory Council on Global Change |
| WCC-3 | Third World Climate Conference |
| WG | Working Group |
| $Wm^{-2}$ | Watt per Square Meter |
| WMO | World Meteorological Organization |
| WPO | World Public Opinion |
| WRI | World Resources Institute |
| WSJ | Wall Street Journal |

# 1. Introduction

Global climate change is one of the greatest challenges the modern world has ever faced, and is a growing threat to human well-being in developing and industrialized nations alike. The potential consequences of human-induced global warming, in addition to natural climatic changes, within this century and beyond are bound to lead to radical, as well as unprecedented ecological, geopolitical, and social disturbances at a global scale. According to observations, the disruption of the global climate system by human activities is well underway by now, as "significant changes in physical and biological systems are [already] occurring on all continents and in most oceans" (e.g. Rosenzweig et al., 2008: p. 353). Driven largely by the combustion of fossil fuels and by deforestation, the current trends of anthropogenic global warming signify that a large and increasing number of people are at risk of severely adverse ecosystem changes (Millenium Ecosystem Assessment, 2005). Climate change is already having significant impacts on human well-being today, and those impacts are destined to become larger as further economic and ecological damages are a certainty.

At the same time, the world has moved to a new economic growth path, driven by the rapid growth of the global economy in general, and in developing countries in particular (Sheehan et al., 2008). China for instance, the "world's manufacturing warehouse," is set for a period of growth which brings about the biggest transformation of human well-being the earth has ever seen (Meinshausen and Hare, 2008: p. 233). In addition to the already committed global warming, due to anthropogenic perturbations of planetary ecosystems since the pre-industrial era (e.g. Ramanathan and Feng, 2008), the major growth in greenhouse gas (GHG) emissions projected for the 21st century is certain to lead to an unprecedented human-induced global warming in the future (e.g. Rogelj et al., 2010; Tomassini et al., 2010). Other studies indicated that the current warming trend is apparently accelerating at a faster pace than previously expected (e.g. Loarie et al., 2009; Walter et al., 2006). In addition, climate change that takes place due to increases in the atmospheric carbon dioxide ($CO_2$) concentration is largely irreversible for 1,000 years after emissions stop (e.g. Solomon et al., 2009). Even for very large reductions in GHG emissions, temperature reduction is likely to occur at a low rate, and a recovery from dangerous levels of global warming seems therefore difficult (Lowe et al.,

2009). Given these glooming prospects, is it really time to "stop worrying and start panicking" (Schellnhuber, 2008)?

Despite scientific warnings in earlier decades, global warming did not become a significant public issue until Dr. James Hansen's "greenhouse effect" testimony before the U.S. Congress in 1988 –one of the hottest years on record at that time – made headlines around the world (e.g. Corfee-Morlot et al., 2007; Leiserowitz, 2007a). Ever since this milestone of putting global warming on the world stage, leading scientific authorities have consistently observed that anthropogenic climate change represents a serious problem, demanding decisive action in the future (e.g. IPCC, 2001a; 2007a; National Academy of Sciences, 2001; WGBU, 2009). Most notably, the Fourth Assessment Report (AR4) by the Intergovernmental Panel on Climate Change (IPCC) provided convincing evidence for the case of human-made global warming (e.g. IPCC, 2007b). Since the publication of this latest cornerstone of climate sciences, countless research efforts have asserted the current warming trend as well as the emission of anthropogenic GHGs as its main driving force (e.g. UNEP, 2009a). The climatic variability and associated uncertainties need to be assessed to understand the size and nature of environmental threats such as climate change (Schenk and Lensink, 2007). For all the complexity of the subject, there is now a large degree of scientific consensus that some degree of global warming is indeed occurring, although there is less agreement about the exact consequences of unchecked global warming (e.g. Stamm et al., 2000). Given these implications, the perception that global climate change is a problem that urgently needs to be addressed by international, as well as national policy-making, has developed considerably over the past decades (e.g. World Bank, 2009). Article 2 of the 1992 United Nations Framework Convention on Climate Change (UNFCCC) for instance, states as ultimate objective a "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UNFCCC, 1992: p. 4). Although the contemporary definition of the two degrees Celsius (ºC) limit above pre-industrial temperatures as a threshold representing dangerous climate change is not scientifically asserted, it has been endorsed by various scientific organizations, and was also acknowledged by the world's community at the 15th Conference of the Parties (COP 15) to the UNFCCC in December 2009 (UNFCCC, 2009).

Because climate policies are intrinsically tied to various other policy areas (e.g. biodiversity, energy, transport, land-use, health, etc.), they have "the potential to radically alter consumption and production patterns throughout the industrialized world," as well as in agricultural societies (Raustiala, 2001: p. 99). It is therefore not surprising that the question about which

policy options are most suitable to address the imminent challenges of global warming remains fairly controversial, especially since the AR4 was unable to successfully address what combinations of mitigation and adaptation (M&A) policies could best reduce the impacts of climate change (Parry, 2009). The failure to address this problem stems partially from a current lack of knowledge on the connections between mitigation, adaptation and impacts (ibid). Given the existing uncertainties and the potential risks involved, especially regarding the timing and intensity of climate response strategies (e.g. Shogren and Thoman, 2000), a decision-making framework based on the precautionary principle has been suggested in the literature (e.g. Keller et al., 2005; Rockström et al., 2009). Both mitigation and adaptation frameworks further imply a myriad of questions concerning their respective costs and benefits, various equity and fairness considerations regarding the distribution of costs associated with these policies, as well as their relevance for sustainable development efforts. Despite a range of conceptual and methodological challenges, the integration of M&A into climate change response strategies has of course already become a reality (Wilbanks and Sathaye, 2007). As these policy instruments addressing environmental, energy, and other issues are designed and implemented in an already policy crowded environment (e.g. Walker et al., 2009), their interactions "in general can be complementary, competitive or self-exclusive" (Oikonomou and Jepma, 2008: p. 132). As the global atmosphere tends to be overused through anthropogenic GHG emissions, which ultimately result in global warming, it represents a *common-pool resource*, i.e. everyone can benefit from the good even without contributing to its provision (e.g. Luterbacher and Sprinz, 2001). It is imperative to attain international cooperation within a global climate regime. Although it has become clear that climate change has a global dimension and implies unprecedented consequences for decades to come (e.g. Hillerbrand and Ghil, 2008), current negotiations for an international regime are dominated by diverging views of the industrialized countries and countries in development due to "self-interested uses of equity arguments" (Lange et al., 2010: p. 360). The existing global climate regime largely omits the historical responsibility of developed nations, which accounted for most of the emitted GHGs to date, whereas climate change may cause most harm to less developed countries (e.g. Dellink et al., 2009). In addition, as potential impacts of climatic changes are distributed unevenly across regions, national preferences may differ substantially according to the respective economic capacity as well as the perceived ecological vulnerability (e.g. Lo, 2010). Therefore, domestic constraints are likely to influence the position of governments in international bargaining. Mitigation policies are generally considered as more equitable by holding responsible nations accountable in proportion of their GHG emissions (e.g. Wilbanks and

Sathaye, 2007). However, the effectiveness of mitigation policies inherently depends on the political commitment and participation of all countries (e.g. Biesbroek et al., 2009), to create an institutional framework to prevent free-riding (Luterbacher and Sprinz, 2001). Analyses have further shown that GHG emission reductions in the 21st century need to be substantial to avoid the most serious climate change impacts (e.g. Washington et al., 2009), and that the costs of inaction may well exceed mitigation costs (e.g. World Bank, 2009). Postponing global GHG emission reductions also increases climate risks and long-term costs (den Elzen et al., 2010). Historically, climate science as well as policy-making has generally focused on mitigation strategies (e.g. Grasso, 2007; Klinsky and Dowlatabadi, 2009), and climate policy discussions have subsequently concentrated on mitigation efforts (Urwin and Jordan, 2008). The current international pledges for GHG emissions reductions are in no way sufficient to limit climate change and its impacts to acceptable levels (e.g. Macintosh, 2010; Rogelj et al., 2010). Moreover, even successful mitigation policies alone will not be able to solve the problem, as some climatic changes will be unavoidable due to past emissions, as well as according to current emission projections, which show rising GHG concentrations for the foreseeable future (e.g. Pielke et al., 2007). Major adaptation efforts are obviously needed to prevent the most serious effects of global warming in the future (Parry et al., 2009).

Because of the fundamental difference between the threat posed by climate change and most prior global threats, there is an urgent need for science to inform society about the implications to address global warming (Hansen et al., 2007). For this reason it is particularly important that the scientific understanding of climate change and its possible large-scale consequences are transmitted in understandable and believable form to the public and policy-makers. The awareness that human activities are changing the climate has taken hold, initially only in the minds of the scientific community, but then through the media, in the minds of policy-makers, and the general public (White and Hooke, 2004). Mass media transmit scientific evidence, produced within the social system of science, in accessible form to the general public, thus popularizing scientific knowledge (Weingart, 1998). As scientific knowledge primarily enters the public realm through media coverage, mass media have been crucial in raising the general public awareness of global warming. Considerable research has been conducted to assess the influence of mass media reporting on the public understanding of environmental problems and subsequent policy decisions (e.g. Smith, 2005; Weingart et al., 2000). These efforts have demonstrated that media coverage significantly shapes the public understanding of climate science and policy (e.g. Boykoff and Mansfield, 2008). The introduction of scientific knowledge into the public framework by extensive mass media coverage

of climate change issues thereby affects the selection of climate policies in political decision-making processes as well. Surprisingly, the growing scientific consensus about climate change is not necessarily supported by the public's perceptions of the degree of consensus within the scientific community (e.g. Moss, 2007). Today, global climate change has nevertheless passed a "tipping point in public awareness" (McKie and Galloway, 2007: p. 368). People around the world now widely believe in the seriousness and urgency of the problem (e.g. Nisbet and Myers, 2007), and the public's support for actions to minimize the rate and magnitude of climate change is increasing (e.g. Larson et al., 2010). The literature most notably refers to two events responsible for triggering the increasingly active global public discourse on climate change: the May 2006 release of former U.S. Vice President Al Gore's documentary *An Inconvenient Truth* and the publication of the IPCC AR4 in Spring 2007 (e.g. Neverla, 2008). These events were eventually connected when the Nobel Peace Prize was jointly awarded to Al Gore and the IPCC in October 2007 (ibid.).

The crucial role of mass media in shaping public understanding of climate change and its influence on the public discourse in such an important policy issue was the main motivation for this study. Since the newspaper coverage of global warming and climate change appears to be primarily driven by significant natural and policy events (e.g. Liu et al., 2008), mass media are likely to focus their reporting on mitigation rather than adaptation policies, given that until recently the climate policy discourse generally promoted mitigation strategies. The second motivation, derived from the assumption that the contemporary news coverage of the issue was unilaterally focused on the possibility to prevent climatic changes in the first place by mitigating the anthropogenic induced influence on the planetary climate system, and thereby underestimating the paramount importance of adaptation in any viable climate policy framework. The principal objective of this paper was to investigate whether the historical focus on mitigation strategies has in fact generated a bias for mitigation in the media coverage. Another objective was to contribute to the research effort, analyzing the role of mass media as an interface between climate science and policy (e.g. Anderson, 2009), its relevance as a preeminent source of scientific information for the general public (e.g. Nisbet and Myers, 2007), as well as its subsequent influence on arguably the single most important current policy discourse (e.g. Boykoff, 2008a; Liu et al., 2008).

The second chapter provides a synopsis of the imminent challenge of global climate change. The current state of knowledge in the physical science basis is introduced. An overview of the scientific evidence the latest IPCC Assessment Report (AR4) is then presented, followed by a selection of policy relevant findings in climate science since the publication of the AR4. A

brief summary of the contemporary scientific consensus is also provided. The developments regarding the implementation of an international climate policy response since the adoption of the UNFCCC in 1992 are elaborated, including the most controversial issues in current negotiations for a global climate regime. After discussing the conceptual and methodological challenges for the integration of policies into a climate change response strategy, an assessment of available climate policy options, as well as a comparison of M&A strategies is presented. The third chapter introduces the relevant theoretical aspects of international political theory and the communication of science through mass media, including the statement of the hypotheses. It further provides an overview of current developments in these research areas, as well as some results of international public opinion surveys about global warming. The fourth chapter initially presents the research methodologies, in particular the design of the content analysis, which was conducted to investigate the news coverage of global warming and climate change in six quality newspapers from the United States, Germany and Switzerland over a six-month period in 2008. A qualitative comparison of public opinion surveys before and after the analyzed period of news coverage was executed to assess the influence of the media reporting about climate change on national public opinions. A summary of domestic climate policy measures adopted in the surveyed countries is also presented, in an attempt to identify if the public demands regarding global warming issues are reflected in the national climate policy-making. The results are subsequently discussed to evaluate the findings given the stated hypotheses. The last chapter reviews the presented evidence in relation to the imminent problem of global climate change, and aims to provide an outlook on how to confront this unprecedented challenge, as well as some suggestions for future research efforts.

# 2. The Challenge of Global Climate Change

This chapter aims to introduce the comprehensiveness and critical importance of the climate change challenge for the evolution of a sustainable and worthwhile existence of mankind on planet Earth. The first section initially presents a historical overview of the physical science basis on climate change leading up to the publication of the IPCC AR4 in 2007. Its main conclusions and key findings are introduced, followed by a synopsis of more recent developments regarding several policy relevant aspects of climate science, also including a summary of the contemporary scientific consensus. The second part highlights the need for a comprehensive international policy response to climate change and elaborates on associated difficulties for the selection of an optimal policy mix. It then provides a short overview of international climate policy-making since the adoption of the UNFCCC in 1992. The most controversial issues in the current negotiations for a future international climate policy regime are also introduced. The various conceptual and methodological challenges to the integration of policy options into climate change response strategies are discussed, including a subsequent assessment of available climate policies.

## 2.1. Physical Science Basis

The basis for the assessment of the scientific knowledge on climate change focuses on the Working Group I (WGI) Contribution to the IPCC AR4 (2007b). This report also represents the primary reference for the content analysis results, especially regarding scientific statements mentioned in the dataset. This chapter provides an overview of the key conclusions of the AR4 WGI Contribution, as well as a summary of recent developments in the physical science basis. In addition, a selection of crucial elements for consideration in future policy-making is also presented. Finally, some insights into the contemporary scientific consensus are presented, also addressing key issues on existing uncertainties. The terms *global warming* and *climate change* are used interchangeably throughout this study. However, their linguistic usage can vary. Leiserowitz (2006) for example, noted that the media and the public most commonly refer to *global warming*, whereas the scientific community generally prefers the

term *climate change*. Next to studies of numerous other scientific bodies, the four comprehensive assessment reports by the IPCC to date have asserted with increasing confidence that global warming if left unchecked poses a dangerous threat to civilization, and is mainly due to a rapid increase in anthropogenic GHG emissions since the beginning of the industrial era in the early 19th century. In this regard, Article 2 of the UNFCCC states as ultimate objective a "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UNFCCC, 1992: p. 4). In 2001, the IPCC released its Third Assessment Report (TAR), providing an unprecedented picture of a warming planet, featuring the now famous *hockey stick* graph that shows a significant increase of Northern Hemisphere temperatures in the last century (IPCC, 2001b). The TAR WGI Summary for Policymakers (SPM) further states that the "projected rate of warming is much larger than the observed changes during the 20th century and is *very likely*[1] unprecedented in at least the last 10,000 years" (IPCC, 2001a: p. 13), and that "anthropogenic climate change will persist for many centuries" (p. 17). The AR4 eventually resolved almost all remaining doubts about the existence of global warming and the human responsibility for increasing temperatures (IPCC, 2007b). The decision to prepare a Fifth Assessment Report (AR5) was taken by the IPCC in April 2008 and is currently outlined. The AR5 WGI Contribution addressing the physical science basis is scheduled to be finalized by 2013 (IPCC, 2009).

### 2.1.1. The IPCC Fourth Assessment Report

Published in 2007, the IPCC AR4 still provides the most comprehensive synopsis of climate change research by an intergovernmental organization to date. Despite a number of remaining uncertainties due to the intrinsic complexities of the global climate system, new observations and related climate models have further improved the physical evidence in the AR4. A major update since the TAR certainly was the conclusion that "now most of the observed warming over the last 50 years is *very likely* due to the increase in greenhouse gas concentrations" (IPCC, 2007a: p. 10). The TAR considered this observed warming only as *likely* (IPCC, 2001b). Some of the main conclusions and projections of the AR4 WGI SPM (IPCC, 2007a) include (abbreviated):

[1] The IPCC used the following terms to indicate the assessed likelihood, using expert judgment, of an outcome or a result: *Virtually certain* > 99% probability of occurrence, *Extremely likely* > 95%, *Very likely* > 90%, *Likely* > 66%, *More likely than not* > 50%, *Unlikely* < 33%, *Very unlikely* < 10%, *Extremely unlikely* < 5% (IPCC, 2007a).

- Global atmospheric concentrations of carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($NO_X$) have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values.
- Warming of the climate system is unequivocal (…).
- Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.
- It is *extremely unlikely* that global climate change of the past 50 years can be explained without external forcing, and *very likely* that it is not due to known natural causes alone.
- It is *very likely* that hot extremes, heat waves and heavy precipitation events will continue to become more frequent.

Despite these findings further asserting the scientific evidence since the TAR, a considerable number of uncertainties remain. Some notable key uncertainties[2] in the AR4 WGI Technical Summary (IPCC, 2007c) and the AR4 Synthesis Report (IPCC, 2007d) include (abbreviated):

- The geographical distribution and time evolution of the radiative forcing[3] due to changes in aerosols during the 20th century are not well characterized.
- Analyzing and monitoring changes in extreme events (…) is more difficult than for climatic averages (…).
- Climate data coverage remains limited in some regions and there is a notable lack of geographic balance in data and literature on observed changes in natural and managed systems.
- Effects of climate changes on human and some natural systems are difficult to detect due to adaptation and non-climatic drivers.
- The evolution and utilization of adaptive and mitigative capacity depend on underlying socio-economic development pathways.
- The effects of non-climate policies on emissions are poorly quantified.

There are two reasons why the AR4 SPM served as main reference for this study. First, the SPM is adopted by consensus and is subject to endorsements by the participating governments during the reviewing process. It thus represents the least common denominator to which all national delegations agree, not necessarily the most objective scientific assessment. Second, the SPM can be considered as the most likely source of information for policy-

[2] Key uncertainties are those that, if reduced, could lead to new robust findings. A robust finding for climate change is defined as one that holds under a variety of approaches, methods, models and assumptions, and is expected to be relatively unaffected by uncertainties (IPCC, 2007d).

[3] Radiative forcing is a measure of the influence that a factor has in altering the balance of incoming and outgoing energy in the Earth-atmosphere system and is an index of the importance of the factor as a potential climate change mechanism. Positive forcing tends to warm the surface while negative forcing tends to cool it (IPCC, 2007b).

makers as the WG Contributions usually are too technical and extensive for a non-academic audience.

The AR4 projections based on simulations by various climate models using natural and anthropogenic forcings also indicate a dominant anthropogenic influence in global and continental temperature changes especially in the Northern Hemisphere (Fig. 2.1). The IPCC thus estimated the discernible human-induced warming averaged over each continent except Antarctica as *likely*. Also, the projected global average surface warming and sea level rise correlate with the evaluated scientific evidence although numerous uncertainties still exist. The AR4 findings have explicitly demonstrated the fact of raising global temperatures and an unmistakable certainty about the nature of its origin. To cope with the challenge at hand, over 100 countries have therefore adopted a global warming limit of 2 °C relative to pre-industrial levels as a guideline for mitigation efforts to reduce climate change risks and possible impacts (IPCC, 2007d). In order to provide an outlook on the state of the art of physical climate science, the most recent climate observations and the latest projections for the 21st century are summarized below.

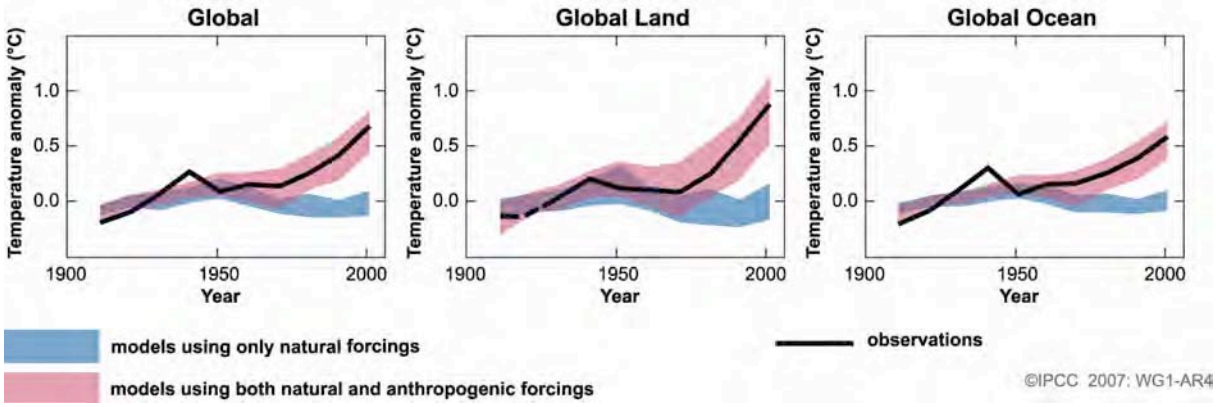


**Fig. 2.1: Comparison of observed continental- and global-scale changes in surface temperature (black line) with results simulated by climate models using only natural forcings (blue shaded bands) and both natural and anthropogenic forcings (red shaded bands) (Source: IPCC, 2007b).**

## 2.1.2. Recent Scientific Developments

Substantial research efforts have been realized since the publication of the AR4. Despite ongoing academic discourses and the associated political controversy, the recent scientific findings deliver an even more extensive and detailed outlook on the existence of global warming. Several publications reaffirmed some of the most relevant AR4 conclusions. Mann et al. (2008) for instance, combined multiple proxies to generate a temperature record over the past

two millennia, demonstrating that the last decade's warmth is unmatched during the past 1,300 years. The temperature reconstruction also provided additional support of the original *hockey stick* results. The most recent monthly *National Climatic Data Center* analysis presented further confirmation of a continuously warming Earth. The combined global land and ocean surface temperature was the warmest on record for both April (Fig. 2.2), and for the period from January–April (NOAA, 2010). Analyses by Lean and Rind (2008) further indicated that most of the increase in global and regional surface temperatures can be attributed to human activities rather than natural factors such as solar variability. In addition, contemporary GHG emission pathways are currently above the fossil intensive emissions scenario (A1FI) specified in the Special Report on Emissions Scenarios (SRES) of the IPCC (IPCC, 2000), which represents the least favorable option for restricting the continuous global temperature increase. A selection of topics that the author considers crucial for the rationale of sustainable future policy discourses is presented below. Covering various aspects of the imminent challenge of global warming, the survey explores some of the most relevant scientific findings since the AR4, along with a critique of suggested approaches to ensure a sustainable and worthwhile environment for generations to come.

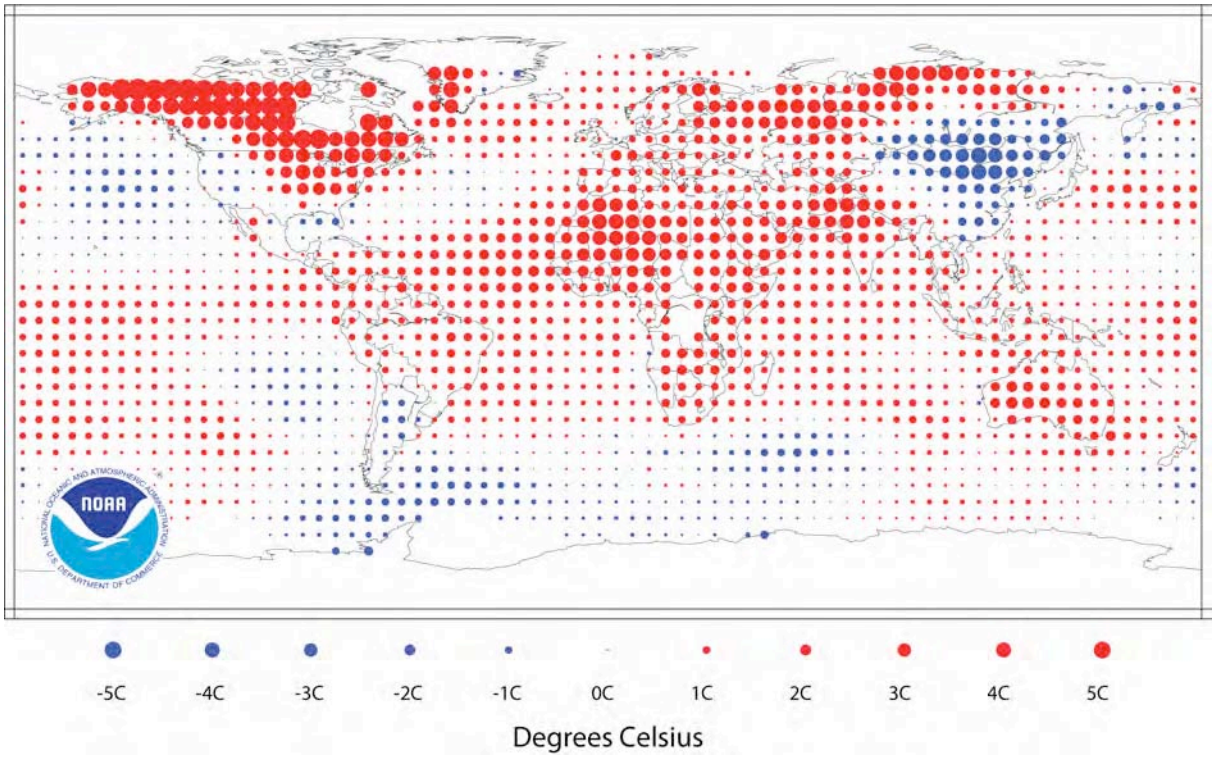


**Fig. 2.2: Global temperature anomalies for April 2010 with respect to a 1971–2000 base period. Temperature anomaly is the difference from average, which gives a more accurate picture of temperature change (Source: NOAA, 2010).**

***Surging Greenhouse Gas Emissions***

Worldwide GHG emissions continued to rise unabated in recent years, 2008 acting as lone exception as financial markets around the globe literally imploded creating a major economic downturn accompanied by an unparalleled fall in global GHG outputs (e.g. Harvey, 2009). Nevertheless, the trajectory of GHG emissions since 2000 is currently above the highest SRES scenario (A1FI) with an assessed *likely* range (66–90%) of an average temperature increase of 2.4 °C to 6.4 °C by 2100 (IPCC, 2007b). Ultimately, $CO_2$ emissions remain the most critical issue, because a substantial fraction of these emissions remain in the atmosphere for several centuries. According to Canadell et al. (2008), the rate of growth for global $CO_2$ emissions between 2000 and 2007 was four times that of the previous decade, and the efficiency of natural sinks has declined over the last 60 years (Le Quéré et al., 2009). Recent trends of global average concentrations of the major, well-mixed, long-lived GHGs, accounting for approximately 96 percent of the direct radiative forcing since 1750, are shown in Figure 2.3 (NOAA, 2009). Tans and Conway (2009) reported an atmospheric $CO_2$ concentration of 385 parts per million (p.p.m.) by 2008, corresponding to a 38 percent increase above pre-

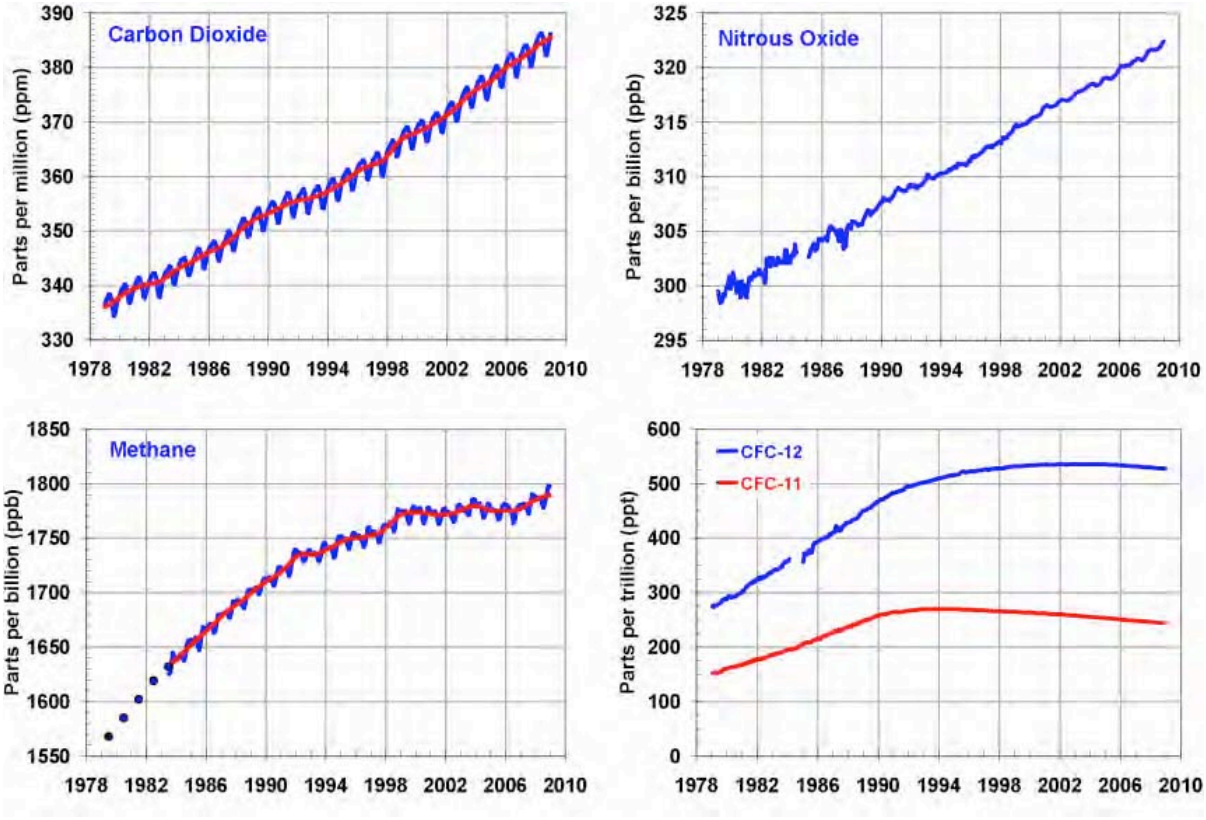


**Fig. 2.3: Global average concentrations of the major, well-mixed, long-lived greenhouse gases – carbon dioxide, methane, nitrous oxide, CFC-12 and CFC-11 – from the NOAA global flask sampling network for the period from 1979–2008. These gases account for about 96% of the direct radiative forcing by long-lived greenhouse gases since 1750 (Source: NOAA, 2009).**

industrial levels. Additional evidence suggests that current atmospheric concentration levels of $CO_2$ and $CH_4$, the two main GHGs, are unmatched for at least 800,000 years (Loulergue et al., 2008; Lüthi et al., 2008). Moreover, Weiss et al. (2008) reported an increase of atmospheric nitrogen trifluoride ($NF_3$) of roughly 11 percent per year from 1978 to 2008. Despite having a *global warming potential*[4] (GWP) of 17,000 times that of $CO_2$, this very potent GHG was not covered by the first phase of the *Kyoto Protocol* or in national reporting requirements. Given its swift growth rate, Prather and Hsu (2008) have therefore called for the incorporation of $NF_3$ in a future international agreement.

Nevertheless, considerable uncertainties in the understanding of the processes controlling the carbon flux and carbon storage of the global climate system remain. An estimated 40 percent of the uncertainty related to the projected warming of the 21st century is related to the unknown behavior of the global carbon cycle (Huntingford et al., 2009). Although these processes are likely to provide a positive feedback leading to amplified anthropogenic warming (Cox et al., 2000), the magnitude of the climate sensitivity[5] of the global carbon cycle is still under debate. A recent study by Frank et al. (2010) quantified the median climate sensitivity as 7.7 p.p.m. $CO_2$ per °C warming, suggesting 80 percent less potential amplification of ongoing global warming than recent pre-industrial empirical estimates of 40 p.p.m. $CO_2$ per °C (e.g. Cox and Jones, 2008). On the other hand, they also found that the most recent climatological base period (1971–2000) was on average 0.7 °C warmer than the coldest episode of the past millennium (1601–1630).

Recently, Rogelj et al. (2010) compiled the national pledges for emission reductions by 2020, provided in the *Copenhagen Accord* agreed at the COP 15 in Copenhagen last December (UNFCCC, 2009), and compared them to the manifested goal of limiting global warming to 2 °C above pre-industrial levels by the end of this century, stated in the same document. Their calculations included pledges from 76 countries, accounting for roughly 80 percent of global industrial emissions, and projected a 20 percent increase of global emissions in 2020 relative to today (ibid.). Even if nations would halve their emissions by 2050, the chance of exceeding 2 °C is still 50 percent, and the current pledges "mean a greater than 50% chance that warming will exceed 3 °C by 2100" (p. 1126). The resulting emission pathways are thus likely to overshoot the 2 °C guardrail according to this analysis. Considering that the pledged com-

[4] The *global warming potential* is an index based upon radiative properties of well-mixed greenhouse gases, measuring the radiative forcing of a unit mass of a given well-mixed greenhouse gas in the present-day atmosphere integrated over a chosen time horizon, relative to that of carbon dioxide (IPCC, 2007a).

[5] In IPCC reports, equilibrium climate sensitivity refers to the equilibrium change in the annual mean global surface temperature following a doubling of the atmospheric equivalent carbon dioxide concentration.

mitments compiled by Rogelj et al. (2010) are effectively non-binding, the prospects of avoiding the 2 °C guardrail in this century are slim. Consequently, the threshold of *dangerous anthropogenic interference* will almost certainly be reached, if global emission trends continue on the projected pathways. Several other papers also argued that even the most restrictive mitigation policies proposed to date would probably overshoot contemporary climate targets. Parry et al. (2009) for example, projected that peak emissions by 2035 would probably translate in a global average temperature increase of about 3 °C, further emphasizing the need for immediate and stringent policy efforts. They also recalled that a recovery process from peak temperatures could last several centuries, stressing that the window of opportunity for effective long-term action on climate change is becoming extraordinarily narrow.

***Committed Climate Change***

Even if GHG emissions were frozen instantly, our planet would still be bound to increasing temperatures for centuries to come due to the inertia of the Earth's climate system. The already *committed warming*[6] thus considerably amplifies the challenge of avoiding potentially dangerous climatic trends, as future mitigation efforts will only be able to limit additional temperature increases to the already committed warming today, but not reduce the already committed warming. Ramanathan and Feng (2008) analyzed the already committed warming as a result of the observed increase of atmospheric GHG concentrations since the pre-industrial era, highlighting the probable overestimation of the aerosol cooling effect in the AR4. They argued that the introduction of more rigorous air pollution policies successively leads to decreasing levels of reflective aerosols, thereby increasing the terrestrial absorption of solar radiation. Using the IPCC estimates for GHGs forcing of 3 (2.6–3.5) $Wm^{-2}$ for the pre-industrial to present (year 2005) period and climate sensitivity of 3 °C (2–4.5 °C range) for a $CO_2$-doubling (IPCC, 2007b), they calculated a committed warming of approximately 2.4 °C (1.3–4.3 °C) above pre-industrial surface temperatures within the 21st century, regardless of the freezing of GHG emissions at 2005 levels (Fig. 2.4). According to climate models, an estimated 0.6 °C of observed warming should have manifested by now (Meehl et al., 2005; IPCC, 2007b). Consequently, Ramanathan and Feng (2008) argued that the residual committed warming of 1.6 °C will unfold during this century. Although Schellnhuber (2008) has is-

[6] The IPCC defines *committed warming* as the further change in global mean temperature after atmospheric composition, and hence radiative forcing, is held constant. If the concentrations of greenhouse gases and aerosols were held fixed after a period of change, the climate system would continue to respond due to the thermal inertia of the oceans and ice sheets and their long time scales for adjustment (IPCC, 2007a).

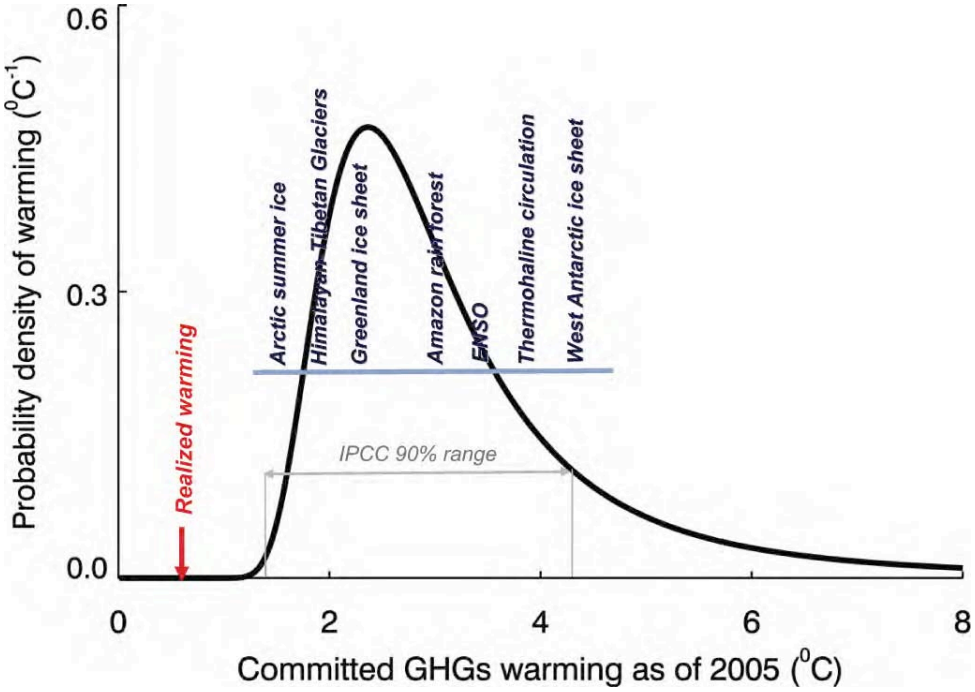


**Fig. 2.4: Probability distribution for the committed warming by GHGs between 1750 and 2005. Shown are the climate-tipping elements (ENSO: El Niño-Southern Oscillation) and the temperature threshold range that initiates the tipping (Source: Ramanathan and Feng, 2008).**

sued some criticism about the authors' model assumptions and their lack of considerations in relation to land cover changes and volcanic emissions, this study possibly emphasized an underestimated element for the definition of future emission reduction targets. The approach certainly deserves to be scrutinized by further research efforts.

### *Climate Tipping Points & Abrupt Climate Change*

Sensitive thresholds and associated feedbacks in the climate system represent other crucial aspects for future policy decisions (e.g. Schneider, 2004). Although geological records indicate that considerable climatic variability and sometimes abrupt, widespread climatic changes have naturally occurred in the past, human interference is supposedly increasing the probability of such events. Alley et al. (2003) noted that "even a slow forcing can trigger an abrupt change, and the forcing may be chaotic and thus undetectably small" (p. 2005). As instrumental records are frequently insufficient to exhibit such minor changes in climatic properties, the apparent interest of limiting anthropogenic influence on the climate system is obvious. Following the definition of *tipping points* by Gladwell (2000) that "little things can make a big difference," Lenton et al. (2008) described such phenomena as small changes that can have large, long-term consequences for a system. They compiled a list of policy-relevant tipping elements in the climate system, including the potential collapse of the Atlantic thermohaline

circulation, the dieback of the Amazon rainforest, and the decay of the Greenland ice sheet (Fig. 2.5). Lawrence et al. (2008) also suggested that Arctic sea ice might undergo abrupt periods of loss during the next 50 years. However, existing uncertainties in assessing potentially dangerous threshold levels often prevent any definition regarding the sensitivity of tipping elements. Furthermore, Schellnhuber (2008) highlighted the possible interdependency between the currently asserted tipping elements. These findings emphasize the importance of the 2 °C guardrail for this century considering the potential consequences of eventually passing a threshold in the next few decades.

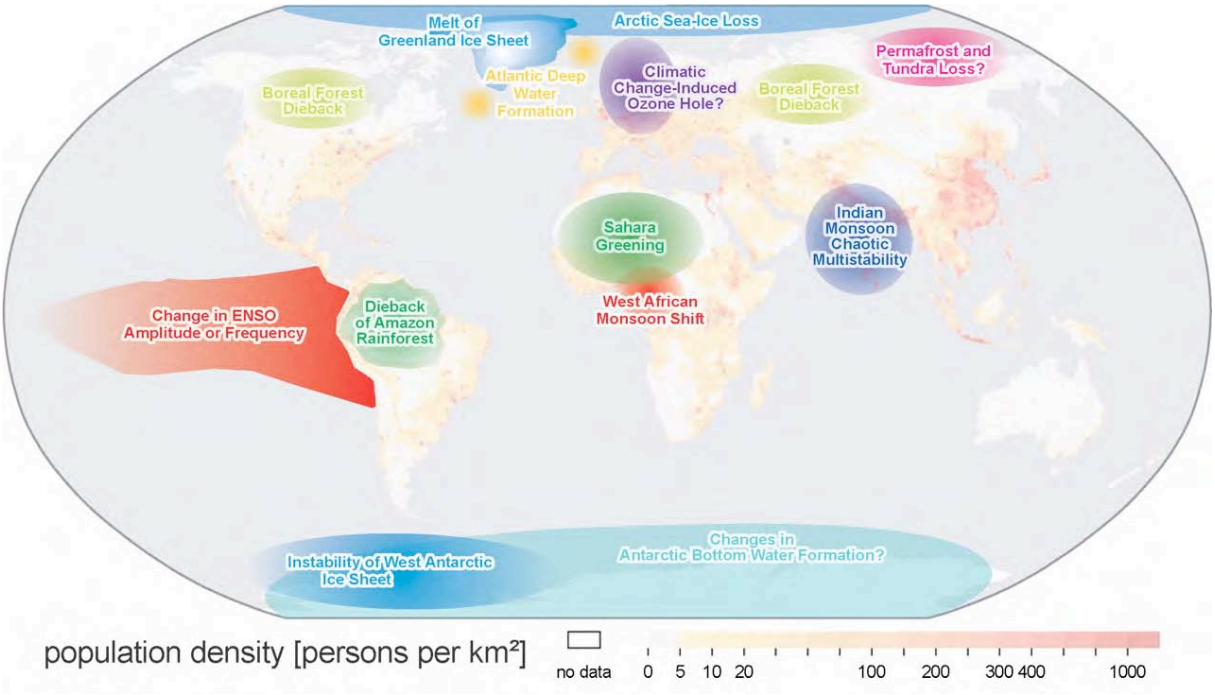


**Fig. 2.5: Map of potential policy-relevant tipping elements in the climate system. The indicated subsystems could exhibit threshold-type behavior in response to anthropogenic climate forcing. They could be triggered this century and would undergo a qualitative change within this millennium (Source: Lenton et al., 2008).**

### *Updated "Reasons for Concern"*

Five *reasons for concern* (RFCs) were originally assessed in the TAR to illustrate the relationships between various impacts in each RFC and increases in global mean temperature according to a color coding scheme reflecting severity of risk based on expert opinion, depending on the rate as well as the magnitude of climate change and the vulnerability of the affected systems (IPCC, 2001b). Figure 2.6 (left) displays the original RFCs in the now well-known *burning embers* diagram. The goal was to give an idea on potential impacts, which might be considered as *dangerous anthropogenic interference* (DAI), without specifying pre-

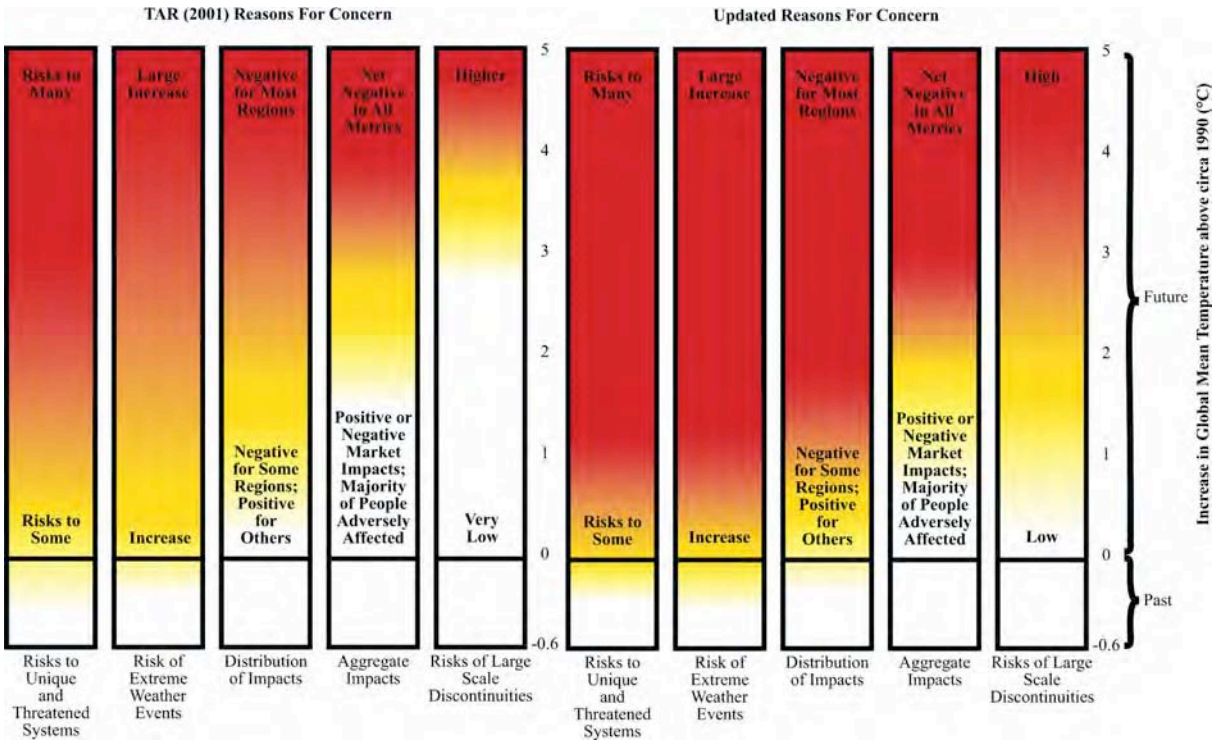


**Fig. 2.6: Risks from climate change, by reason for concern – 2001 RFCs from the IPCC TAR (left) compared with the 2009 updated RFCs by Smith et al. (right). Climate change consequences are plotted against increases in global mean temperature after 1990. Each column corresponds to a specific RFC and represents additional outcomes associated with increasing global mean temperature. The color scheme represents progressively increasing levels of risk: white regions = neutral or low impacts or risks / yellow regions = negative impacts or more significant risks for some systems / red regions = substantial negative impacts or more widespread and/or severe risks. The colors should not be interpreted as representing dangerous anthropogenic interference, which is a value judgment (Source: Smith et al., 2009).**

cise levels of what would constitute DAI. A look at the original *burning embers* diagram suggests that a warming of 2–3 °C relative to recent temperatures is likely to involve dangerous impacts in various segments. According to a statement in the AR4 Synthesis Report, the RFCs "remain a viable framework for assessing key vulnerabilities" (IPCC, 2007d: p. 64). Figure 2.6 (right) visualizes the recent update of the original RFCs by Smith et al. (2009), allowing a comparison with the original RFCs in the TAR. By revising the sensitivities of the RFCs to increasing global average temperatures, they estimated that even a smaller amount of warming could lead to significant consequences in all five RFCs. The updated temperature range in yellow and red is now much wider than in the TAR.

An essay by Schneider (2009) elaborates on the effects of a possible tripling of atmospheric $CO_2$ from currently ~388 p.p.m. to roughly 950 p.p.m. by 2100, adopting the A1FI SRES emission scenario as the business as usual emission trend. According to IPCC estimates with a *likely* range for warming of 2.5 °C to 6.4 °C under the A1FI scenario by 2100 (IPCC, 2007b), there is a 5–17 percent chance that temperatures will rise by more than 6.4 °C by 2100. Although the likelihood of reaching such risk levels is probably low, the number and

intensity of abrupt events and the possibility of irreversible damages increases non-linearly with warming. In any case, the prospect of an "atmosphere in 2100 with 1,000 p.p.m. of $CO_2$-equivalents would be catastrophic" (Schneider, 2009: p. 1104).

***Dangerous Anthropogenic Interference***

The ultimate objective of the UNFCCC is the stabilization of atmospheric GHG concentrations at a level that would prevent DAI with the climate system (UNFCCC, 1992). Previous research has convincingly demonstrated the relationship between human activities and rising atmospheric GHG concentrations resulting in increasing global average temperatures (e.g. IPCC, 2007b). Have we already passed a natural threshold such that it is now impossible to avoid dangerous climate change (Lovelock, 2006)? Any determination concerning a DAI with the climate system is at least partly subjective and therefore not exclusively a scientific issue. Whereas the provision of the necessary scientific foundation for advisable policy decisions naturally is the prerogative of science, the ultimate evaluation of what really constitutes a critical level of climate change is a value judgment and hence not a choice to be made by the research community (Moss, 2007). The target of limiting global warming to no more than 2 ºC above pre-industrial temperatures serves as an example for the definition of such a threshold. Originally proposed by the German Advisory Council on Global Change (WBGU, 1995), a 2 ºC warming limit for this century has been widely accepted by a number of scientific bodies as well as more than 100 countries (e.g. IPCC, 2007e; WBGU, 2009). The international community has recently adopted this target at the COP 15 in Copenhagen (UNFCCC, 2009). Rarely has a scientific idea had such a strong impact on world politics. According to Boykoff et al. (2010), problematic inferences are frequently drawn from such a target, namely that 2 ºC represents a significant rather than arbitrary threshold for instance. However, the target does not represent a scientifically dangerous limit but "clearly [is] a political goal" according to Hans Joachim Schellnhuber, the father of the two-degree target (Evers et al., 2010). Indeed, other studies provided different estimations of potentially dangerous temperature limits, reflecting the huge uncertainties in the scientific evidence. Most notably, Keller et al. (2005) adopted a warming of 2.5 ºC compared to pre-industrial levels as a potential DAI threshold, whereas Hansen et al. (2007) argued that even a 1 ºC global temperature increase above 2000 levels might be highly disruptive, concluding that the world has already come close to such a dangerous level.

The rate of past and current sea level rise and its causes are also subject to an active debate, and provides another example of popular criticism whether anthropogenic influence relates to

rising sea levels. Jevrejeva et al. (2009) however, recently used a delayed response model to attribute past sea level variability to various natural and anthropogenic forcings. According to their results, about 75 percent (14±1.5 cm) of the sea level rising since 1850 and its dramatic acceleration is associated with a rapid increase in atmospheric GHG levels.

### 2.1.3. The Scientific Consensus

The topic of climate change has generated considerable scientific and political controversy. Despite the mostly unwarranted criticism, there is now a large degree of scientific consensus in the relevant research communities that global warming exists and that humanity is mostly responsible for it by increasing atmospheric GHG concentrations (Doran and Kendall Zimmermann, 2009; IPCC, 2007a; Oreskes, 2005). The AR4 findings have been endorsed by nearly 200 nations including the U.S. Even personalities considered *climate skeptics* such as the Danish environmental economist Bjørn Lomborg, do not deny the fact that global warming is happening (Lomborg, 2007: p. 8). There is also little doubt that anthropogenic GHG emissions must be significantly reduced below today's levels in order to lower the risk of rapid and potentially irreversible changes in the climate system. Nevertheless, expert opinions on the extent of the consequences of climate change, as well as the dimension of the human influence are more diverging (e.g. Doulton and Brown, 2009; Post, 2008), despite the mounting scientific consensus that global warming is indeed occurring, and that the nature of the observed warming is mainly of anthropogenic origin. Also, the question of the timing for emission reductions remains debatable, given their potentially high costs depending on the chosen scenarios.

The major obstacle for more converging opinions is due to the uncertainty inherently associated with projections of current climate models, as well as to the severity and geographical distribution of the potential impacts of global warming in the future. Uncertainties in interdisciplinary scientific frameworks such as climate change result from long time scales and the sheer complexity of the planetary environmental system. Due to the ambivalent scientific inputs to the non-academic community, the confusion among the public and policy-makers alike is not surprising. Zehr (2000) even argued that the wide range of temperature projections by 2100 are used as proof for existing uncertainties, and that they frequently provide a reason for political inaction. Also, scientific assessments conducted by intergovernmental research bodies often play a pivotal role in the interactions between national and international policy-making on the one side and scientific research and policy advice on the other (Siebenhüner,

2003). The still noticeable disagreement among scientific peers over the exact consequences of future climatic changes thus create the kind of science-policy problems, in which "the stakes are high, decisions urgent, values are in conflict, and facts uncertain" (Baer and Risbey, 2009: p. 33). National and international policy-makers, who are the principal clients of scientific reports by supranational agencies such as the IPCC, need answers to questions that objective science alone cannot answer (Kandlikar et al., 2005). But if scientists evaluate research findings of their peers on the basis of political perspectives, then the scientific debate among academics risks of morphing into political debates (Pielke, 2004). White and Hooke (2004) demonstrated that the IPCC, while being an excellent body of considerable reputation, has been established in such a way that its reports are subject to a sometimes distorting governmental review. Considerable research has been conducted on the linguistic aspects of the definition of uncertainty and associated risks, and on how to synthesize and accurately communicate scientific uncertainties (Kandlikar et al., 2005; Oreskes, 2004; Patt, 2007). The ultimate goal should be to improve decision-making by quantifying uncertainty, not to remove it from the decision process (Aspinall, 2010). Standardizing the IPCC terminology thus constituted an important step for the representations of uncertainty in climate assessment reports (Moss and Schneider, 2000).

The recent publication of the *Copenhagen Diagnosis* by a number of internationally acclaimed climatologists – including IPCC members – has again stirred extensive debates about the role and influence of scientists in political debates. The report basically summarized of what the authors considered as the most policy-relevant findings in climate science in the last three years since the AR4 (Allison et al., 2009). Intended to provide a synthesis for stakeholders attending the COP 15 in December 2009, the report is an urgent call for a substantial climate treaty, but does not include any yet unknown conclusions. Because of this lack of new or additional scientific evidence, the authors have received widespread criticism for attempting to influence the political process according to their agenda. Another incident, now famously dubbed *Climategate*, further questioned the scientific evidence on global warming, as well as the integrity of widely respected climate scientists just before the start of the negotiations for a post-Kyoto agreement in Copenhagen (e.g. Hickman and Randerson, 2009). Thousands of e-mails, stolen from a server at the Climatic Research Unit (CRU) of the University of East Anglia in the United Kingdom, have been posted on the Internet, contesting the validity of key findings in the IPCC AR4. While raising legitimate concerns about how socio-political viewpoints and personal convictions of climatologists might affect climate policy-making according to specific agendas, allegations about the scientific evidence and its

consistency is unwarranted (e.g. Gleick et al., 2010). The entire writing process of the IPCC is subjected to several stages of extensive and repeated review by experts as well as by governments, and the AR4 conclusions have been approved word by word by all governments in compliance with IPCC procedures (IPCC, 1999). It is thus unlikely that researchers' personal ambitions or individual political agendas have been able to significantly influence key scientific findings, even if some climate scientists – including Phil Jones, the former head of the CRU who is at the center of the *Climategate* incident – may have stepped too far over the line from science to advocacy. After the assessment of the contemporary scientific evidence of climate change as well as remaining uncertainties, the introduction of some relevant concepts for future policy-making, and a discussion of the scientific consensus, an overview of climate policy options and the problems associated with the implementation of an international agreement is now presented.

## 2.2. Climate Change Policies

The imminent need for a stringent and concerted global implementation of sustainable climate policies to minimize the negative effects of global warming is undisputed today. However, the design of coherent climate change policies remains a complex puzzle of coordinating institutions, developing feasible conceptual frameworks, and mainstreaming climate policy into other policy domains from the international to the local level (Biesbroek et al., 2009). In advance of the COP 15, already dubbed the *mother of all conferences*, even emerging economies like China, India and Brazil have tentatively announced national climate targets and proposed action plans to combat global warming for the first time (e.g. G5, 2009). This is an encouraging signal of the spreading confidence in the scientific knowledge, and can be considered as a symbolic change of mind as well: In the long run, unchecked climate change will most probably shake our current way of life to the core at a planetary scale. As of the beginning of 2010, the proposed global policy responses, whether in relation to mitigating the effects of growing GHG emissions or to the pledged contributions for adaptation measures, are not even close to any valuable level or time frame able to limit global warming to acceptable levels as defined in Article 2 of the UNFCCC. At this point, the GHG reduction targets defined in the Kyoto Protocol, most of which have not been met, and the yet to be successful emissions trading scheme of the European Union (EU) are the only international mandatory mitigation policies in effect (Curtis, 2009).

The perception that climate change is a problem that needs to be addressed by political decision-making has developed considerably over the past decades (e.g. World Bank, 2009). The challenges in defining appropriate policy responses are substantial. The complexity and unprecedented scale of climate change in time and space, as well as the scientific uncertainties involved, do not encourage immediate political decision-making (Weingart et al., 2000). Pielke (1998; 2005) elaborated on a further difficulty in climate policy-making, highlighting a surprising but nonetheless crucial lack of consensus on the meaning of the term *climate change* in UNFCCC and IPCC terminology. In Article 1 of the UNFCCC, it is defined as "a change of climate which is attributed directly or indirectly to human activity" in addition to natural climate variability over time (UNFCCC, 1992: p. 3), whereas in IPCC usage it is referred to as "any change in climate over time, whether due to natural variability or as a result of human activity" (IPCC, 2007a: p. 2). Pielke (1998) emphasized the critical importance of this conceptual distinction in providing decision-makers with a frame of reference for the selection of appropriate policy decisions, arguing that this inconsistency also enhances the ineffectiveness of the global climate policy response (Pielke, 2005). White and Hooke (2004) further noted the emerging political awareness that, next to the intrinsic natural climate variability, also human activities lead to climatic changes, had "triggered a growing and often heated public debate" (p. 375). Therefore, any reasonable discourse should obviously allow a clear distinction of the arguments, as policy decisions are naturally influenced by the predominant societal *zeitgeist* and political will. Since the impacts associated with climate change are both substantial and long-term, as well as unevenly distributed geographically, there are winners and losers on individual, corporate and national levels. According to Parry (2009) however, the AR4 was unable to successfully address the most important policy question, namely what combinations of M&A policies can best reduce the impacts of climate change. The failure of addressing this problem stems partially from a current lack of knowledge on the connections between mitigation, adaptation and impacts. Figure 2.7 pictures the inter-connection of impacts, mitigation and adaptation as parts of a mix of actions and outcomes. Parry (2009) argues that in the absence of sufficient knowledge, we tend to assume that "the wisest course of action involves: (a) reducing emissions as much as we can afford so as to keep impacts and adaptation costs to the minimum over the long term, (b) adapting to most of the remaining impacts so as to minimise damage to society and the environment, and (c) bearing the costs of the unavoidable residual damage" (p. 24). However, success of this approach is purely hypothetical, as we still lack the proper means to ascertain the optimal policy mix. The next IPCC assessment report (AR5) therefore needs to find a solution for con-

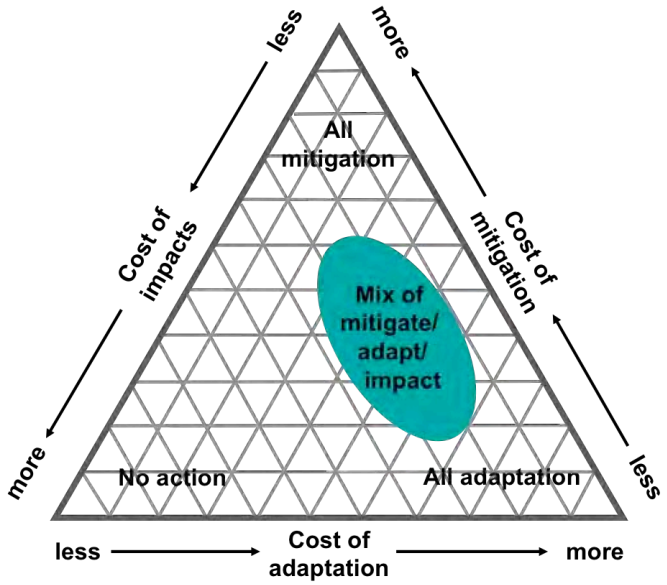


**Fig. 2.7: Schematic *loop* on the inter-connection between climate change impacts, mitigation and adaptation. The right-hand location of the nexus of actions reflects the mentioned assumptions of the optimal policy mix (Source: Parry, 2009).**

solidating this *loop* between the three elements in order to ascertain the most suitable combination of climate policies. The aim of the following chapters is to provide an overview of available policy options, as well as a comparison of the different strategies, in an attempt to resolve some of the issues mentioned above.

### 2.2.1. International Climate Policy-making

The negotiation of the 1992 UNFCCC marked the breakthrough of international climate policy. For the first time, the industrialized countries, referred to as *Annex I countries*[7], pledged to reduce GHG emissions within a given time period. Although not legally binding, the convention contained the objective to stabilize atmospheric GHG concentrations that would prevent dangerous human damage to the climate system, the concept of "common but differentiated responsibilities and respective capabilities" of the different parties in relation to a precautionary risk reduction, and the call for international cooperation to improve human adaptation and mitigation through financial support and technological progress (UNFCCC, 1992: p. 4). Today, the UNFCCC consists of 192 parties. The next milestone was the adoption of the 1997 Kyoto Protocol (UNFCCC, 1998), which committed the Annex I countries of the 1992 con-

[7] Annex I countries are: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, European Union, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland, and United States of America (UNFCCC, 1992).

vention to legally binding GHG emission reductions of about 5 percent below 1990 levels by 2012, also specifying six relevant GHGs including carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). The COP in Copenhagen marked the latest international effort for a follow-up agreement to the Kyoto Protocol expiring in 2012. The negotiations for a post-Kyoto treaty constitute a global challenge of unprecedented proportions as most of the key issues for a successful agreement are inextricably connected. Controversial issues for designing a comprehensive global climate policy framework include the

- Adoption of fair and equitable GHG emission reduction targets and timetables for industrialized, emerging, and developing countries;
- Promotion of adequate incentives for the conservation of natural carbon sinks, and the attribution of a fair market value to ecosystem services in general;
- Definition of the appropriate role and scale of market-based mechanisms. Unresolved issues include the extent of international emissions trading as a complementary form to domestic efforts to improve energy efficiency and reduce $CO_2$ emissions;
- Implementation of an international fund to support developing countries in adapting to inevitable climatic changes, and the definition of modalities to collect the financial contributions needed;
- Facilitation of international cooperation in clean energy research, and subsequent technology transfers at a global scale promoting capacity building in developing countries; and
- Identification of suitable methods for the accelerated emergence of a global *green economy* to allow a decoupling of future economic growth and rising GHG emissions, as well as to provide attractive incentives for private-sector investments in sustainable technologies.

The stakes and expectations for the climate summit in Copenhagen have been very high, and not surprisingly the outcome was disappointing from an environmental perspective. Although an agreement called the *Copenhagen Accord* was adopted in the last hours of the conference, the accord merely serves as guidance without implementing any of the pledges put forward by the world's biggest polluters to binding GHG emission reduction targets prior to the summit (UNFCCC, 2009). The deal recognizes in fact the need to restrict global warming to 2 °C and also outlines the international financing to help the developing countries cope with climate change. However, the document ultimately fails to address the key issues regarding the accountability of past GHG emissions as well as the future responsibilities in a global climate regime. Due to the seemingly irreconcilable perspectives of industrialized and developing countries, the international community was unable to break the current stalemate in order to enable the adoption of mandatory emission reduction targets for industrialized countries or monitored national emission reduction targets for emerging countries. In addition, the designated financial contributions to developing countries for mitigation and especially adaptation

measures are not nearly enough to sufficiently address the projected needs of the most vulnerably regions to cope with climate change (e.g. UNFCCC, 2008). Protecting the world from dangerous climate change still remains a challenge to be addressed requiring international cooperation but also coordinated national policy-making in order to anticipate the major consequences of global warming in this century and beyond.

### 2.2.2. Climate Policy Frameworks

In the past decades, public awareness on anthropogenic global warming, particularly on the impacts of climate change and the measures needed to mitigate or adapt to the impacts, has notably increased. Due to the rising concerns of society, scientists and policy-makers have devoted considerable attention and resources to the issue of global climate change in order to develop adequate policy responses. As already mentioned, there are various conceptual and methodological challenges to the integration of M&A into climate change response strategies. Historically, academic research, as well as climate policy-making, were generally focused on mitigation issues (Biesbroek et al., 2010; Grasso, 2007; Klinsky and Dowlatabadi, 2009). Urwin and Jordan (2008) argued that the discussion of climate policy integration has thus concentrated on mitigation decisions mostly taken at international and national levels. A number of reasons have led to this apparent policy preference, ranging from the inherent complexity and scientific uncertainties associated with global climate change, through to the current state of technology (ibid.), issues of scales (Adger et al., 2005), the availability of financial resources and short time horizons (Smit and Pilifosova, 2001), and the nature of the climate system as a global public good. Biesbroek et al. (2009) coined the term *mitigation-adaptation dichotomy* for describing the scientific and political framing of M&A as two different approaches to deal with the same problem. They also emphasized the common failure of policy-makers to act upon existing knowledge about adaptation and mitigation options (ibid.). Naturally, both strategies contain numerous synergies and trade-offs because of different economic, social, spatial and ethical implications. For this reason, they are often insufficiently addressed in the evaluation of climate change response strategies (Hillerbrand and Ghil, 2008). In addition, any appropriate mix of policy options considerably depends on the magnitude and rate of climate change (Wilbanks and Sathaye, 2007). Their implementation can be complementary, substitutable or even mutually exclusive (e.g. Oikonomou and Jepma, 2008; Sovacool and Brown, 2009). A combination of both policy options is thus undoubtedly needed to effectively reduce the risks of potentially dangerous impacts, as well as to enhance

the capacity to adapt to inevitable climatic changes, despite their largely independent deployment opportunities. In face of this conceptual puzzle, scientists and policy-makers today have nevertheless recognized that both M&A measures are ultimately needed to reduce GHG emissions, as well as the future impacts of climate change (e.g. Biesbroek et al., 2009; Dowlatabadi, 2007).

In recent years adaptation strategies have received increasing attention from stakeholders and media alike, and the need of enhancing the integration of adaptation measures into climate policy frameworks is now widely acknowledged. For instance, the parties to the UNFCCC have adopted a program to help countries make better-informed decisions on adaptation (SBSTA, 2005). Adaptation issues were also prominently featured at the Third World Climate Conference (WCC-3), organized by the World Meteorological Organization (WMO) in 2009, as exemplified by the vision of the conference (WMO, 2009):

> A Global Framework for Climate Services that links science-based climate predictions and information with the management of climate-related risks and opportunities and supports adaptation to climate variability and change.

Vignola et al. (2009) also stressed the importance of adaptation policies especially for developing countries, where economies and livelihoods largely depend on resilient ecosystem services threatened by global warming. However, the enormous diversity of considerations that need to be addressed for the adoption of a legally binding international agreement to confront global warming is daunting, as will now be elaborated in more detail.

### *Uncertainties and Risks*

A vital aspect for successful policy interventions is the assessment of future risks and uncertainties in science, society and politics, as well as in the inertia of the climate system, especially for the timing and intensity of climate response strategies, and thus for the flexibility of climate policies over time (IPCC, 2007e; Shogren and Thoman, 2000). Numerous political and economic trade-offs in the flexibility and stringency of climate policies need to be addressed. To ensure the resilience of the planetary life-support system, assessments of the best possible policy combinations are ideally based on the accuracy of projections of climatic changes and associated impacts in the future. Addressing current uncertainties in the scientific knowledge is especially important for the evaluation of regional impacts and multi-decadal climatic changes, and for the estimation of mitigation efforts required to reduce future risks. However, substantial uncertainties about mitigation costs still exist (IPCC, 2007e), while un-

certainty ranges of damage estimates and subsequent adaptation costs are even larger (IPCC, 2007f).

The issue of irreversible or potentially abrupt climatic changes is another important element for the determination of sustainable climate policies. The climate response to anthropogenic forcings, as well as much of the damages, are likely to be irreversible over human time scales or even longer, and the possibility of abrupt changes in the Earth system cannot be completely ruled out (IPCC, 2007e). As some irreversibility will almost certainly occur, decision-makers need to pay special attention to environmental and socio-economic irreversibilities with a focus on the timing and scale of policy responses. Given the existing uncertainties and the potential risks involved, a decision-making framework based on the precautionary principle has been suggested in the literature, also recognizing that policy action should not always wait for scientific certainty (e.g. Keller et al., 2005). To improve the feasibility of future policy strategies, any proposals should thus be aimed at increasing the systemic resilience of the human society through scientific research, as well as technical, economic and social development at a global scale (IPCC, 2007e).

***Costs and Benefits***

Since resources are generally scarce, the evaluation of the costs and benefits of different policy interventions is crucial for the selection and implementation of reasonable effective climate policies. To avoid the most serious climate change impacts, GHG emission reductions in the 21st century need to be substantial (Washington et al., 2009). According to estimates by Parry et al. (2009), the potential costs for adaptation funding to an expected warming of 3 °C would be enormous. To respond effectively to global warming, the assessment of the costs and benefits of various actions as well as inaction is required. In addition, complex efficiency and equity issues must be addressed. Shogren and Thoman (2000) compared climate policy interventions to an insurance according to the *precautionary principle*: reducing the odds of adverse events occurring through mitigation, and reducing severity of negative consequences by increasing the capacity for adaptation once climate change occurs. Costs of national mitigation efforts usually decrease if other actors also implement efficient mitigation policies (e.g. Hulme et al., 2009). Moreover, the costs of inaction, i.e. from the damages caused by greater warming, may well exceed mitigation costs (e.g. World Bank, 2009), further emphasizing the need of a global agreement in order to optimize subsequent policy results. On the other hand, the effectiveness of adaptation measures in providing rapid and locally fitting climate protection decreases, while associated costs increase significantly with climate change and could

easily exceed adaptation capacities (Parry, 2009). With respect to future temperature outcomes, the substantial range of uncertainty thus represents a major challenge for the provision of suitable adaptation measures.

Economic cost-benefit analyses allow to identify the spatial and temporal distribution of possible impacts of different climate policies, as well as to solve existent problems of equity and resource allocation. Hof et al. (2009) for example, applied an *Integrated Assessment Model* in order to estimate the interactions between adaptation costs, residual damages and mitigation costs, using the so-called *Contraction & Convergence* (C&C) approach. In this burden-sharing regime, the atmosphere is considered as a global common good to which all are equally entitled. Emission rights are thus defined on the basis of a convergence of per capita emissions under a contracting global emission profile. Figure 2.8 shows the respective costs and residual damages for the different emission allocation scenarios in 2050 under a C&C regime. Greater emphasis on domestic and international incentive-based mechanisms in the short and medium term is obviously necessary to reduce future adaptation efforts and residual damages in the long term. Hof et al. (2009) argued that additional funding mechanisms are required to finance adaptation costs in developing countries, which are most vulnerable to the impacts of climate change according to projections. To alleviate the expected impacts in affected regions, optimal climate policies should also be coupled to social and economic development opportunities in order to amplify the relationship between climate response strategies and sustainable development efforts. In this respect, climate change also represents a major challenge for international equity considerations.

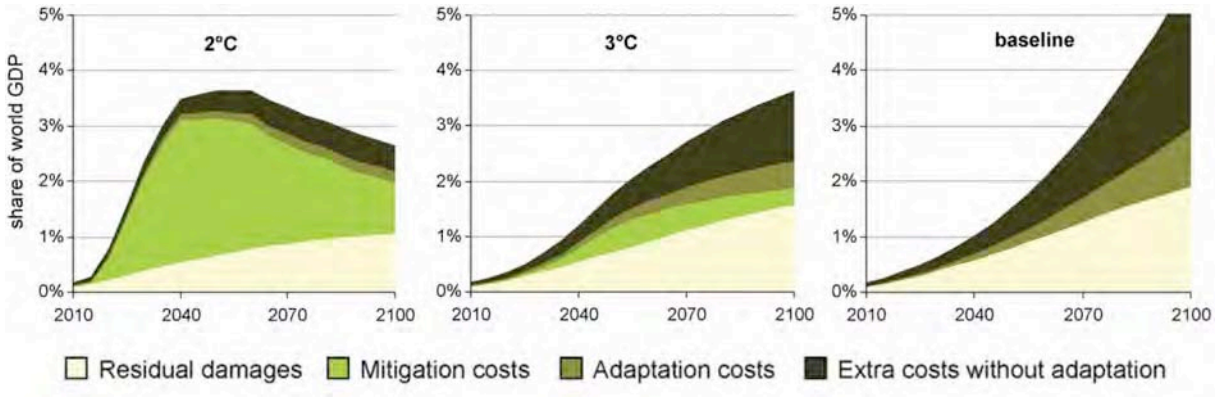


**Fig. 2.8: Global mitigation costs, adaptation costs, residual damages, and extra costs if no adaptation would be undertaken for a climate target of 2 °C, 3 °C and for the baseline, assuming full participation with emissions allocated according to a C&C 2050 regime (Source: Hof et al., 2009; adoption by the author).**

***Equity and Fairness***

Climate change by its very nature is a global problem where responsibilities are difficult to attribute as the vulnerability to impacts and adaptive capabilities vary considerably among regions. Historically, the industrial countries accounted for most of the emitted GHGs to date, whereas climate change may cause most harm to less developed countries (e.g. Dellink et al., 2009). Emerging nations like China and India are already contributing a major share of total global $CO_2$ emissions today and are projected to do so in the future (Boden et al., 2009). Although their respective per capita emissions remain significantly below other major emitters (ibid.), mitigating climate change can only be achieved if such countries participate in a treaty for the post 2012-period. According to Article 3.1 of the UNFCCC (1992), the global effort should be shared between the parties "on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities" (p. 4). Bargaining on the equitable distribution of the costs and responsibilities lies at the core of contemporary policy debates, as exemplified by the irreconcilable positions of the countries at the recently held COP 15 in Copenhagen. The negotiations revealed sharp differences between industrialized countries and many developing nations, which are mainly driven by actual development priorities and are much less concerned about the long-term challenge of climate change. As regional M&A capabilities inherently depend on financial and technological resources, socio-economic development may indeed represent a better strategy for reducing potential climate impacts in the future rather than focusing on current GHG emission reductions (Sudhakara Reddy and Assenza, 2009). Moreover, the implementation of mitigation options is generally considered as more equitable by holding responsible nations accountable in proportion of their GHG emissions (Wilbanks and Sathaye, 2007).

International climate policy not only relates to current human development issues, but also raises questions of intergenerational equity due to the long-term character of climate change impacts. Sustainable concepts should thus address the needs of today's societies without compromising the needs of future generations. This ethical aspect of policy-making is not prominently featured in current negotiations. For the success of a global burden-sharing regime, it is crucial to address all the political and socio-economic elements as well as to ensure institutional and procedural fairness in the related decision-making processes.

***Linking Climate Policy to Sustainable Development***

Global mitigation efforts can enhance sustainable development prospects in part by reducing the risk of adverse impacts of climate change (IPCC, 2007e), whereas future vulnerabilities

depend not only on climate change, but also on development pathways (IPCC, 2007b). Least developed countries, which are generally most affected by climate change, frequently lack the financial capabilities for an adequate funding of adaptation efforts. Since not all of the projected impacts can be prevented under any realistic emission abatement pathway, sustainable climate policies need to enhance the capacity of the most vulnerable regions to adapt to climate change. Unmitigated climate change is thus incompatible with sustainable development efforts (e.g. World Bank, 2009). Various factors influence such capacity building including economic and natural resources, institutions and governance, as well as technological progress (IPCC, 2007b). Wilbanks and Sathaye (2007) stressed the importance of integrating development issues in the evaluation of response portfolios that include both M&A, because sustainable development is a key element in shaping capacities and reducing the vulnerability to climate change. By addressing the legitimate demands of developing countries to economic and social welfare, sustainable development and capacity building thus constitute an integral part in the design of effective international climate policies in the short term. Sharing information and knowledge is also a prerequisite for the integration of developing countries into a global policy regime. Caspary and O'Connor (2002) suggested that such co-benefits are probably more significant in developing countries than in developed countries. Shrestha and Pradhan (2010) further noted that the adoption of cleaner fuels and advanced technologies can have significant impacts on the cost effectiveness of climate policies. From a sustainable development perspective, such co-benefits of climate policies thus represent an important component of future policy-making, especially in view of the still widespread uncertainties about impact costs and respective M&A payoffs. Given the diverse implications of M&A options for the selection of successful future policy interventions, the next chapter now provides a comparison of available climate response strategies.

### 2.2.3. Assessment of Mitigation and Adaptation Strategies

The current policy framework for avoiding potentially dangerous global climate change is essentially composed of M&A pathways. The IPCC terminology defines mitigation as intervention to reduce the anthropogenic forcing of the climate system including strategies to reduce GHG sources and emissions, and enhancing GHG sinks. Another definition also lists technological change and substitution that reduce resource inputs and emissions per unit of output as mitigation policy options (IPCC, 2007e; f). Adaptation is determined as adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects,

moderating harm or exploiting beneficial opportunities. Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects are also specified as adaptation policies (IPCC, 2007e; f). Briefly put, mitigation aims to "avoid the unmanageable" and adaptation aims to "manage the unavoidable" (Scientific Expert Group, 2007).

M&A policies have different advantages as well as disadvantages (Table 2.1), and there are considerable interrelationships between the options as already discussed before. In general, mitigating GHG emissions minimizes the direct risks from climate change, whereas adaptation efforts are primarily able to reduce the magnitude of impacts at local and national scales. However, the effectiveness of mitigation policies is depending on the participation of all countries at an international level (Biesbroek et al., 2009), and the adoption of energy efficiency and carbon sequestration technologies at a global scale also involves a number of policy steps (White and Hooke, 2004). In view of the challenging emission reduction targets of 70–80 percent required by 2050, excluding major GHG emitters from mitigation actions will either raise the costs to others or render the target unachievable (Hulme et al., 2009). Currently envisaged mitigation of GHG emissions will definitely not be sufficient to appreciably limit climate change and its impacts to acceptable levels (e.g. Dowlatabadi, 2007; Macintosh, 2010). Even successful mitigation policies alone will not be able to solve the problem of climate change, but they can decelerate climate change and make adaptation easier. Global investments in adaptation on the other hand may buy time for mitigation. Mitigation should thus

**Table 2.1: Comparison of different elements of mitigation and adaptation policy options (Sources: Dowlatabadi, 2007; IPCC, 2007e; adoption by the author).**

| | **Mitigation** | **Adaptation** |
|---|---|---|
| **Objective** | Reduction of impacts (diminish GHG emissions) | Reduction of residual damages (enhance resilience building) |
| **Policy approach** | Top-down (international regime) | Bottom-up (local initiatives) |
| **Temporal scale** | Long-term (intergenerational) | Short- to medium-term (intragenerational) |
| **Spatial scale** | Global (regional) | National (local) |
| **Sectoral focus** | Energy, industry and transportation | Agriculture, human health, water resources, economy, nature conservation etc. |
| **Distribution of benefits** | Global (most valuable to least developed countries) | Local (but limited to countries with adaptive capabilities) |
| **Distribution of impacts** | If poorly integrated into local context it may exacerbate other areas of concern (e.g. development etc.). | If poorly integrated into local context it may exacerbate vulnerability to other stressors. |

complement adaptation efforts and sustainable development (e.g. Ayers and Huq, 2009).

Given the difficulties in the political arena and the natural variability of the climate system, some climatic changes are inevitable. Therefore, most adaptation measures make sense under any climate scenario, resulting in benefits independent of climate change, and marginal benefits in the case of climate change (Pielke, 1998). Their implementation is marketplace driven rather than by top-down policy directive and can be tailored to optimize specific short-term, local, and individual needs (White and Hooke, 2004). A focus on adaptation strategies in industrialized countries may result in declining mitigation efforts, which in turn enhances adaptation needs in developing countries, as future climate change will be stronger (Michaelowa, 2001). There are also ecological, socio-economic, and technological limits to adaptation (Adger et al., 2009). The resilience of ecosystem services for instance, may be threatened by unchecked global warming. Also, the lack of funding in least developed countries might hinder local initiatives for adaptation measures, while even the adoption of the latest technologies cannot account for all of the potential future risks. In general, the benefits of adaptive actions exceed associated costs, whereas adaptation costs rise with global warming and its effectiveness decreases. The assessment of the costs and, in particular, the benefits of different adaptation options, is more challenging compared to mitigation strategies. The various benefits of different adaptation measures are more difficult to compare because they can be expressed in terms of monetary damage avoided, human lives saved, losses to natural and cultural values avoided, and so on (e.g. Klein et al., 2005).

As the recent negotiations at the COP 15 failed to produce a sufficient agreement according to the requirements based on the available scientific evidence, geo-engineering alternatives are increasingly gaining attention. Recent studies on offset strategies addressed the technical and economic feasibility of geo-engineering options (e.g. The Royal Society, 2009). Due to issues of international governance, associated environmental risks, and ethical implications, a possible future use of such techniques is generally considered only as a last resort (e.g. Virgoe, 2009). Assessing the potential of emergency responses to confront possibly drastic consequences of climate change nonetheless makes sense, since temperature increases may go beyond dangerous levels, and the projected vulnerability of important systems could be higher. To estimate future damaging effects and potential adaptation needs, Parry et al. (2009) simulated the outcomes of three global average surface temperature scenarios for peak GHG emissions in 2015, 2025, and 2035 respectively, with 3 percent global emission cuts annually thereafter. The range of projected damaging effects and the adaptation needs for selected levels of impact risk coverage, including examples of these effects for a range of global sectors,

are illustrated in Figure 2.9. They concluded that we should be planning to adapt to at least 4 °C of warming, emphasizing that policies of adaptation and recovery need much more attention.

Obviously, there is no unequivocal solution to the challenge of climate change. The remaining impacts of climate change, even after successful mitigation, will be distributed unevenly throughout the world affecting the least developed countries hardest (e.g. Biesbroek et al., 2009). Long-term efforts have to be combined with short-term actions requiring institutional, technical, and spatial measures to adapt to the impacts. A coherent international architecture is therefore essential in finding a common ground for the differentiated participation of developed and developing countries in a global climate policy regime based on shared burdens and mutual benefits. The next chapter aims to explain some of the difficulties in the design of a sustainable long-term climate change regime, and to show why international cooperation is inevitably delicate to achieve.

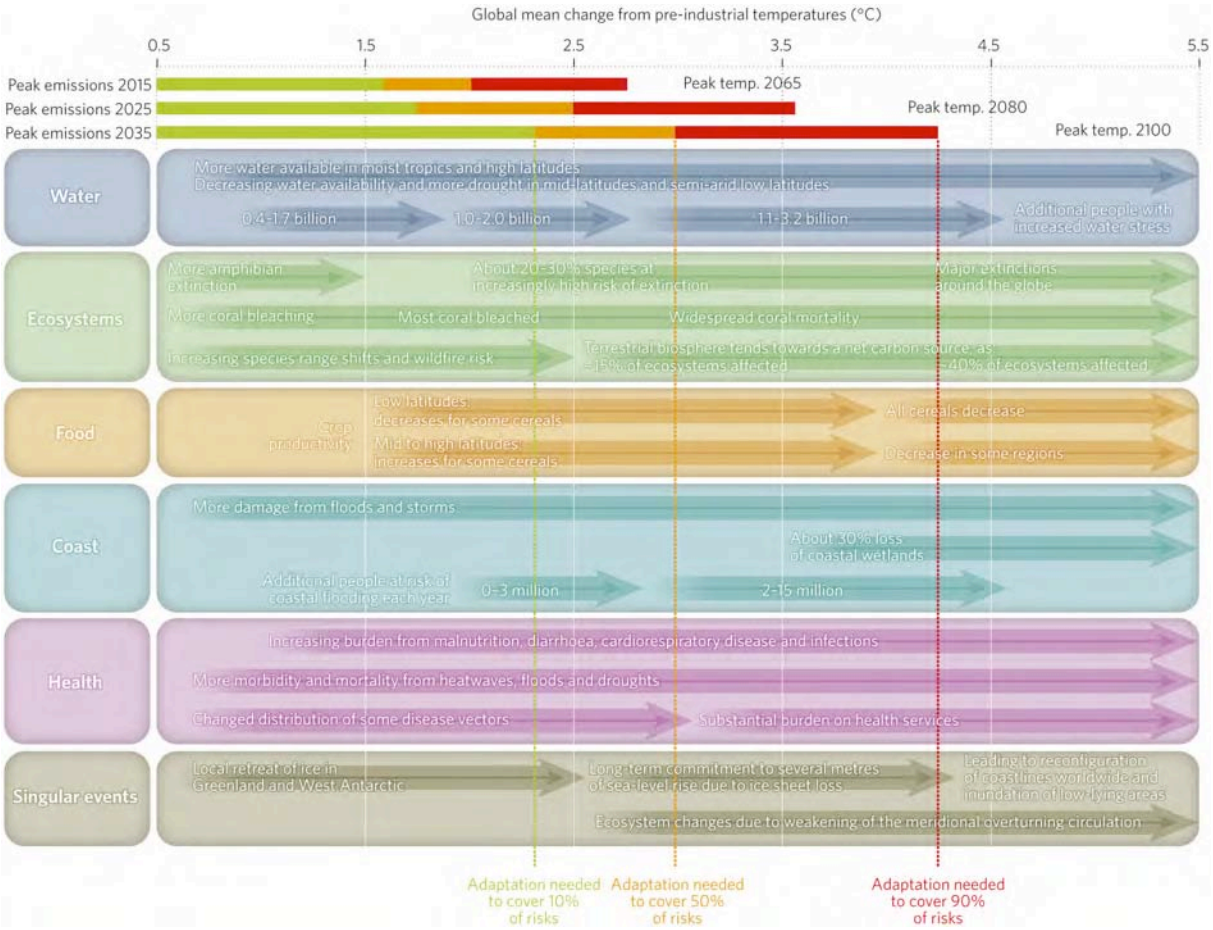


**Fig. 2.9: Expected effects on a range of global sectors for different global mean temperature increases from preindustrial levels. Plotting peak temperatures from the three scenarios shows the range of projected damaging effects and the adaptation needs for 10%, 50% and 90% coverage of impact risk, and examples of these effects for a range of global sectors (Source: Parry et al., 2009).**

# 3. Theory

This chapter introduces the theoretical background of the thesis and also aims to provide an overview of current developments in the relevant research areas. Given the wide range of theoretical implications associated with the presented research questions, it is nearly impossible to duly account for all the different aspects and ramifications in each of the scientific fields outlined below. Therefore, the focus of interest and the respective emphasis on various subject areas presented in the following sections do not pretend to reproduce an extensive factual state of the respective academic discourses, but should be viewed as a compendium of what the author considers relevant for the general understanding, the methodical assessment, as well as for the main conclusions of this study.

The first part introduces the relevant theoretical perspectives of the relationships between nation-states and other actors in the international system with a focus on democratic governments. After elaborating the notion of global public goods, the formation of international regimes, as well as the basic tenets of national decision-making processes and corresponding domestic constraints concerning environmental policies, are illustrated. The second part addresses some relevant aspects of mass media theory and the communication of science, as well as the role of news media in shaping public understanding of environmental issues. A summary of the general media coverage, and newspaper coverage of global warming in particular, is also presented. Finally, an assessment of the potential influence of news media and other domestic political actors on national public opinions and policy agendas is given. After the illustration of the different concepts, the hypotheses derived from the theoretical arguments are stated at the end of this section.

## 3.1. Political Economy of Climate Change

Global warming and the collateral amplification of the greenhouse effect generate, in all likelihood, anthropogenic climate change of global dimensions and unprecedented consequences for decades to come (e.g. Hillerbrand and Ghil, 2008). Global warming and sea level rise will continue for centuries due to the time scales associated with climate processes and feedbacks,

even if GHG concentrations were to be stabilized immediately (e.g. Lowe et al., 2009). The recent scientific literature provided numerous evidence that human-influenced climate change is already having a significant impact on physical and biological systems globally and in some continents and will continue to do so in the future (e.g. IPCC, 2007a; Rosenzweig et al., 2008). As there is no a priori relationship between the quantity of GHGs that a region or a country emits and the consequences for that same area in terms of climate change (Luterbacher and Sprinz, 2001), the associated impacts are not distributed evenly across geographical scales, thereby creating winners and losers within a warming environment. The acceleration of climate change will further exacerbate the differences between developing and developed countries' welfare and unleash a suite of complex social, economic and political risks (e.g. World Bank, 2009). The cooperation of countries within global climate change politics thus represents a crucial aspect to solve the problem (e.g. Victor, 2006; Von Stein, 2008). However, Paavola and Adger (2006) argued that the existing global climate change regime largely omits responsibility of developed nations, and has so far failed to operationalize assistance for developing countries making only minor progress towards eliminating obstacles for fair participation. Given these implications, global climate change constitutes a classic collective action problem, which needs international cooperation to ensure policy compliance and to avoid free-riding (Olson, 1965). In the context of this unprecedented global challenge, some general principles of *International Political Economy* (IPE) and relevant elements of different theoretical perspectives will now be introduced.

Today's world system can be characterized by the competition among self-interested nation-states subject to external influences arising from the international system, and among interests within nations-states subject to internal influences originating from national decision-making processes. Nationally different constituents like corporate interests and environmental pressure groups in turn influence domestic policy-making. National self-interest also seems to pressure many nations toward free-riding, often effectively preventing necessary international action to achieve long-term stability of GHG emissions (Luterbacher and Sprinz, 2001). The demand for cooperative climate policies arises out of the interests shared by all countries, to varying degrees to address the problem of a changing climate (Victor, 2006). Although nation-states continue to seek their own interests, international regimes are created to overcome collective goods dilemmas by coordinating the behaviors of individual states. The level of analysis in this study focuses mainly on democratic governments, and their relationships with other actors in the international system (governments, transnational corporations, non-governmental organizations (NGOs), epistemic communities (e.g. IPCC), etc.), as well as on

the roles, i.e. the opportunities and constraints, of decision-makers within their respective socio-economic and political systems. Nation-states represent the principal actors in the international framework of climate policy-making by exerting authority over the conditions and processes in domestic decision-making. In other words, IPE deals with national governmental decisions in the context of international political and economic institutions.

Neo-liberalism is considered to be the most influential perspective in IPE regarding environmental issues, mainly because liberalists are more likely to focus on intermestic areas of mutual interests, i.e. the linkages between international and domestic politics, than the neo-realist paradigm. According to the theory of *Institutional Liberalism*, international institutions play a significant role in promoting cooperation in issue areas where there is a high degree of interdependence among states and non-state actors (Bernauer et al., 2010). Figure 3.1 illustrates the complex system of political coordination and associated interdependencies in the decision framework of global environmental governance today. Decision-making mechanisms have to address issues of legitimacy, accountability, as well as transparency in order to improve the effectiveness of global regimes. They also have to integrate all the relevant actors in collective decisions-making processes. Efficient international regimes have to be able to limit negative externalities of decentralized actions by coordinating the international policy response to a given problem, and thereby reducing the incentives for free-riding.

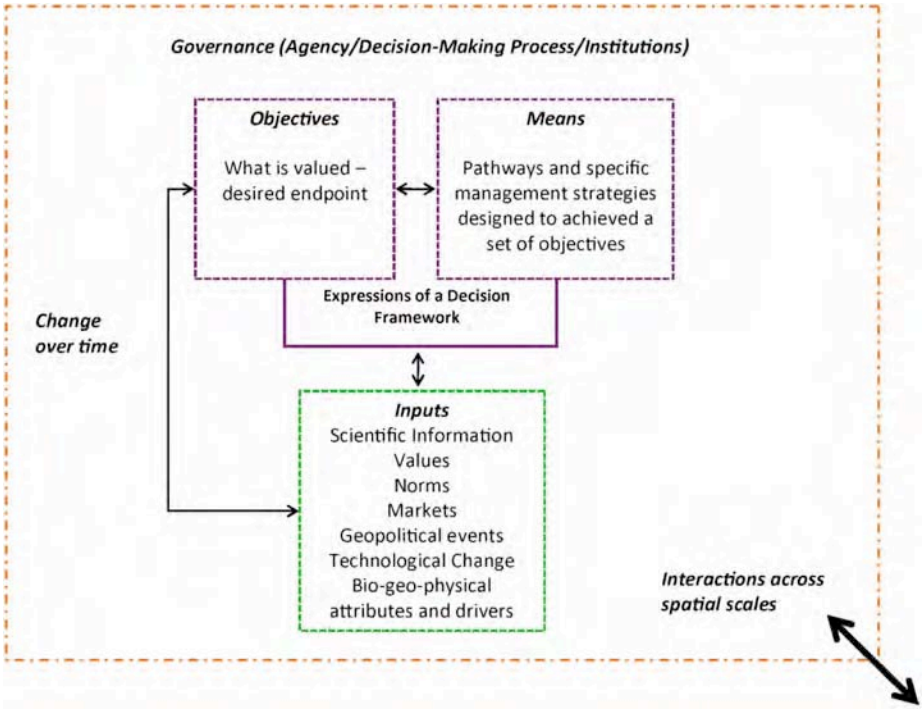


**Fig. 3.1: Core elements of a decision framework (Source: Hagerman et al., 2010)**

The following part will first introduce the notion of global public goods, and show how their characteristics apply to the climate system representing such a global public good. An overview of the theoretical background of international regime formation will then be presented. Finally, a summary of the implications of national policy-making and their relations to the international system is given.

### 3.1.1. The Climate System – a Global Public Good

The Earth' climate system, and as such climate change, represents an "exemplary global public good because each country's emissions of greenhouse gases contribute cumulatively to the increase of the overall concentration, and each country's abatements entail higher cost than benefit, unless effective concerted collective actions take place" (Grasso, 2004: p. 1). According to the definition by Samuelson (1954), a *public good* is a good that is non-excludable and non-rival. This means that everyone can benefit from the good even without contributing to its provision (non-excludability), and that any individual use of the good does not seriously decrease the amount available to others (non-rivalry). Some economists argued that these characteristics cause problems for the provision of public goods leading to instances of market failure. Stern (2007) even called climate change the result of "the biggest market failure the world has ever seen" (p. 4). The availability of public goods is generally determined partly by the laws of nature or by past human activities, but also by the actions of many consumers and producers as well as by public policy (Sandmo, 2003). Kaul and Mendoza (2003) defined a *global public good* as "goods whose benefits extend to all countries, people, and generations" (p. 95). According to this definition, the planetary climate system represents such a global public good, as its benefits are available to all individuals and nations irrespective of their contributions to its provision. On the other hand, the global atmosphere also represents a *common-pool resource*, i.e. a collective good, to which everyone has access. According to Ostrom et al. (1999), common-pool resources include natural and human-constructed resources in which "exclusion of beneficiaries through physical and institutional means is especially costly, and exploitation by one user reduces resource availability for others" (p. 278). Naturally, such resources are limited or exhaustible (i.e. rival) as they tend to be overused through anthropogenic GHG emissions, ultimately resulting in global warming (Luterbacher and Sprinz, 2001). The climate system thus appears as a non-exclusive but rival collective good. Given the two characteristics – difficulty of exclusion and substractability – climate change as an urgent environmental problem represents a common-pool resource dilemma in

which a nation's short-term self-interests are at odds with long-term group interests and the common good (Ostrom et al., 1999). The excessive use of the global atmosphere through anthropogenic GHG emissions can also be viewed as an example of the *tragedy of the commons*, where individuals acting independently and rationally in their own self-interest, will ultimately deplete a common-pool resource even when it is clear that it is not in anyone's long-term interest for this to happen (Hardin, 1968).

In summary, the benefits of avoided climate change are spatially indivisible and freely available over the globe, irrespective of whether a country is contributing to the regime costs or not. As regime benefits by individual nations do not exclude their availability to others, enforcing binding commitments on the use of the climate system is difficult (Kaul et al., 2003). The emerging collective or public good problem to be solved is similar to a prisoners' dilemma situation, requiring international cooperation in order to provide sufficient incentives for the participation in an environmental regime and to create a particular institutional framework to keep free-riding from occurring (Luterbacher and Sprinz, 2001). As a consequence, international cooperation is crucial to the provision of global public goods and the achievement of common goals in general, as individual countries alone are unable to adequately address many of the important issues such as climate change, but need a broad international consensus as well as transparent decision-making processes. The coordination of national actions, sharing both knowledge and information on climate change, and the transfer of technologies as well as financial considerations for less developed countries are required for international cooperation to ensure the implementation of a successful climate regime. However, the enormous scale of the differences when comparing the annual costs of inaction (780 billion US$), with the annual costs of corrective actions for a doubling of atmospheric $CO_2$ concentrations (125 billion US$) should make international coordination in climate policy more appealing (Conçeicão, 2003).

According to political economy theory, there are several reasons for explaining the difficulties in achieving international cooperation on climate change. First, governments are naturally reluctant to limit or constrain their sovereignty in political decision-making processes and to submit themselves to international regimes (e.g. Waltz, 1979). The formation of any international regime will thus undoubtedly be governed by the configuration of power among the interested actors. *Hegemonic Stability Theory* further predicts that the degree of international cooperation is directly proportional to the degree to which one actor dominates international politics (Keohane, 1980). The prospects for cooperation can thus be influenced if an actor is identified as a *hegemon*, and is willing to use its power resources to pressure for an agree-

ment. In the case of climate change, the prospects for international cooperation certainly depend on the commitment of the U.S., which remain an influential global player next to being still one of the biggest GHG emitters (Rowlands, 2001). In a strategic environment, leadership from significant GHG emitters may therefore provide incentives for other countries to follow suit. Second, although national governments represent their countries in international negotiations, governmental representatives in democracies rely on "majorities in legislatures or in public referenda" for the ratification of international agreements (Sprinz and Weiß, 2001: p. 67). As potential impacts of climatic changes are distributed unevenly across regions, national preferences may differ substantially according to the respective economic capacity, i.e. the perceived level of abatement costs, and the country's ecological vulnerability (Lo, 2010). Therefore, domestic constraints are likely to influence the position of governments in international bargaining. Putnam (1988) described the two-level metaphor for the linkages between the domestic and international politics as follows:

> At the national level, domestic groups pursue their interests by pressuring the government to adopt favorable policies, and politicians seek power by constructing coalitions among those groups. At the international level, national governments seek to maximize their own ability to satisfy domestic pressures, while minimizing the adverse consequences of foreign developments. Neither of the two games can be ignored by decision-makers, so long as their countries remain independent, yet sovereign (p. 434).

Finally and most importantly, an effective international climate regime crucially depends on mechanisms to enforce policy compliance as the non-excludability of free-riders impedes cooperation. In a free-riding situation, mitigation efforts are borne by individual nations while the free-riders enjoy the benefits of the mitigation commitments of the former. In addition, individual mitigation costs decrease with efficient mitigation actions undertaken by others (IPCC, 2007e). However, if emerging economies like China, Brazil or India do not participate in the international effort to mitigate global climate change, the problem will not be solved even when the rest of the world cooperates. The challenges of ensuring compliance to such long-term global initiatives are therefore enormous. Effective and accountable institutions are central to the efficient provision of global public goods. As global environmental problems originate primarily from the lack of cooperation among nation-states, resulting in the underproduction of these goods or depletion of a common-pool resource through the absence of any enforcement mechanisms, an overview of the formation of global environmental regimes is now presented.

### 3.1.2. International Environmental Regimes

The establishment of worldwide regimes represents an important feature of the contemporary international system (Little, 2008). Krasner (1982) defined regimes as "sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a given area of international relations" (p. 2). Principles and norms provide the basic characteristics in the definition of a regime. Any changes of the fundamental principles and norms imply a change of the regime itself, whereas changes in rules and decision-making procedures are changes within a regime itself (ibid.). Regimes are generally based on a conception of common interests in which collaboration represents an optimal strategy for participants, or are the product of a common aversion where the actors agree on a negative outcome all wish to avoid (e.g. climate change). International regimes deal with various issues such as trade (World Trade Organization), security (weapons non-proliferation), the management of natural resources (whaling agreements), or environmental problems (Kyoto Protocol), and are usually associated with international organizations. Walker et al. (2009) however, argued that transnational institutions to date "primarily focus on single problems, ignoring system-wide interactions," advocating a more effective cooperation facilitated by better-designed institutions (p. 1345).

The *Montreal Protocol* aimed at protecting the ozone layer is generally regarded as a successful example of international environmental cooperation. It entered into force in 1989 and as of 16 September 2009, all United Nations (UN) member states have ratified the original protocol (UNEP, 2009b). International environmental agreements have increased substantially in number in recent decades (CIESIN, 2009). In the case of climate change, reasons for the lack of a comprehensive global regime are the differentiated costs and benefits of M&A efforts, existing uncertainties regarding environmental and economic consequences, the moderate public pressure for international cooperation, the absence of strong enforcing mechanisms as to avoid free-riding, and insufficient financial support for developing countries. There are several different perspectives in IPE to analyze specific conditions under which nation-states show the tendency to pursue the creation of international regimes, thereby partially delegating power and sovereignty to supranational institutions in order to maximize their utility within the constraints of world politics (Woods, 2008). The two main approaches in the analysis of international regimes are the liberal-institutional and the realist paradigms. Proponents of both approaches agree that a regime represents the response of rational actors operating within the anarchic structure of the international system. Common assumptions are that the international

system is anarchic, i.e. nation-states try to maximize their self-interests, that states are rational actors, and that they are responsible for the establishment of regimes (Little, 2008). Consequently, the effectiveness of an international agreement is limited by the commitment level of the agreement's least interested party (Victor, 2006). Table 3.1 provides an overview of the main concepts and respective hypotheses regarding the prospects of international cooperation on global climate change of both approaches. The main difference between the approaches is the focus on absolute and relative gains respectively. From a realist's perspective, relations in the international system are often characterized by a zero-sum game, i.e. one actors' gain equals another actors' loss. States are thus mainly concerned with relative gains in order to maximize their gains – and minimize their losses – relative to other states' gains (e.g. Grieco, 1988; Waltz, 1979). In the neo-liberal or institutionalist approach, international interactions can result in a positive-sum game based on absolute gains, i.e. cooperation can be mutually beneficial even if states do not profit more than the other side (e.g. Axelrod and Keohane, 1985). Several authors have argued that realist concerns for relative gains severely limit the capacity of nations to cooperate (e.g. Grieco, 1988; Snidal, 1991a; b).

**Table 3.1: Comparison of the main theoretical approaches of international regime formation in general, and the hypothesis and evaluation regarding global climate change (GCC) in particular (Sources: Grieco, 1988; Rowlands, 2001; Sprinz and Luterbacher, 1996; adoption by the author).**

| | **(Neo-)Liberal Institutionalism** | **Realism / Neorealism** |
|---|---|---|
| **Key concept(s)** | International regimes (*Contractarian*: cooperation under anarchy, utility maximizers);<br>Institutional factors (*Constitutive*: organizations and institutions) | Power and interests; hegemonic stability |
| **Main goal** | To achieve greatest possible absolute gains | To achieve greatest relative gains *and* smallest gap in gains favoring partners |
| **Barriers to cooperation** | State concerns about partners' compliance | State concerns about partners' compliance *and* partners' relative gains |
| **Hypothesis on international cooperation on GCC** | International regime on GCC will emerge and assist the strengthening of international rules of GCC regulation. | Major powers determine the international rules of GCC regulation. |
| **Evaluation of GCC policy to date** | *Contractarian*: useful in highlighting the divergent interests of actors in light of global climate change; however, more cooperation actually realized than anticipated.<br>*Constitutive*: activities of international structures have been important but not all-determining. | Undoubtedly power has played a role (as has the most powerful country, the United States), but the "less powerful" have still exerted influence. |

Numerous studies in the field of international politics have also analyzed the design mechanisms of how to ensure the participation of countries in global environmental regimes and consequently to avoid defection. Barrett (2005) for example, argued that successful global environmental treaties have to include self-enforcing mechanisms from the start, emphasizing that a treaty must be individually and collectively rational, which means that all of the states involved must benefit more with the treaty than without. Also, a treaty must be fair, or perceived as legitimate to all parties. Specifically focusing on the UNFCCC and the Kyoto Protocol, Von Stein (2008) mentioned legalization and flexibility as two important institutional characteristics for countries to ratify the agreements. Pittel and Rübbelke (2008) examined the need of incentives for major polluters from the developing world to participate in a global climate regime, stressing the importance of ancillary benefits of international GHG abatement policies such as aid or the reduction of local air pollution. Other research addressed the influence of non-state actors like NGOs and epistemic communities to the development of international regimes (e.g. Haas, 1992; Raustiala, 1997; Ward, 2006). Some authors have further argued that democratic countries are more likely to make credible international policy commitments than their non-democratic counterparts (Bernauer et al., 2010; Mansfield et al., 2002). Bättig et al. (2008) for instance, evaluated the cooperative behavior of 198 countries relative to each other within the international climate change regime between 1990 and 2005 according to five indicators and their aggregation to a *Cooperation Index* (Fig. 3.2). Their results suggest that developed countries with emission targets under the Kyoto Protocol are more cooperative than the other countries (ibid.).

While international cooperation for the adoption of a global climate regime is undoubtedly necessary, corresponding policy decisions at a national level are a prerequisite for enhancing the opportunities for any international agreement (e.g. Putnam, 1988; Sprinz and Weiß, 2001). To closer examine national decision-making processes, the following section provides a short introduction to *Public Choice Theory,* as well as an overview of potential domestic influences on national climate policy-making.

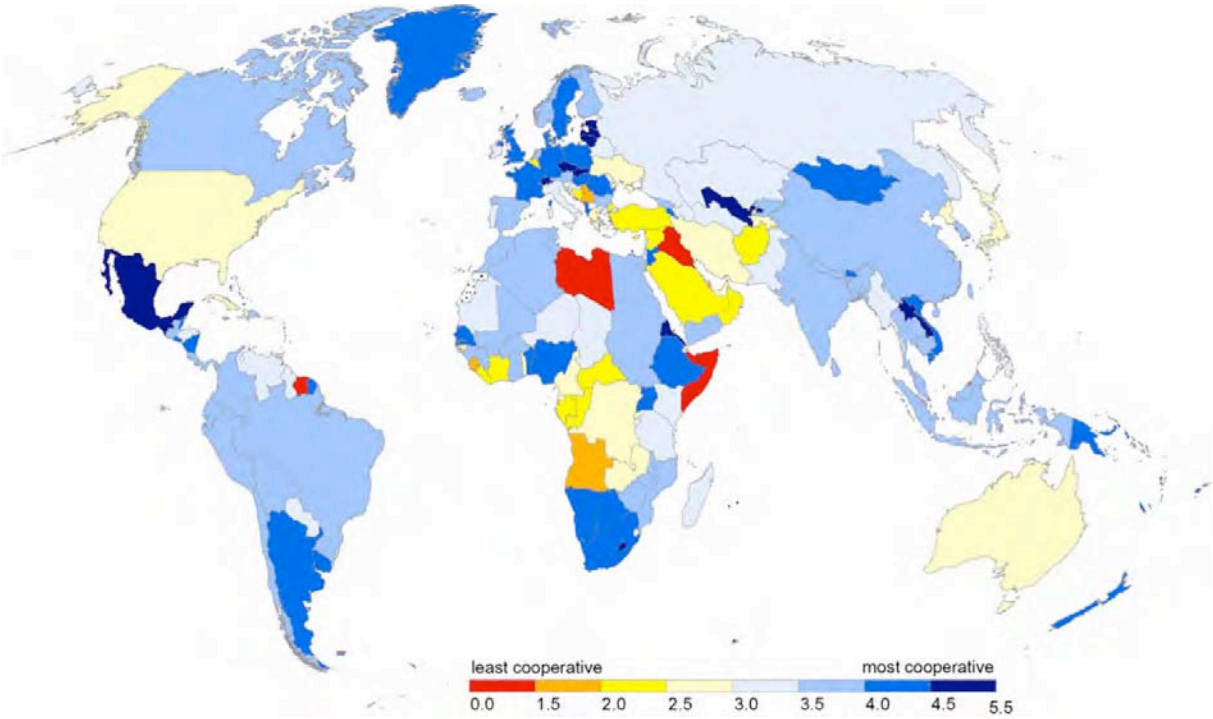


**Fig. 3.2: The aggregated *Cooperation Index* on a scale between 0 (= least cooperative) and 6 (= most cooperative) based on five indicators that estimate whether and how fast countries have committed to the two climate change agreements (UNFCCC and Kyoto Protocol) and whether and how effectively measures have been implemented in line with these agreements (reporting, financing, mitigation of emissions) (Source: Bättig et al., 2008).**

### 3.1.3. National Climate Policy-making

The specific challenges of climate change not only require international cooperation, but also political commitments within national borders to fulfill the established obligations. Although climate change is a global concern, countries have adopted markedly different climate policies at a national level (Rowlands, 1995). In contrast to international policy-making where no authority to enforce collaboration towards a regime exists, the provision of public goods at a national level is typically organized by the state. *Public Choice Theory* studies the decisions of political actors and their interactions in the social system under alternative constitutional rule, and analyzes the decision-making mechanisms in a society. The *Median Voter Theorem* posits that under certain conditions, majority voting leads to a stable equilibrium with the chosen policy being that favored by the median voter (Black, 1948). In representative democracies, the political outcomes also reflect median voter preferences (Downs, 1957). The following theoretical debate elaborates the demand and supply side arguments in order to evaluate the effect of democracy on the provision of public goods and the international environmental treaty ratification behavior.

The existence of civil liberties in democratic countries is likely to make the electorate more aware of environmental problems (demand side). Moreover, democratic leaders are likely to experience greater incentives to satisfy public demand for public goods in order to survive in office (supply side). The existing literature on environmental performance has in fact demonstrated that democracies usually perform better in terms of domestic environmental quality (e.g. Bernauer and Koubi, 2009; Ward, 2008). In general, democracy has a positive effect on the provision of public goods, including global public goods such as climate change mitigation (e.g. Bättig and Bernauer, 2009), whereas non-democratic countries are more likely to underprovide public goods (e.g. Bueno de Mesquita et al., 2003; McGuire and Olson, 1996; Olson, 1993). Some authors have claimed, however, that in democratic countries special interest groups enjoy a disproportionate influence on policy-making (e.g. Olson, 1965). Powerful business associations for instance, frequently play an important role in the decision-making process of climate policy (e.g. Börner, 2009; Vormedal, 2008). Congelton (1992) also argued that elected governments may have shorter planning horizons than non-elected governments because of political myopia, focusing on the maximization of votes at the next election instead of promoting stricter environmental policies with longer-term benefits. Results from a study by Bättig and Bernauer (2009) for example, showed that the effect of democracy on levels of political commitment to climate change mitigation (policy output) is positive, but the effect on measured GHG emission levels and trends (policy outcomes) is ambiguous.

Democratic countries are also more likely to make credible international policy commitments relating to environmental protection than their non-democratic counterparts (e.g. Mansfield et al., 2002; Neumayer, 2002). The degree of civil liberties, such as freedom of speech, press and association tends to be higher in democracies (Payne, 1995). Citizens are thus likely to be better informed by independent mass media and other sources (e.g. NGOs) about environmental problems and government policies in general (e.g. Bernauer et al., 2010; Ward, 2006). This implies that public demand by the median voter and/or politically influential interest groups for risk mitigation is likely to be stronger in democracies, hence the likelihood of ratifications of environmental treaties increases (e.g. Neumayer, 2002). According to the median voter argument, democratic governments are also expected to ratify global environmental treaties more often than autocracies (e.g. Bernauer et al., 2010). In summary, the existence of civil liberties in democracies is likely to influence public demand for environmental risk mitigation according to the median voter (demand side). Assuming that democratic leaders maximize their interests (i.e. re-election), many authors (e.g. Bernauer et al., 2010; Neumayer,

2002; Von Stein, 2008) have argued that democracies are also more likely to ratify international environmental agreements (supply side).

Numerous research efforts have also addressed the influence of domestic political actors on national environmental policies (e.g. Prittwitz, 1990; Rowlands, 1995). As climate change has significant strategic impacts on many companies, a strong public demand and pressure on policy outcome has traditionally come from parts of industry lobbies. Powerful corporations adversely affected by mitigation policies have thus increasingly exercised considerable influence on national climate policies (e.g. Vormedal, 2008). Newell and Paterson (1998) for instance, demonstrated that the fossil fuel industry has been systematically able to secure its interests in relation to climate policy-making, and that these interests have further been consistent with the interests of "capital-in-general," because growth in energy use is a precondition for the general accumulation of wealth (p. 695). More recent studies have shown a general shift in corporate strategies from opposition to accommodation and cooperation (e.g. Levy, 2005). Instead, companies now seek to influence regulatory design and the adoption of favorable mitigation policy options (Vormedal, 2008). On the other hand, environmental NGOs have been quite effective in raising public awareness and concerns by popularizing ecological problems in the past. NGOs are now considered as an integral part of the political landscape and the community of non-state actors surrounding the global warming issue has evolved considerably (Raustiala, 2001). In issue areas with high levels of uncertainty such as climate change, governments also face incentives to seek expert advice. As a result, transnational expert or *epistemic* communities may thus exert substantial influence within policy processes (ibid.). Haas (1992) defined an epistemic community as "a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-area" (p. 3). Although epistemic communities are usually organized at an international level, their influence extends to domestic policy decisions as well. National climate policy-making is often based on the results and recommendations derived from scientific publications such as the Assessment Reports of the IPCC, which represents a prominent example of such an expert network (Schreurs, 2002).

Next to the rights of individuals to debate, to assemble, to demonstrate, and to form organizations, freedom of the press is also likely to raise the public awareness of environmental problems and possibilities for their mitigation in democratic countries. Independent media companies play a crucial role in the transmission of information to the public, especially given their influence on the public opinion on major issues. Consequently, news media represent an important actor in shaping public understanding of environmental issues by transmitting infor-

mation to the general public (e.g. Stamm et al., 2000), and thus play an important role in setting public as well as policy agendas (e.g. Liu et al., 2008). As the increasing news coverage on environmental issues has been one of the major reasons that led to the increasing awareness of global warming, not only in the academic and political realm, but also in the general public, the most relevant aspects of news selection, their implications to the communication of science, and how news reporting influences the forming of public opinion about such issues are discussed in the following section.

## 3.2. Mass Media and the Communication of Science

"Climate change communication among the scientific community, policy-makers, and mainstream media is characterized by a highly complex set of interactions" (Russill and Nyssa, 2009: p. 343). News media have long been recognized as important sources of scientific information among non-scientists (e.g. Nisbet and Myers, 2007). Much research has established the role of mass media in shaping public understanding of environmental issues (e.g. Burgess 1990; Stamm et al., 2000; Wilson, 1995), and their influence on public policy through the scientific and political framing of climate change, has been well documented in recent years (Trumbo, 1996; Trumbo and Shanahan, 2000). Several studies have also provided insights into the links between news media and the public understanding and debate of climate change (e.g. Smith, 2005; Weingart et al., 2000). Through their extensive coverage of global warming since the 1980s, the mass media have created public concern and a call for political commitments, although considerable constraints on the level of individuals exist (e.g. time, money, and lack of knowledge). The representation of climate change is nevertheless highly varied at a national level, despite being an important global phenomenon. "Different mass media, and different groups within those media, communicate climate science through a set of culturally specific frames, which have a major influence on public perception," and thus on subsequent policy decision in democracies (Billett, 2010: p. 2).

The main task of the mass media is to transmit scientific knowledge, produced within the social system of science in adequate, popular and appealing form to the public (Weingart, 1998). There has been an increasing competition over the adequacy of the representation of global warming through this popularization of science in the mass media. Since the general public relies on the mass media as main source of its knowledge about science, investigating the mass media's portrayal of global warming is crucial (e.g. Boykoff, 2008a; Boykoff and

Boykoff, 2004; Wilson, 2000). However, the media do not simply mirror reality. On the contrary, they make their own selections according to some implicit criteria. Several studies have assessed journalistic norms and values on how news media identify, select, and transmit information about reality (e.g. Galtung and Ruge, 1965; Gans, 1980), and demonstrated the effect of news reporting on public opinion through agenda-setting (McCombs and Shaw, 1972). Academic research has also recognized that environmental change does not exist isolated from society, but that the information and knowledge about the physical world are interpreted in the context of specific social values and cultural norms (e.g. Demeritt, 2006). The mass media are a key part of this process, acting as gatekeepers of information in general (White, 1950), and the news coverage on climate change in particular (Carvalho and Burgess 2005). Research about the mass media's ability to accurately report scientific findings about climate change to a non-expert audience has also been extensive (e.g. Bell, 1994a; b; Boykoff, 2008a; Trumbo, 1996). Other authors examined the communication of scientific uncertainty. Zehr (2000) for example, investigated how this was represented in the press coverage and the implications for public perception of scientific authority, finding that indications of uncertainty were generally linked to assertions that policy development was premature. Until recently, what seemed to receive disproportionate attention in the media is not the vast amount of information that we know with high confidence, but rather the perception that there is much uncertainty and that our information base is poor. Moss (2007) argued that this uncritical focus on uncertainty undoubtedly contributes to the public's misperceptions about the degree of consensus in the scientific community. On the other hand, Sarewitz (2004) showed that greater scientific understanding can actually lead to more complicated policy-making by providing an expanded knowledge base for varying interpretations of the available science. The general media coverage of climate change, and of newspapers in particular, as well as its influence on the shaping of public opinions at a national level, is now elaborated in more detail.

### 3.2.1. Media Coverage of Climate Change

News coverage on global warming has increased markedly in recent decades (e.g. Doulton and Brown, 2009; Mazur, 2009), although McManus (2000) argued that the heterogeneous impacts of climatic change in fact reduce the likelihood of its being reported extensively. The communication of the climate change issue from scientists and policy-makers to a general audience via the mass media has also been a subject of increasing scientific interest because of its implications for the public understanding of the problem. Some scholars analyzed the

reasons behind the cyclical nature of the news coverage of climate change (e.g. Carvalho and Burgess, 2005; Trumbo, 1996; Weingart et al., 2000), whereas other studies investigated how news media transmit the science of climate change, including the influence of news sources (Antilla, 2005), and journalistic norms (Boykoff, 2007a; Boykoff and Boykoff, 2007). Further research examined economic and social influences that affect media perspectives (e.g. Dispensa and Brulle, 2003), how news media help shape public understanding of climate change risks (Smith, 2005), or how value systems affect news coverage on the climate change problem and solution orientations (Carvalho, 2005; Carvalho and Burgess, 2005; Wilkins, 1993). In addition, the social construction of climate change as a global environmental problem does not necessarily reflect the scientific construction of the issue (e.g. Von Storch, 2009). Research investigating the connection between scientific knowledge, media, and public understanding of climate change frequently suggests a gap between scientific and media representations of anthropogenic climate change (e.g. Boykoff and Mansfield, 2008; Russill and Nyssa, 2009). There are several reasons for this apparent discrepancy.

In their seminal paper introducing the notion of *news values* for the identification, selection, and sorting of information, Galtung and Ruge (1965) demonstrated that journalists tend to select the news value of a piece of information according to the actuality, sensation, personalization, and locality of the information to be published. Obviously, these criteria are diametrically opposed to those used in research methodology for validating scientific evidence such as objectivity and experimental traceability. By adhering to important journalistic norms of objectivity and neutrality, mass media tend to abide to the norm of balance: identifying the most dominant, widespread positions and then presenting both sides of an argument (Boykoff, 2008c; Boykoff and Boykoff, 2004). In terms of the global warming issue, such *balance* frequently allows skeptics to be quoted on par with climate researchers leading to a balanced reporting where there is not necessarily a balance in facts, i.e. balanced coverage does not always mean accurate coverage. Boykoff and Boykoff (2007) argued that in the case of anthropogenic climate change, journalistic norms and influences have contributed to this informational bias (Fig. 3.3). Freudenburg and Muselli (2010) also found reporters to frequently exaggerate the debate, underplaying the actual scientific consensus on climate change. Boykoff and Mansfield (2008) further reported that the media coverage often diverged significantly from the scientific consensus. Again, the reported scientific consensus on global warming did not reflect the actual consensus among climate scientists. Oreskes (2005) for example, analyzed 928 abstracts of articles, published in refereed scientific journals between 1993 and

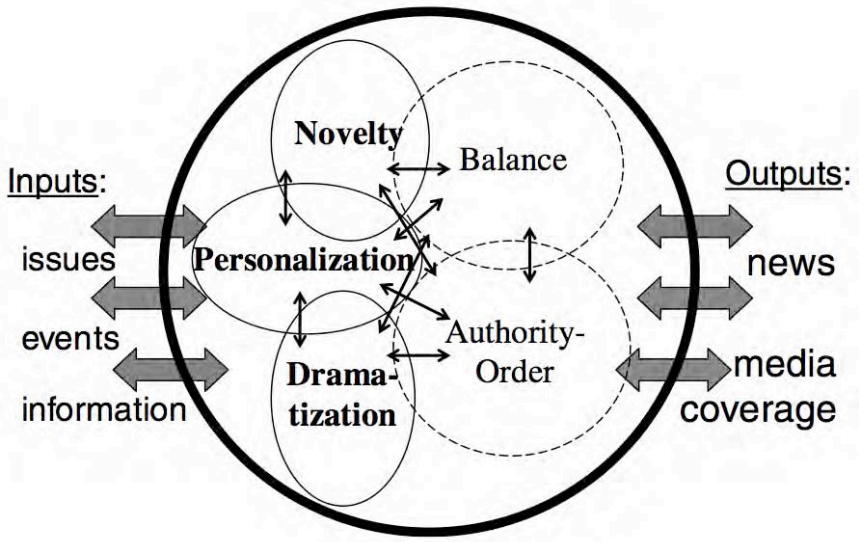


**Fig. 3.3: Interacting Journalistic Norms. This figure depicts the public arena of mass media production, where journalistic norms interact. These complex and dynamic factors take place between and within (as well as feed back into) a larger context of political, social, cultural and economic norms and pressures (Source: Boykoff and Boykoff, 2007).**

2003, and listed in the ISI Web of Knowledge database with the keywords *global climate change*. None of the papers disagreed with the consensus position of the research community. Other research investigating the news coverage in several countries showed that a significant number of media accounts doubted either the existence or the anthropogenic origins of climate change altogether (e.g. Boykoff and Boykoff, 2004; McManus, 2000). Again, these results do not reflect the agreement within the climate science community on global warming and its possible large-scale consequences (e.g. IPCC, 2007a; UNEP, 2009a). Media coverage of climate change thus apparently continues to deliver remarkably mixed, undetermined or even harmless messages, which also seem to be frequently linked to various other issues such as energy, public health or international cooperation, rather than just being viewed as an environmental-ecological problem (Liu et al., 2008). Billett (2010) however, noted that in comparison to the present skepticism in the North American and European press, the Indian press entirely endorses climate change as a scientific reality, indicating a different framing of global warming in news media of developing countries, possibly deriving from the fact that in these countries the climate is expected to change more strongly than in developed countries (e.g. Bättig et al., 2007).

### 3.2.2. Newspaper Coverage of Climate Change

Mass media coverage on global warming not only increased in general, but the issue has also received more attention in the print media, especially in newspaper articles in recent years.

Figure 3.4 illustrates the worldwide newspaper coverage of climate change or global warming since 2004 through April 2010, featuring two major peaks; one in 2007, the year of the publication of the IPCC AR4, and one at the end of 2009 due to the increasing media attention to the climate change issue anticipating the COP 15 in Copenhagen. Liu et al. (2008) showed that the newspaper coverage of global warming and climate change indeed appeared to be primarily driven by significant natural and policy events. Mazur (2009) on the other hand, argued that the worldwide fluctuations in news coverage of global warming do not necessarily correlate with specific events and they should therefore not be viewed as triggers for increased media attention. Nisbet and Myers (2007) observed a strong relation between patterns in media attention to global warming and shifts in poll trends, further emphasizing the connection of news coverage and public opinion. According to a study by Stamm et al. (2000), the American public specified newspapers (84.9%), television (75.5%), and magazines (60.2%) as their main source of information about global warming. Television and daily newspapers were also found to be the main source of information about environmental issues in Japan (Aoyagi-Usui, 2008). Carvalho and Burgess (2005) further assessed that prestige press newspapers considerably affect the policy discourse and decision-making at national and international levels. Numerous studies have further analyzed the press coverage in various countries like Australia (McManus, 2000), India (Billett, 2010), and Japan (Sampei and Aoyagi-Usui, 2009). Most research efforts however, focused on newspapers in the U.S. (e.g.

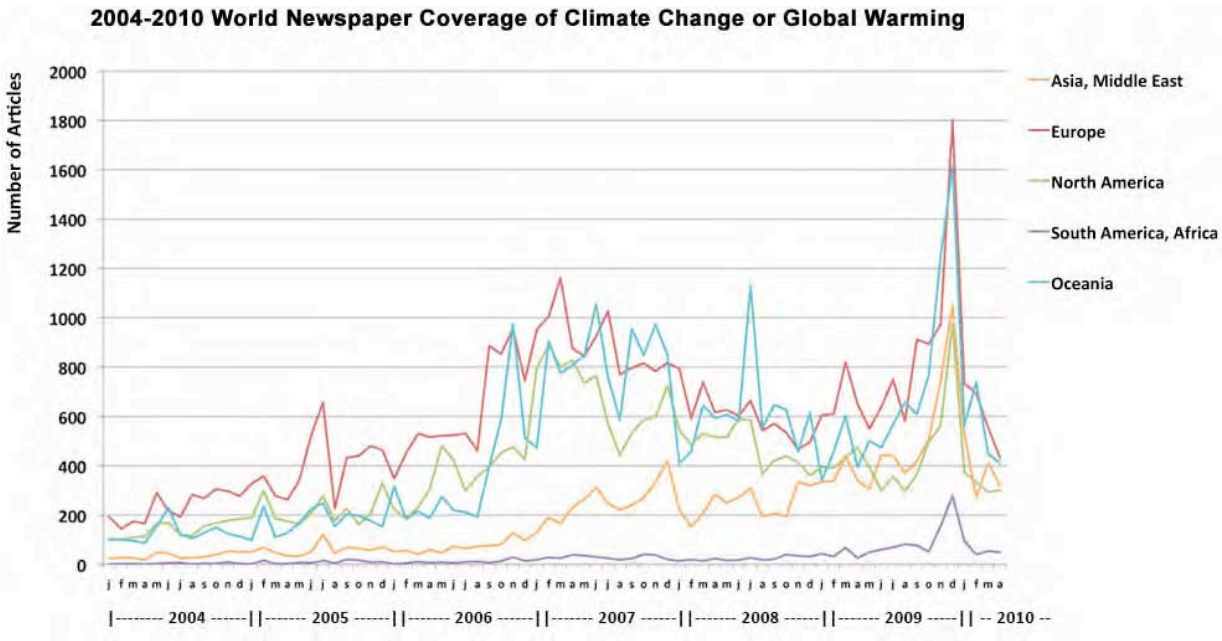


**Fig. 3.4: Newspaper coverage of climate change or global warming in 50 newspapers across 20 countries and six continents updated through April 2010 (Source: Boykoff and Mansfield, 2010 ©).**

Antilla, 2005; Boykoff, 2007b; Boykoff and Boykoff, 2004; 2007) and the United Kingdom (e.g. Boykoff, 2008b; Boykoff and Mansfield, 2008; Doulton and Brown, 2009).

Today, it is widely acknowledged by scientists and policy-makers alike that both M&A policies are equally important (e.g. Biesbroek et al., 2009), as well as inherently interlinked (e.g. Laukkonen et al., 2009). The IPCC AR4 has also stated with *very high confidence*[8] that even the most stringent mitigation efforts cannot avoid further impacts of climate change in the next few decades, thus making adaptation unavoidable (IPCC, 2007f). In addition, "most adaptation measures do make sense under any climate scenario," as they result in benefits independent of climate change (Pielke, 1998: p. 167). Nevertheless, academic research as well as climate change related policy-making historically focused on mitigation strategies (e.g. Paavola and Adger, 2006). The subsequent political discussion regarding climate policy integration was thus primarily concentrated on mitigation efforts (Urwin and Jordan 2008). Only recently, both the scientific community (e.g. Biesbroek et al., 2009; Dowlatabadi, 2007) and political stakeholders (e.g. WMO, 2009) acknowledged the crucial importance of an appropriate consideration of adaptation policies, especially in view of their link to sustainable development efforts as a key element in shaping capacities and reducing the vulnerability to climate change (e.g. Wilbanks and Sathaye, 2007).

Several reasons have led to this apparent preference for mitigation strategies, ranging from the inherent complexity and scientific uncertainties associated with global climate change, through to the issues of scales (Adger et al., 2005), and the availability of financial resources and short time horizons (e.g. Smit and Pilifosova, 2001). As a consequence, mass media are more likely to focus their reporting on mitigation rather than adaptation policies, since the newspaper coverage of global warming and climate change appears to be primarily driven by significant natural and policy events (e.g. Liu et al., 2008). In addition, mass media play a crucial role in shaping public understanding of environmental issues and climate change in particular (e.g. Anderson, 2009; Carvalho and Burgess, 2005: Stamm et al., 2000; Wilson, 1995), by acting as gatekeepers in the transmission of information to the general public (White, 1950). Through the identification and selection of information according to news values (Galtung and Ruge, 1965), news media report newsworthy issues by adhering to various journalistic norms (see Fig. 3.3). According to media theory, these conditions should ideally guarantee the objectivity and neutrality in news coverage, and thus provide a proper account

[8] The IPCC uses the following scale of confidence levels to express the assessed chance of a finding being correct: *very high confidence* at least 9 out of 10; *high confidence* about 8 out of 10; *medium confidence* about 5 out of 10; *low confidence* about 2 out of 10; and *very low confidence* less than 1 out of 10 (IPCC, 2007d).

of scientific facts of global warming. The theoretical reasoning above results in the following hypotheses that will be tested in the next chapter:

*H1: Newspaper coverage of climate change generally features a bias for mitigation policy options.*

*H2: Scientific facts about global warming are accurately reported in newspapers.*

### 3.2.3. Public Opinion and National Climate Policies

The power of the news media in shaping national public opinions and policy agendas has been well documented in media agenda-setting studies (Gilliam and Iyengar, 2000; McGraw and Ling, 2003). According to Liu et al. (2008), the news media generally play two roles in setting public and policy agendas. First, through repeated news coverage over time, the news media have the ability to influence the relative salience of a particular public issue (McCombs and Shaw, 1972; Soroka, 2003). Second, and more importantly, the news media have the ability to portray a particular public issue in different ways and thus influence how the public and policy-makers think about the issue (Kiousis, 2004; McCombs and Shaw, 1972). In democracies, the public is usually well informed by independent mass media about environmental problems and government policies in general (Bernauer et al., 2010). News media represent an important actor in shaping public understanding of environmental issues by transmitting information to the general public (e.g. Stamm et al., 2000), and play an important role in setting public as well as policy agendas (e.g. Trumbo and Shanahan, 2000). According to median voter argument (Black, 1948), the subsequent public demand for environmental risk mitigation is likely to influence national policy-making. Because of their crucial role for societal agenda-setting processes, the media have always been subject to ideological influences as well as economic and political dependencies (e.g. Boykoff and Boykoff, 2004; Doyle, 2002). Their supremacy as gatekeepers of information is thus constrained by other influential stakeholders such as political decision-makers, opinion-leaders, public relation actors often related to powerful interest groups, or environmental NGOs capable of altering published information according to their proper agendas (e.g. Boykoff, 2008a; Boykoff and Rajan, 2007). To some degree, at least, these stakeholders also have the ability to influence public opinion and subsequent political decision-making, although the extent of their influence naturally depends on the specific national context.

Numerous studies have explored public awareness and risk perceptions, as well as personal concerns about and knowledge of global warming (e.g. Henry, 2000; Leiserowitz, 2007a; Lorenzoni and Pidgeon, 2006). Nisbet and Myers (2007) presented a comprehensive summary of several public opinion polls conducted on the topic over the past 20 years. Their results showed that the public awareness of global warming has increased considerably. A combined 89 percent of the public reported hearing either a lot or some about global warming in 2007. According to a global survey[9] conducted in 2002, the world's citizens are well aware of the environmental quality in their countries (Fig. 3.5a), and a majority of the respondents think that national governments should be held accountable for the environment (Fig. 3.5b) (Gallup, 2002). In addition, results from a 30-country[10] opinion survey conducted between October 2005 and January 2006 showed that on average 90 percent of the respondents across all countries said that "climate change or global warming, due to the greenhouse effect" is a serious problem (GlobeScan, 2006). In a 2007 BBC World Service poll, an average of eight in ten (79%) agreed that "human activity, including industry and transportation, is a significant cause of climate change", and nine out of ten said that action is necessary to address global warming (GlobeScan, 2007). Another survey conducted by Gallup International, asking citizens in 57 countries[11] whether they thought that global warming is having a serious impact

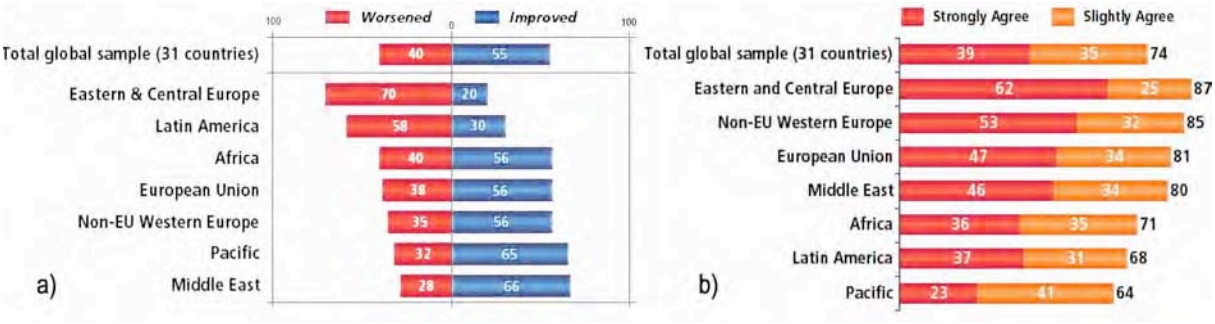


**Fig. 3.5: Number of respondents (%) who a) think that the quality of their country's environment had worsened or improved from 1992–2002, and b) the support for holding national governments accountable for the environment. The poll included over 24,000 people in 31 countries (Source: Gallup, 2002).**

[9] All of the mentioned polls might include results where percentages do not add up to exactly 100%. This may be due to rounding errors or the exclusion of "don't know" responses.

[10] The poll included 33,237 people from Argentina, Brazil, Canada, Chile, China, Costa Rica, El Salvador, Finland, France, **Germany**, Great Britain, Guatemala, Honduras, India, Indonesia, Italy, Japan, Kenya, Mexico, Nicaragua, Nigeria, Panama, Philippines, Poland, Russia, Saudi-Arabia, South Africa, South Korea, Turkey, and the **United States**.

[11] The poll included over 60,000 people from Albania, Argentina, Austria, Bolivia, Bosnia and Herzegovina, Bulgaria, Cameroon, Canada, Colombia, Croatia, Czech Republic, Denmark, Dominican Republic, Ecuador, Finland, France, **Germany**, Ghana, Greece, Guatemala, Hong Kong, Iceland, India, Indonesia, Ireland, Italy, Japan, Kosovo (UN Administration), Luxembourg, Macedonia, Malaysia, Moldova, Netherlands, Nigeria, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Romania, Russia, Senegal, Serbia, Singapore, South Africa, South Korea, Spain, Sweden, **Switzerland**, Turkey, United Kingdom, Ukraine, **United States**, Venezuela, and Vietnam.

now in the area where they live, also indicated a substantial public concern about climate change impacts already today: nearly seven out of ten agreed (66%) while only three in ten (27%) felt the opposite way (Gallup, 2008).

An online survey in October 2006 and April 2007 polling 26,486 internet users across 47 countries, further revealed that global concerns about climate change have increased dramatically in the six months ahead of the G8 Summit in Heiligendamm, Germany (Nielsen, 2007), where climate change was one of the major topics on the agenda (G8, 2007). Figure 3.6 illustrates the rise of concern per country including the United States (+7%), Germany (+12%) and Switzerland (+17%). Another poll[12] conducted in 2009 found that on average 60 percent across all nations thought their government should give higher priority to climate change than it did at the time, with merely 12 percent wanting a lower priority (WPO, 2009). These results demonstrate a genuine public concern about climate change in developed as well as in developing countries. Results from opinion polls in the investigated countries support this global concern. On a national level, surveys found that almost 50 percent of the American and 69 percent of the German public perceived global warming as a serious problem (e.g. Leiserowitz, 2006; 2007b). In Switzerland, 62 percent of the respondents considered climate change the biggest threat among other issues such as crime (gfs, 2009a).

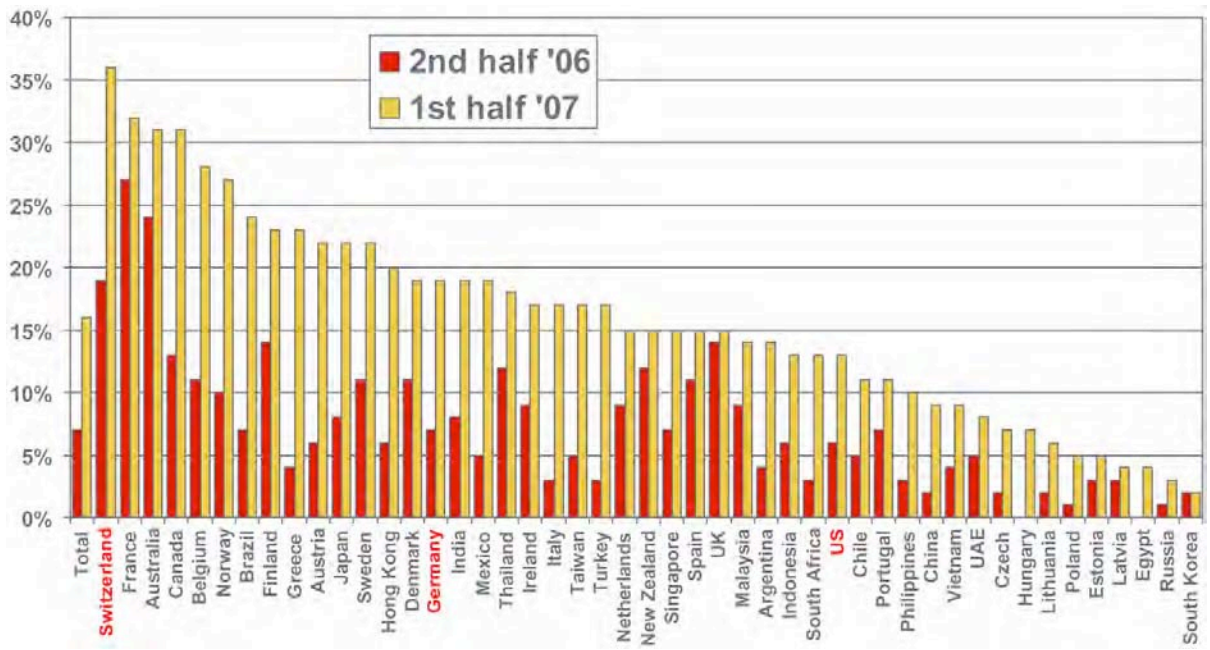


**Fig. 3.6: Percentages of citizens from 47 countries, naming global warming as their biggest or second biggest concern in the next 6 months in October 2006 and April 2007 (Source: Nielsen, 2007).**

[12] The poll of 18,578 respondents was conducted in 19 countries that comprise 60 percent of the world's population, namely Chile, China, Egypt, France, **Germany**, Great Britain, India, Indonesia, Iraq, Kenya, Mexico, Nigeria, the Palestinian territories, Poland, Russia, South Korea, Turkey, Ukraine, and the **United States**.

However, recent developments have dealt an enormous blow to the credibility and sincerity of climate science in general, as well as to the public perception of the seriousness of global warming. The *Climategate* e-mails leaked from the Climate Research Unit (CRU) at the University of East Anglia in the United Kingdom in November 2009, immediately raised questions about the scientific objectivity of several prominent researchers, including Phil Jones, who resigned in December as head of the CRU (Guterl, 2010). Evidence of sloppy work and exaggerations in the current IPCC report also kept appearing, including Jones' disputed temperature curve, the apparently false assertion that Himalayan glaciers would disappear by 2035, and the supposed increase in natural disasters, for which no source was given. The highly regarded IPCC suddenly finds itself at the center of a crisis affecting an entire scientific discipline (Evers et al., 2010). On top of that, its chairman, Rajendra Pachauri, is under increasing pressure to resign after blatantly dismissing a report stating the 2035 Himalayan glacier claim was wrong as "voodoo science", and because of his ties with companies that could benefit from climate policies. In summary, the climate science community is currently facing an unprecedented public-relations disaster, which supposedly led to a major shift in public opinions around the world. Figure 3.7 for example, illustrates the significant development in US public opinion about the depiction of climate change in the media coverage (Gallup, 2010).

"While climate-change science, policy and ecological – meteorological events have shaped media reporting and public understanding, journalism and public concern have also shaped climate science and policy decisions" (Boykoff, 2008a: p. 13). Although various other economic, political, or social protagonists frequently legitimize the promotion of special interests

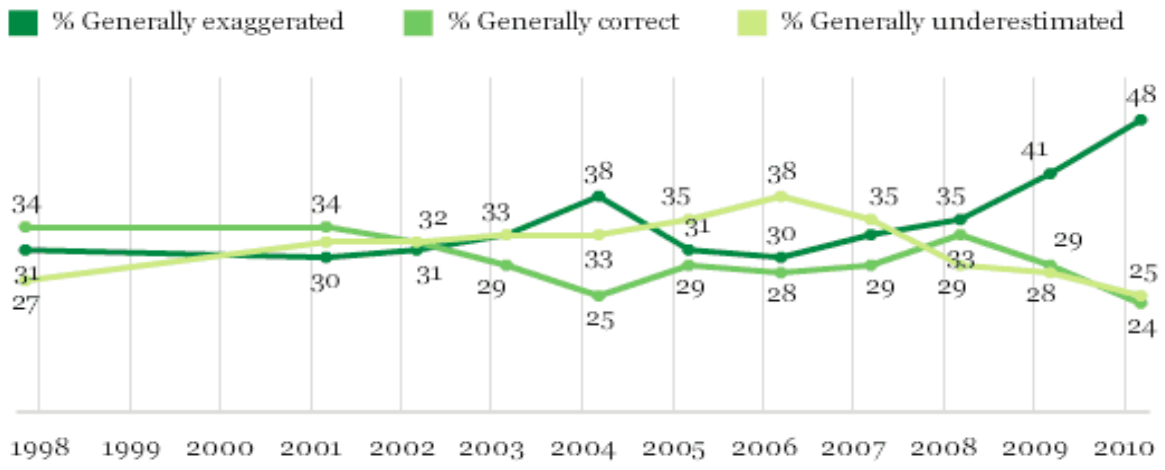


**Fig. 3.7: Percentages of US citizens answering the question: "Thinking about what is said in the news, in your view is the seriousness of global warming (*answer*)?" since 1998 (Source: Gallup, 2010 ©).**

(e.g. Olson, 1965), and thus tend to influence domestic climate policy-making (Bernauer and Caduff, 2004), mass media also play a crucial role in shaping public understanding of environmental issues (e.g. McGraw an Ling, 2003; Stamm, 2000), and consequently in setting public as well as policy agendas regarding national decision-making processes related to climate policies (e.g. Boykoff, 2008a). Two additional hypotheses are derived from the theoretical reasoning above, namely:

*H3: Media coverage of global warming influences national public opinions.*

*H4: National climate policy-making usually reflects median voter preferences.*

In order to collect the data for the verification of the hypotheses, a content analysis of climate change related articles in the chosen newspapers over a six-month period was executed. In addition, the developments of national public opinions and domestic climate policy-making in the respective countries were assessed. The next chapter introduces the methodology used in this study and presents the results of the empirical analysis including a subsequent discussion of the findings.

# 4. Empirical Analysis

After the introduction of the relevant theoretical background and the statement of the hypotheses, the empirical methods used for the data analysis are presented. This study investigates the daily print media coverage of climate change in six so-called prestige press newspapers published in the United States, Germany, and Switzerland. The significant newspaper coverage of global warming (see Fig 3.4) and the demonstrated influence of so-called prestige press titles on public opinion (e.g. Carvalho and Burgess, 2005) represent the main arguments for the selection of newspapers for the content analysis. Although extensive research efforts have already examined the coverage of global warming in US newspapers in the last two decades (e.g. Antilla, 2005; Boykoff and Boykoff, 2007; Trumbo, 1996; Wilkins, 1993), the U.S. was included in the analysis because of its geopolitical power and, more specifically, its pivotal role in negotiations for a global climate regime. The selection of German and Swiss newspapers is not only based on geographical considerations, but further aims to address the rather limited amount of research on climate change news coverage to provide additional insights into the respective national contexts regarding media representations of the issue.

In democracies, citizens are usually well informed about environmental issues and government policies in general by independent news media (Bernauer et al., 2010), which serve multiple functions such as problem-alerting, solution-informing, and policy-proposing in national political decision-making processes (e.g. Liu et al., 2008). Previous research has illustrated that the communication of scientific findings through different media channels influences political decision-making processes (e.g. Trumbo and Shanahan 2000; Weingart et al., 2000). Other studies have also shown that median voter preferences are likely to influence national environmental policy-making (e.g. Bättig and Bernauer, 2009). The news coverage of global warming constitutes no exception to this rule, despite the enormous complexities of the subject and associated scientific uncertainties, as well as the diverging media representations of the issue. Billett (2010) even stated that by communicating climate science, the different mass media exert “a major influence on public perception and, by extension in a voting democracy, on subsequent public policy” (p. 2).

For the testing of the hypotheses, a content analysis is performed on the aggregated data to obtain an overview of the news reporting on climate change in the chosen newspapers. The main objective is to provide a general overview of the news content of climate change related articles, and to assess the naming frequency of climate policy options in particular. In addition, scientific statements in the climate change context are recorded in the analysis of the selected material. These statements are subsequently investigated in order to determine the accuracy of the scientific evidence transmitted by the chosen newspapers, and to identify possible discrepancies between the information published in these print media and the findings of the three IPCC WG Contributions to the AR4 (IPCC, 2007b; e; f). After analyzing the newspaper coverage, an overview of national public opinion polls related to the climate change issue in the surveyed countries, as well as a summary of national climate policy-making since the publication of the IPCC AR4 is presented. These findings are subsequently compared to the content analysis results to ascertain if, and to what degree, the media reporting on global warming in the selected newspapers influences public opinion, i.e. median voter preferences and, as a consequence, climate policy responses at a national level.

## 4.1. Research Design

### 4.1.1. Sampling

The empirical evidence presented in this study comes from a systematic reading of newspaper articles – the unit of analysis – also including editorials, so-called op-eds (opposite the editorial page), columns, letters to the editor and interviews. The survey focused on six daily prestige press newspapers from the United States (*The New York Times*, *The Wall Street Journal*, and *The Washington Post*), Germany (*Die Welt*, *Die Süddeutsche Zeitung*), and Switzerland (*Neue Zürcher Zeitung*). The numerical distribution of the selected newspapers accounts for the size and geopolitical influence of the respective countries. The sample was compiled by using the search subject *climate change* in the *Dow Jones Factiva* search builder engine for the six-month period from 1 July to 31 December 2008. The specific time span was chosen mainly to account for the most recent newspaper coverage at the beginning of the coding procedure, as well as to obtain a reasonable amount of articles for the analysis. The search engine treats the term *global warming* as identical to *climate change*. The database search yielded a total of 831 articles. 133 articles have been removed from the sample during the analysis for different reasons, i.e. unrelated to climate change or duplicate articles. The remaining

698 articles have been processed in the analysis. Appendix I exhibits the entire sample of articles per publication. Table 4.1[13] presents an overview of the extracted sample per country and newspapers. The rationale for the selection of prestige press newspapers derives mainly from the fact that they are considered as one of the primary influences on policy discourses and decision-making at national and international levels (e.g. Boykoff, 2007b; Carvalho and Burgess, 2005). This holds especially true for the three analyzed US publications (McChesney, 1999). The selected newspapers all have an international reputation of journalistic achievements and objectivity, as well as a considerable average daily circulation (Table 4.1). Despite a considerable reconfiguration of the global media system in recent years, newspapers are still considered as the prime source of information for the general public (Stamm et al., 2000), as well as for other relevant media consumers such as opinion-leaders or political and economic stakeholders (e.g. Doyle, 2002; Starr, 2004). All of the selected countries are located in the Western Hemisphere, representing democratic political systems including a constitutional guarantee of freedom of speech, press and association. They also feature long scientific traditions suggesting an intact academic discourse, and thus allowing for an active contest between the various arguments regarding public issues such as environmental quality.

The sample has been analyzed by the methods of content analysis (Krippendorff, 2004). In addition, a qualitative assessment of scientific statements relating to temperature, precipitation, sea levels, extreme events, and anthropogenic global warming, has been conducted to investigate the accuracy of the news coverage. The contributions of the three IPCC Working Groups to the AR4 served as references for the comparison of the reported statements to the available scientific evidence (IPCC, 2007b; e; f). The AR4 represents the most recent com-

**Table 4.1: Summary of the analyzed articles by country and newspaper including the respective average daily circulation, and the circulation of daily newspapers per capita (Source: [a] Audit Bureau of Circulations, 2010; [b] Media-Daten Verlag, 2010; [c] WEMF, 2009).**

| Country (% of Sample) | Publication (No. of Articles) | | Average Daily Circulation | Circulation per Capita (2004)* |
|---|---|---|---|---|
| **USA (31%)** | *The New York Times* | (99) | 951,063[a] | |
| | *The Wall Street Journal* | (47) | 1,913,284[a] | 193 |
| | *The Washington Post* | (73) | 578,482[a] | |
| **Germany (58%)** | *Die Welt* | (121) | 262,537[b] | 267 |
| | *Die Süddeutsche Zeitung* | (281) | 435,493[b] | |
| **Switzerland (11%)** | *Neue Zürcher Zeitung* | (77) | 125,228[c] | 420 |

*** Total average circulation of daily newspapers per 1,000 inhabitants (Source: UNESCO, 2010)**

[13] See Annex I for Tables enumerated in capital letters (A – J).

prehensive synopsis of the physical science basis on climate change by an intergovernmental agency. After instructions, a pilot test was conducted on approximately 10 percent (N=86) of the initial number of articles to evaluate the assessment of the content analysis. Krippendorff's agreement coefficient (α) was used as statistical measure in the calculation of the inter-coder reliability (Krippendorff, 2004). The pilot test was executed independently resulting in an inter-coder reliability rate of 92 percent[14]. The designed coding measures and their respective variables are introduced and explained in the next section.

### 4.1.2. Content Analysis Measures

All articles in the six chosen newspapers including the search subject *climate change* have been coded for the period from 1 July to 31 December 2008. Table A presents an overview of the content analysis measures and their respective variables. All articles in the sample were analyzed independently as long as they featured a title of their own, and were thus considered as a unique entity, whether they represented news or agency reports, editorials, columns or letters to the editor. If an article featured more than one subject, the coding focused exclusively on the parts relating to *climate change*. In cases where more than one variable was applicable, only the variable with the highest prominence or relevance was coded. A description of each measure and its variables is provided below.

***Publication Name***

For identification purposes, the *Publication Name* assigned each article to the newspaper in which it was published. Each newspaper is determined by a variable consisting of a unique abbreviation (Table A).

***Article Date***

The *Article Date* examined the temporal distribution of the articles within the surveyed period from 1 July to 31 December 2008. For each article, the date of its publication was coded in the following format: DD.MM.YY.

***Article Length***

The number of words per article was coded to assess the scope and prominence of climate

[14] The inter-coder reliability test was conducted by the author in coordination with Silvan Aerni, MSc student at the Graduate School of Climate Sciences, University of Bern. This rate of agreement is above accepted criteria for inter-coder reliability (Krippendorff, 2004; p. 241).

change related articles in the three surveyed countries. If an article covered several different topics, only the parts specifically dealing with climate change were considered and the measure was adjusted accordingly.

***Text Form***

The assessment of the measure *Text Form* in newspapers is crucial to differentiate between journalistically objective news coverage and subjective contributions. A news article or agency report constitutes journalistic reporting in its purest form. Ideally, they are objective in the sense that they do not include subjective statements, whereas editorials, so-called op-eds (opposite the editorial page), opinions, columns, and letters are subjective by definition. They usually include personal opinions and/or subjective viewpoints of their respective authors. Generally, editorials are written by a member of the newspaper's editorial board, whereas op-eds are usually composed by individuals who are unaffiliated with the newspaper. A column also explicitly contains an opinion or a point of view. Letters, on the other hand, are considered as opinions by readers of the newspaper, and as such represent a viewpoint of the general public.

*Article / Agency Report*: used when facts and detailed information answering general questions to Who, What, When, Where, Why and How, were presented objectively and without further commentary.

*Editorial / Opinion*: used when an article was written by an editor or an employee of a newspaper and clearly included subjective statements. Interviews were considered as opinions of the interviewee.

*Op-Ed / Column*: used when an article was written by a prominent figure, an expert of the issue or an opinion leader. The author had to be unaffiliated with the newspaper. For this analysis columns were also coded with this variable.

*Letter*: used when an article was written by a reader of the newspaper, usually referring to a previous news article.

***Article Subject***

The *Article Subject* was coded to classify the climate change newspaper coverage by different topics. It further aims to illustrate the ideological background of the news selection by editorial boards of the respective newspapers.

*Climate Change News*: used when an article reported general information about climate change or global warming and its projected impacts or any other climate change related issues (e.g. general information on climate change, coverage of extreme events, book reviews etc.).
*Science / Technology*: used when an article presented scientific findings or technological advances related to climate change.
*Politics / Policies*: used when an article reported on political actions such as policy-making and other governmental decisions or incentives in relation to climate change.

***Article Tone***

The *Article Tone* identified the tenor of the discourse in each article. The measure attempts to qualitatively assess whether an article objectively reported widely accepted facts (e.g. "global warming is happening now"), or if articles explicitly contained subjective conclusions.
*Neutral*: used whenever the news coverage was clearly objective such as in reproductions of agency reports for example.
*Alarming*: used when the author or an individual statement included some sort of urgency.
*Alarmist*: used when the author or an individual statement included expressions such as *catastrophic*, *disastrous*, *fatal*, *irrevocable* etc.
*Skeptical*: used when an article or the opinion of an author was clearly skeptical in relation to human induced global warming and subsequent policy decisions. For example, a statement including doubts concerning the achievement of GHG emission reductions was not coded.

***Viewpoint***

The *Viewpoint* determined the source of represented statements or opinions mentioned in an article. This classification aims to provide an insight into media inputs and their respective origins.
*Scientist*: used when an article contained statements made by scientists or affiliated institutions and organizations.
*Public Opinion / Opinion Leader*: used when an article contained any kind of feedback from the public (e.g. letters to the editor), or features statements of individuals unaffiliated with any governmental institution such as interest groups, private companies, NGOs etc. Newspapers were also regarded as private companies in this analysis. Any article comprising any opinion of an individual with journalistic background was therefore coded with this variable.
*Decision-Maker*: used when an article contained statements made by elected officials, political advisors or any other individuals affiliated with governmental institutions.

*Not Specified*: used when an article did not contain any specific statements, which could be associated with one of the categories mentioned above, or if the affiliation was not clearly specified.

***Geographical Context***

The *Geographical Context* investigated the localization of the respective article contents. Therefore, the context always referred to the article subject itself, not to the national origin of the respective newspaper.

*National / Local*: used exclusively if an article mentioned one single country, one or several geographical regions within a country, or institutions and organizations at a national level.

*Regional*: used when an article referred to a region (i.e. more than one country) or regional, supranational organizations such as the EU. A region was defined by the continental distribution of countries.

*Global*: used when an article referred to more than one region or multiple countries from several different regions (continents), or the article subject applied on a global scale. This category also included international organizations such as the UN or the IPCC.

***Policy Preference***

The determination of the *Policy Preference* constituted the most important aspect of the content analysis given the main hypothesis. This measure recorded the respective policy options cited in the articles. In order to distinctly classify the reported climate policies, the definitions according to the glossaries in Appendix I of the AR4 WGII (IPCC, 2007f), and in Annex I of the AR4 WGIII (IPCC, 2007e), were used as reference for the analysis.

*Mitigation*: used when an article exclusively referred to policies, which aim to reduce GHG emissions and enhance sinks. Technological change and substitutions that reduce resource inputs and emissions per unit of output were also defined as mitigation options (IPCC, 2007e). The Kyoto Protocol was always coded as a mitigation policy option.

*Adaptation*: used when an article referred to initiatives and measures, which aim to reduce the vulnerability of natural and human systems against actual or expected climate change effects such as raising river or coastal dikes.

*Both*: only used when both policy options were prominently featured in an article. A simple reference to adaptation strategies within an article about mitigation options was not considered as sufficient to be coded with this variable.

*Not Specified*: only used when no specific reference to any policy option was evident.

### 4.1.3. Scientific Statements

To investigate the accuracy of the news coverage of climate change, the data sample was qualitatively checked for statements explicitly referring to findings or projections originating from climate sciences. Articles containing at least one *Scientific Statement* on specific elements of global warming were coded. Scientific statements relating to temperature, precipitation, sea levels, extreme events, or anthropogenic global warming, were processed through this measure. If a statement qualified accordingly, it was transcribed for further comparison purposes. References to any other scientific information were excluded.

*Statement Applicable*: only used when a statement in an article explicitly referred to *Temperature*, *Precipitation* (including snowfall), *Sea Level*, *Extreme Events,* and *Anthropogenic Global Warming*.

*Not Applicable*: used when a statement in an article did not explicitly refer to one of the elements mentioned above.

If an article contained one or several scientific statements specifically referring to one of the categories mentioned above, they were transcribed for a qualitative analysis. The transcription of the statements is provided in Annex II. Statements applying for more than one category were treated separately for each category. For example, a statement referring to temperature and precipitation was counted once for each category. The extracted statements were then evaluated for consistency, namely whether the statements were true or false, according to the scientific evidence in the AR4. For simplification, only statements with a congruent reference in one of the three IPCC WG Contributions to the AR4 were transcribed (IPCC, 2007b; e; f). If a reference included a corresponding probability of occurrence (see Footnote 1) regarding a specific transcribed statement, the estimated percentage for each statement was also recorded and subsequently averaged per category. The fraction of correct statements in each category was then compared to the corresponding mean of the assessed AR4 probabilities to examine the level of accuracy in the analyzed newspaper coverage of climate change for each statement category.

### 4.1.4. National Public Opinions and Climate Policy-Making

After analyzing the newspaper coverage and the transcription of scientific statements, the different factors influencing public opinions, as well as domestic political decision-making processes, in relation to global warming are presented. Previous research has demonstrated that the

media coverage in democratic countries significantly influences the shaping of public opinion and policy discourses concerning environmental issues (e.g. Liu et al., 2008), and that news reporting of global warming raises public awareness of the issue (e.g. Sampei and Aoyagi-Usui, 2009). It has further been asserted that subsequent demands by the median voter tend to influence the respective policy outputs of national political decision-making processes (e.g. Bättig and Bernauer, 2009). In other words, national public opinions usually reflect the media coverage of climate change in the respective countries, and median voter preferences subsequently translate into correspondent domestic climate policy-making. Based on the theoretical arguments presented in the second chapter, the following synopsis initially highlights several political, economic, and cultural elements of each country. The various domestic constraints on international bargaining are also introduced, followed by a presentation of the respective national contexts in relation to environmental policy-making. In addition, the potential influences of various political actors on the shaping of national public opinions, as well as on domestic climate policy-making, are addressed. Finally, a short assessment of the respective national vulnerabilities to climate change is provided.

***United States***

Despite the recent emergence of other major players, such as the EU or the BRIC countries (Brazil, Russia, India, and China), the United States is still considered the most influential actor in the international system due to its dominating economic and geopolitical powers. The country is undoubtedly a major player in the case of global climate change (e.g. Rowlands, 2001). With a share of almost 20 percent of the global gross domestic product (GDP), the U.S. represents the world's biggest economy today (IMF, 2010). It is also the second largest emitter of $CO_2$ behind China (Boden et al., 2009), and still figures among the top emitters per capita (WRI, 2010). Analyzing the country's historical position in international negotiations for a global climate change regime, Oberthür and Ott (1999) found that the US stance has been "largely determined by its position as the world's largest producer of coal, oil and gas, although it is a net importer of energy" (p. 18). Reflecting the energy intensive American lifestyle, the United States indeed represented the world's biggest total primary energy producer as well as consumer in 2007 (EIA, 2010). As a country with strong polluter interests, it is not surprising that economic aspects and the cost-effectiveness of climate policies in particular, have been essential for both its preference for policy instruments at a national level and the degree of its involvement in the international climate regime (e.g. Baumert et al., 2002; Bodansky, 2001; Stewart and Wiener, 2003). With respect to international cooperation, the

United States has been skeptical towards binding emission reduction commitments from the outset. Although it signed and ratified the UNFCCC in 1992 (UNFCCC, 1993), the US Congress, with the support of influential stakeholder groups, consistently opposed the *targets and timetables* approach that has been at the center of the Kyoto Protocol negotiation process (Schreurs, 2003; Sprinz and Weiß, 2001). Given the traditional US position in international climate regime negotiations, the country is considered as a dragger compared to the EU. The most comprehensive actions to address climate change in the United States to date have taken place at state and local levels (Litz, 2008). These initiatives are probably the most significant drivers of US federal climate policy (Jobber and Sieminski, 2008). Several states enacted legislation for mandatory caps of GHG emissions or implemented energy efficiency policies (e.g. Rabe, 2002). For instance, the first regional cap-and-trade system with the participation of ten Northeastern states came into effect in 2009, aiming to stabilize emissions levels between 2009 and 2015 (Litz, 2008). In addition, a large number of states have adopted mandatory rules and regulations to promote the use of renewable energy or instituted tax incentives to stimulate production and use of biofuels (e.g. Litz, 2008; Menz, 2005). Lutsey and Sperling (2008) even argued that with its national bottom-up policy-making, the U.S. has been more committed to climate change mitigation than is generally acknowledged.

There has always been a substantial influence of different non-governmental actors on national public opinion and climate policy-making. During the 1990s, industry-led think tanks such as the *Global Climate Coalition* adopted a confrontational strategy to avoid mandatory regulations, involving strong political pressure and outreach campaigns questioning the anthropogenic nature of global warming to influence public opinion and domestic climate policy-making (e.g. McCright and Dunlap, 2003). Although representatives of industry sectors adversely affected by mitigation policies have continued to work against strong commitments (e.g. Bang, 2003), a general shift in corporate strategies from opposition to accommodation and cooperation has been observed in the recent past (Vormedal, 2008). Although environmental NGOs (ENGOs) in the U.S. are relatively well organized, their effect on national climate policy outcomes is often counterbalanced by powerful and well-financed corporate interest groups (e.g. Luterbacher and Sprinz, 2001; Sprinz and Weiß, 2001). Bang (2003) for instance, reported that public opinion or ENGOs in the U.S. never managed to shape the agenda and direction of the policy-making process in the same way as the industry lobby. Gough and Shackley (2001) further argued that the US ENGOs' focus on the promotion of flexibility mechanisms, such as the Clean Development Mechanism (CDM), reflected the predominant US political culture that supports market-based approaches rather than state in-

terventions to reduce GHG emissions. An interesting paradox of US climate policy was revealed by an examination of the role of epistemic communities (Agrawala and Andresen, 1999). Even though the United States has been the "single largest contributor to the science of climate change since the late 1950s," there was "sharp division between physical scientists who worry about climate damages and senior policy analysts who worry about the costs of emission reductions to the US economy" (p. 29).

Much research has demonstrated that the United States is seriously vulnerable to adverse impacts of climate change (e.g. Field et al., 2007). The US average temperature is very likely to rise more than the global average over this century, with some variation from place to place (Karl et al., 2009). Yohe (2010) recently calibrated the five *reasons for concern* (see Fig 2.6) for the United States to assess the vulnerability to climate change, and suggested that if US policy-makers not only considered aggregated economic impacts across the country, but instead focused their attention on changes in the intensities, frequencies, and regional distributions of extreme weather events driven by climate change, they could easily uncover dangerous anthropogenic interference with the climate system. Among the factors that could have strengthened public demand for climate policies most notably is the perceived increase in the damages from the increasing occurrence of extreme weather events such as the hurricane *Katrina* in August 2005 (Bang et al., 2007), which parts of the news media link to global warming, and hence periodically put the issue on the public agenda (Moser and Dilling, 2004). Harris (2009) argued that there has been a substantial shift toward greater concern in the US public's understanding and opinion regarding climate change in recent years. In a 2006 poll for example, 80 percent of Americans said that action is needed to address climate change, including 43 percent who think immediate steps should be taken "even if this involves significant costs" (p. 14) compared to only 17 percent who said expensive measures should be avoided "until we are sure that global warming is really a problem" (Chicago Council on Global Affairs, 2007: p. 13). An overwhelming majority (93%) further believed that improving the global environment should be a US foreign policy goal (ibid.). Bang (2003) however, argued that Americans indeed expressed concern for the environment, but comparatively little willingness to suffer economic losses to protect it.

***Germany***

Germany represents the single largest $CO_2$ emitter in the EU as well as its biggest economy in relation to the GDP (Germanwatch, 2009). Although European climate policy is often characterized by uncoordinated measures taken at domestic levels along national interests, German

climate policy-making can be put into the supranational European context. Its GHG emission reduction targets are basically in line with EU positions. Like the United States, the EU also has strong polluter interests, as it is the world's third largest $CO_2$ emitter (Boden et al., 2009). While Germany resembles many EU countries in terms of pollution interests, the country also has an interest in energy efficiency as it relies heavily on energy imports (Sprinz and Weiß, 2001). In contrast to the United States, the economic costs of $CO_2$ emission reductions can be considered as moderate, mainly because roughly half of the voluntary commitment of reducing 25 percent of its 1990 $CO_2$ emissions by 2005 has been accomplished due to the decline and subsequent restructuring of the economy of the former German Democratic Republic (ibid.). The country's political and economic power makes it a leading actor exerting substantial influence on environmental policies within the EU, as well as in the global climate policy-making regime. As a pusher for short-term commitments, and keeping the focus of the negotiations within the *targets and timetables* framework, the EU has demonstrated strong leadership ambitions within the international climate regime (Bang et al., 2005). This leadership role was further accentuated after the United States rejected the Kyoto Protocol in 2001, leaving the EU as the only actor with sufficient political power to push for the adoption of the Protocol (ibid.). Germany's climate policy is mainly organized at a federal level. The main pillars of the country's national climate-protection strategy include saving energy, improving energy efficiency, achieving a balanced mix of energy sources and expanding use of renewable energies (BMU, 2010). The 2005 *National Climate Protection Programme* stipulated several climate protection strategies in various economic sectors aimed at saving energy, improving energy efficiency, achieving a balanced mix of energy sources, and expanding the use of renewable energies (ibid.). The introduction of cross-sectoral instruments, such as the EU Emissions Trading System (ETS), have also played an increasingly important role. Germany represents the largest participant in the scheme (Brunner, 2008). In 2007, the *Integrated Energy and Climate Programme* (IECP) was adopted, which consists of various measures for the future national energy and climate policy strategy, as well as several legislative projects in different ministries. The IECP is further aimed at reducing the national GHG emissions by 40 percent by 2020 relative to levels in 1990 (BMU, 2010). Through the implementation of these decisions, the German government acknowledged climate protection as both an ecological and an economic imperative according to a statement by the *Federal Environmental Agency* (BMU, 2007a).

As in the United States, a substantial influence on public opinion and national climate policy-making has come from different non-governmental actors. German business NGOs tradition-

ally hold close relationships with several federal ministries involved in climate policy (Sprinz and Weiß, 2001). As a result, measures to reduce emissions of industry or energy consumption were often introduced on a voluntary basis, indicating a substantial corporate influence on climate policy outcomes (e.g. Bang, 2003; Beuermann and Jäger, 1996). In 2000 for example, Germany's powerful industry lobby cooperated with the federal government in signing a voluntary agreement for specific emissions reductions for the major industries (e.g. Bang, 2003; Sprinz and Weiß, 2001). ENGOs held substantial influence over public opinion, but their influence on actual policy outcomes was rather limited (Sprinz and Weiß, 2001). Epistemic communities, like the WBGU, have also provided important inputs regarding global change and climate policy (e.g. WBGU, 2009). Its chair, Hans Joachim Schellnhuber, was appointed Chief Government Advisor on Climate and Related Issues during Germany's EU Council Presidency and G8 Presidency in 2006 (PIK, 2006). The German expert community thus appears to be well connected within the national policy-making framework. After all, the German press also tends to pay relatively high attention to reports from scientific communities such as the IPCC when compared to other countries such as the U.S. (Grundmann, 2007). The publication of the AR4 in 2007 for instance, resulted in an unusually extensive coverage by German media (Brunner, 2008).

According to Sprinz and Weiß (2001), Germany combines relatively moderate ecological vulnerability and abatement costs, an increasingly strong non–fossil fuel energy sector, and ENGOs that influence the programmatic orientation of the government. Nevertheless, studies indicated that future warming could be especially noticeable in winter months, also projecting significant changes in precipitation patterns with a considerable decrease of summer precipitation and a considerable increase during winter months (BMU, 2010). Extreme events are also expected to grow in magnitude and frequency in the future (ibid.). In general, European citizens usually are more environmentally conscious than Americans (e.g. Brunnée, 2008), and public concern about climate change has always been considerable in Germany. A national survey conducted in 2006, revealed considerable support for various national climate policy measures, as well as a majority of 67 percent who wanted the country to take a leading role in international climate policy (BMU, 2006). The widespread public support for an ambitious national $CO_2$ reduction target, combined with a high activity from the ENGOs, is partly responsible for the continuous proactive climate policy of the German government (Bang, 2003). In summary, public demand was an important influential factor in the national climate policy-making process, whereas special interest lobbying and ENGO activism both exerted some influence on government policy positions.

***Switzerland***

The Swiss economy is primarily based on the service sector and heavy polluting industries are almost completely absent. As a small nation, Switzerland does not have such distinct polluter interests as compared to Germany and the United States, especially since its contribution to global GHG emissions are negligible (WRI, 2010). Having no fossil fuel resources of its own, the country heavily depends on energy imports, which account for 80 percent of its primary energy supplies (FOEN, 2009). Although not a member state of the EU, its cooperation with the EU is based on several bilateral agreements covering a wide range of policy areas including environmental and climate protection (FDFA/FDEA, 2009). The EU further represents the country's biggest trade partner (Eidgenössische Zollverwaltung, 2009). In regard of international cooperation, Switzerland is well known for its neutrality in foreign policy issues and international affairs. The country's strong standing in international environmental policy is remarkable for such a small nation (Perrez, 2009). The Swiss government (Federal Council) has further demonstrated its commitment to play an active role in international negotiations by incorporating environmental issues as a priority in its foreign policy strategy (FOEN, 2007). In addition, Switzerland has put forward a proposal for a global $CO_2$ tax according to the polluter-pays principle to finance global adaptation efforts (DETEC, 2008). Like Germany, the country acts as a pusher for setting short-term commitments and also supports the *targets and timetables* framework within international negotiations. Furthermore, Switzerland's climate policy legislation is partly linked to supranational strategies in Europe. Its national GHG emission target under the Kyoto Protocol is equivalent to EU commitments (FOEN, 2009). The country has also run an emissions trading scheme for GHG emissions since 2008, and the Federal Council has repeatedly stated its desire to link its system to the EU ETS (Schäfer, 2009). As in Germany, environmental policies are mainly coordinated at a national level under the responsibility of the Federal Office for the Environment (FOEN). The modern legislative framework for Switzerland's environmental policy is based on the *Federal Act on the Protection of the Environment*, adopted in 1985 and last revised in 2003 (FOEN, 2009). The principal legal basis of the country's national climate policy is the *$CO_2$ Act*, which entered into force in May 2000 (Schäfer, 2009). Its primary instruments include voluntary actions in various areas, a subsidiary $CO_2$ levy for heating and process fuels as well as transport fuels, emissions trading and complementary use of flexible mechanisms (CDM), and measures in other policy areas relevant to climate change mitigation (FOEN, 2009). In 2008, the Federal Council has appointed the *Swiss Interdepartmental Committee for Climate Policy*

to coordinate activities of the Federal Administration and to facilitate a coherent Swiss climate policy compliant with the UNFCCC (FOEN, 2009).

Schenkel (2000) has observed significant changes in Switzerland's environmental policy through an increasing number of non-governmental actors such as business associations and environmental mass organizations. While it was clear early on that voluntary and other measures would be insufficient to reach the *$CO_2$ Act's* targets, business lobbies nevertheless vehemently opposed the introduction of a general $CO_2$ levy on fossil fuels (Schäfer, 2009). Instead of a much higher $CO_2$ levy, the oil importers launched a proposal for the so-called *Klimarappen* (climate cent), a voluntary surcharge of about 1 Swiss cent per liter of transport fuel sold in Switzerland (Arquit Niederberger, 2005). Ultimately, the parliament approved a compromise combining the *Klimarappen* for transport fuels with a $CO_2$ levy on stationary fuels. Börner (2009) further observed that business associations also played an important role in the decision-making process during the revision of the Swiss *$CO_2$ Act* aimed at designing national climate policy after 2012. On the other hand, Swiss ENGOs also exert considerable influence on climate policy outcomes (Ingold, 2009), especially through their ability to mobilize a broader public and to form coalitions at local levels (Schenkel, 2000). The environmental movement also fiercely opposed the *Klimarappen* arguing that the surcharge would induce no domestic behavioral changes (Schäfer, 2009). Furthermore, several relatively influential scientific expert groups regarding climate change and policy exist in Switzerland. The *Advisory Group on Climate Change Research and Policy* serves as an interface between science, the federal administration, the cantons, and the public (Arquit Niederberger, 2005). Its mandate is quite extensive and includes the nomination of the scientific expert who participates on the official Swiss negotiating delegation for each UNFCCC COP (ibid.).

Switzerland is expected to face significant impacts related to global warming in the coming decades as average temperatures are projected to rise 2–3 °C (e.g. OcCC, 2007). This warming trend and changing precipitation patterns are expected to have significant effects on ecosystems (FOEN, 2009). Switzerland already experienced abnormally mild winters in recent years and Swiss glaciers are melting at an unprecedented pace (Beniston, 2007). Changing seasons and unusual precipitation patterns also have discernible effects on agriculture, water supply and energy demand (ibid.). Although Swiss news coverage of global warming has considerably decreased since 2007 compared to other issues such as the global economic crisis (fög, 2009), Swiss media are nevertheless more likely to pay increasing attention to climate change and its consequences in the future given the country's vulnerability to climatic changes. The influence of the Swiss public on national policy-making is traditionally high as

direct democracy and federalism represent important elements of the political system. Global warming has always been a major concern and continues to rank among the top problems in national public opinion (e.g. Nielsen, 2009). In summary, the visibility of damages and public pressure arguably represent the main reasons for the high priority given to the environment in Switzerland (Schenkel, 2000).

To estimate the influence of the newspaper coverage on public opinions, and whether public demands deriving from median voter preferences are subsequently reflected in domestic policy decisions, a qualitative assessment of national opinion polls as well as climate policy-making was executed for each surveyed country in the periods before 1 July and after 31 December 2008 of the content analysis. The results were then evaluated in order to identify potential influences on respective national climate policy-making.

## 4.2. Results and Discussion

### 4.2.1. Content Analysis

The findings of each content analysis measure and the analysis of the transcribed scientific statements are presented and discussed below. Table B provides an overview of the results per measure and newspaper. Appendix II includes the entire coded dataset per newspaper. The list of scientific statements extracted and transcribed from the sample, including the AR4 probability estimates and according references, is provided in Annex II. 6,980 coding decisions were taken in total. The detailed results of each measure are provided and discussed below. The main focus lies on the analysis of the measure *Policy Preference* according to the arguments of the hypotheses.

***Publication Name***

Every coded article was assigned to the corresponding newspaper to analyze the article distribution per newspaper. Figure 4.1 shows a) the article distribution per newspaper and b) the average number of articles per newspaper and country for the surveyed period. The news coverage of climate change was found to be significantly more extensive in German titles. *Die Süddeutsche Zeitung* and *Die Welt* together accounted for over 58 percent of the total number of articles in the survey (N=402), whereas the US and Swiss newspapers combined represented only 42 percent of all articles (N=296). The average number of articles per newspaper

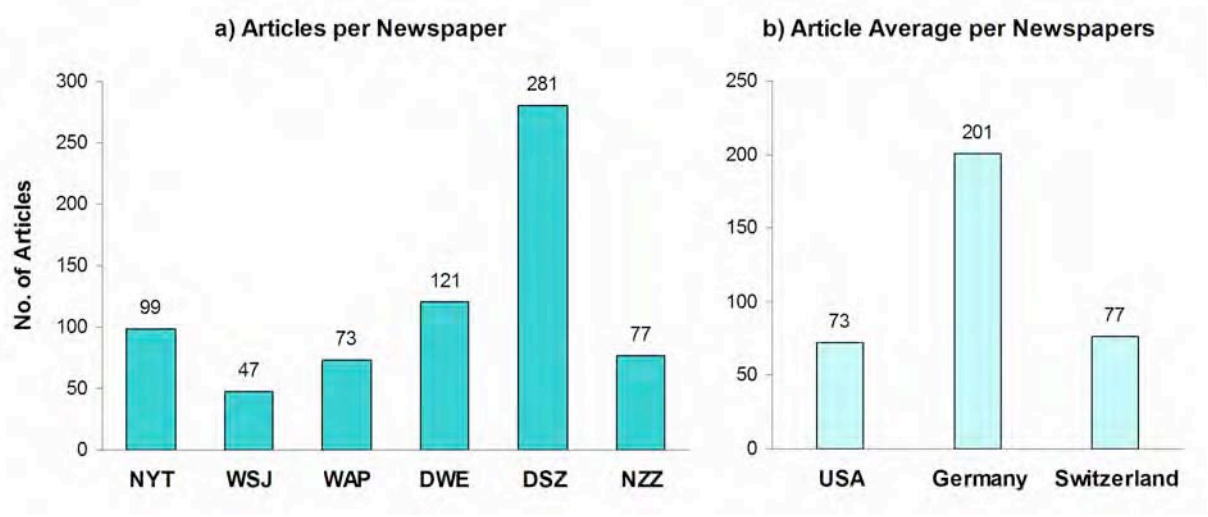


**Fig. 4.1: a) total number of articles (N=698) per newspaper and b) average number of articles in newspapers per country in the surveyed period (1 July – 31 December 2008).**

in Germany (N=201) was almost three times the average in the U.S. (N=73) and Switzerland (N=77). Russill and Nyssa (2009) reported similar results for US print news media, which also featured fewer stories about climate change compared to other countries. In the ranking of the 2008 top stories in the Swiss press, the global warming issue had also lost considerable attention in comparison with the year 2007 (fög, 2009). US mass media traditionally have a tendency to focus on national news stories. In 2008 for example, national news coverage in US newspapers accounted for over 68 percent of the newshole (PEW, 2009a). In summary, the media agenda in international prestige press papers, including the *New York Times*, the German *Frankfurter Allgemeine Zeitung*, and the *Neue Zürcher Zeitung*, was dominated by the financial crisis, the US presidential election, and the conflict in the Middle East, whereas the global warming issue was not prominently featured in news outlets (fög, 2009).

### *Article Date*

In Figure 4.2, the daily sum of articles from all newspapers is plotted for every date with at least one article in the surveyed period. The newspaper coverage of climate change is evenly distributed over time for the most part. The outlier in mid–July illustrates the news reporting on the G8 Summit in Hokkaido, Japan from 7–9 July 2008, where global warming was one of the main topics (G8, 2008). At the summit, the eight participating countries agreed to adopt the long-term goal of achieving at least a 50 percent reduction of global GHG emissions by 2050 with all Parties to the UNFCCC. The second spike in mid–December accounts for the COP 14 in Poznań, Poland, from 1–12 December 2008. At that meeting, the attending countries committed themselves to shape an ambitious and effective international response to cli-

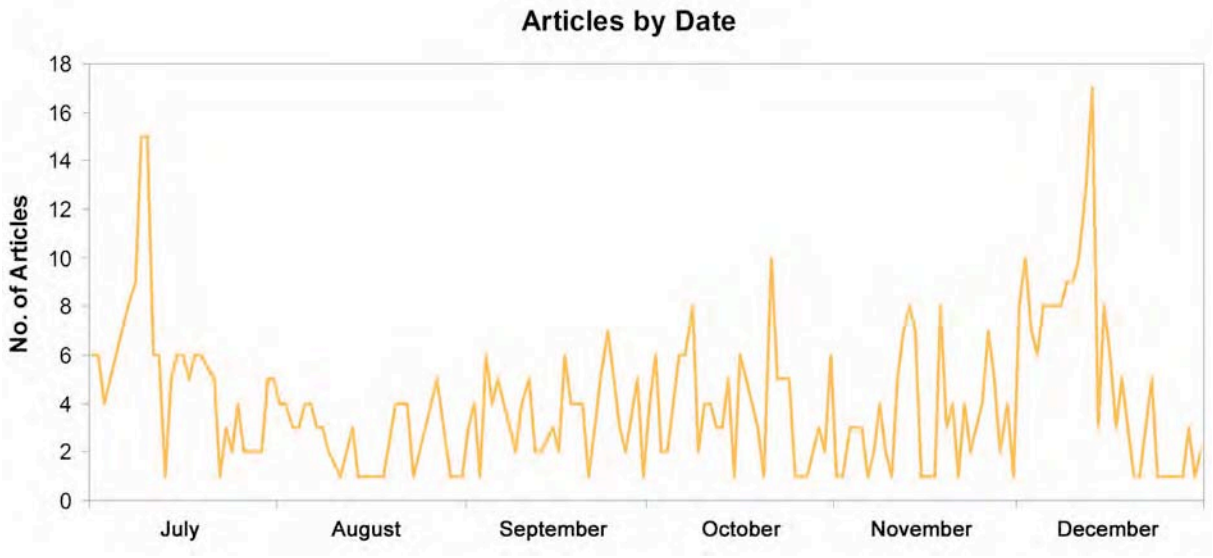


**Fig. 4.2: Daily total of all climate change related articles (N=698) in the surveyed period (1 July – 31 December 2008. Dates without articles have been excluded.**

mate change to be agreed at the COP 15 in December 2009 (UNFCCC, 2008). Progress was also made on a number of important ongoing issues particularly important to developing countries, including the reducing of emissions from deforestation and forest degradation (REDD) and disaster management. Apart from the mentioned events, the constant distribution of the surveyed news coverage could be expected, given the news situation in the investigated period according to other research. Mazur (2009) for instance, argued that the fluctuation in global warming coverage is generally not reflected by the continuous heating of the atmosphere. Liu et al. (2008) also reported that the newspaper coverage of climate change indeed appeared to be primarily driven by significant natural and policy events.

### *Article Length*

The *Article length* was coded to measure the extensiveness and prominence attributed to the global warming issue by the respective editorial boards in their news selection. Figure 4.3 presents the mean article lengths in words per newspaper. Interestingly, the article length in the three US newspapers (689 words) was found to be 56 percent higher on average than in the three European titles (441 words), while the total number of news stories in the U.S. accounted for only 32 percent of the total media coverage of climate change in the surveyed period (Table B). The finding indicates that, although the news selection of US publications did not attribute as much prominence to the issue of global warming as compared to European titles, they seemed to provide more extensive in-depth coverage, once the decision for the publication of an article on the subject was made.

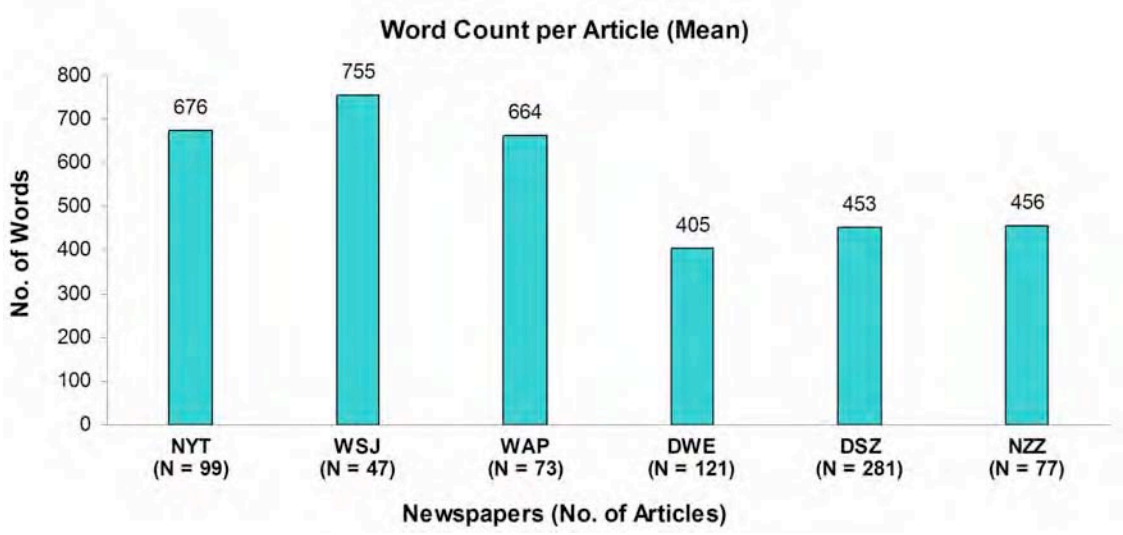


**Fig. 4.3: Mean number of words per article and newspaper for the whole dataset (N=698).**

### *Text Form*

This measure was coded to distinguish between objective journalistic reporting as represented by articles or agency reports, and contributions, which usually include some sort of subjective viewpoints. Naturally, the news selection may also be influenced by ideological orientation of the respective editorial boards. This form of news reporting is usually objective by definition, and thus should be unconstrained of any personal, economical or ideological influences. Figure 4.4 shows the distribution of the variables for the measure *Text Form*. The newspaper contributions in all countries predominantly consist of articles and agency reports. In German and Swiss titles, articles and agency reports accounted for more than 80 percent of all contributions, whereas in US contributions only 68 percent were coded accordingly. The average for all newspapers was 79 percent (Table B). On the other hand, US newspapers, most notably the *New York Times*, featured significantly more editorial contributions (16%) compared to

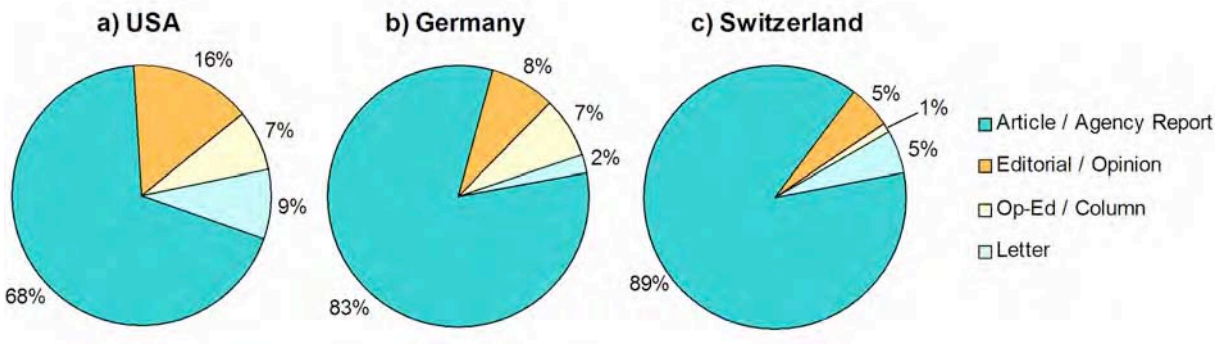


**Fig. 4.4: Results of the measure *Text Form* in a) the United States (N=219), b) Germany (N=402) and c) Switzerland (N=77).**

the German and Swiss titles, with an overall occurrence of 10 percent in the whole data set. The number of letters to the editor was also significantly higher in the U.S. (9%), whereas the total average of the entire survey was 5 percent. In summary, editorial boards of US titles generally decided to publish significantly more news contributions on climate change featuring distinct subjective opinions than their European counterparts.

***Article Subject***

This measure aimed to provide an overview of the distribution of the various topics regarding the climate change news coverage. Figure 4.5 shows the results of the measure *Article Subject* per country. The German and Swiss newspapers exhibited a somewhat higher number of articles reporting on general issues about climate change (51% and 54% respectively), whereas articles concerning the political decision-making in relation to climate change seemed to be slightly more prominent in the US news coverage (44%). The observed majority of general contributions in all three countries further indicated an elevated public awareness as well as an increasing linkage of global warming to other public issue areas (e.g. Liu et al., 2008). Surprisingly, stories on scientific findings or technological developments only accounted for a small fraction of the total contributions in all countries as well as newspapers. The result did not reflect the evidence provided by other authors, which frequently suggests a more extensive media coverage on scientific aspects of climate change given the controversial public discourse on the general academic consensus and the apparent emphasis on existing uncertainties (e.g. Anderson, 2009). At the same time, no significant developments in climate science have taken place in the surveyed period. The significant number of articles on climate policy-making probably reflects the relatively intense political developments regarding climate change during the second half of 2008 including the G8 Summit in Japan and the

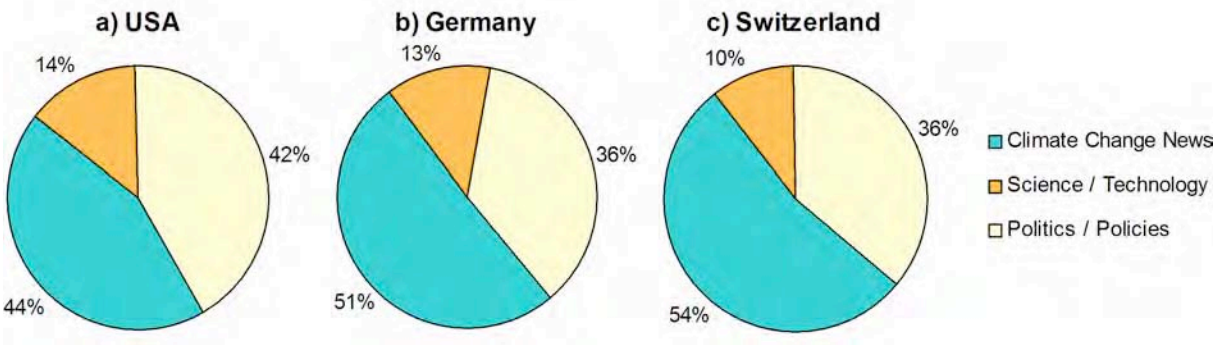


**Fig. 4.5: Results of the measure *Article Subject* in a) the United States (N=219), b) Germany (N=402) and c) Switzerland (N=77).**

COP 14 in Poland (see Fig. 4.2). Other scholars have also demonstrated that the news coverage of climate change is strongly linked to the political agenda on this issue and to public pronouncements of high-level decision-makers in particular (e.g. Carvalho and Burgess, 2005)

***Article Tone***

One of the most important premises of journalistic news reporting certainly is the pursuit of maximum neutrality and objectivity on a given topic regardless of internal or external pressures such as editorial ideologies, economic dependencies or political agenda. For this reason, the tone of the article contents was investigated. Naturally, such qualitative assessments of content material are at least partly subjective. Nevertheless, the results per country shown in Figure 4.6 are significantly clear regarding the variable *Neutral* included in the analysis. In all newspapers, as well as in all three countries the neutral contributions overwhelmingly prevailed. Interestingly, US publications featured significantly more articles with an alarming tone (16%) than German and Swiss titles (9% and 6% respectively), whereas only a small number of skeptical contributions was observed. In their analysis of US prestige press coverage for the period of 1988–2002, Boykoff and Boykoff (2004) also reported just over 6 percent of articles (N=340) showing a dominant skepticism of anthropogenic contributions to global warming. However, the tone and the level of skepticism in news media usually depend on the ideological orientation of the respective editorial boards as well. Carvalho (2007) for instance, found that ideological constellations indeed shaped media representations of climate science and policy issues. The *Wall Street Journal* with 17 percent and *Die Welt* with over 12 percent of the articles featured a considerable more skeptical coverage of global warming than the other titles in this survey, possibly reflecting the more conservative ideologies of the

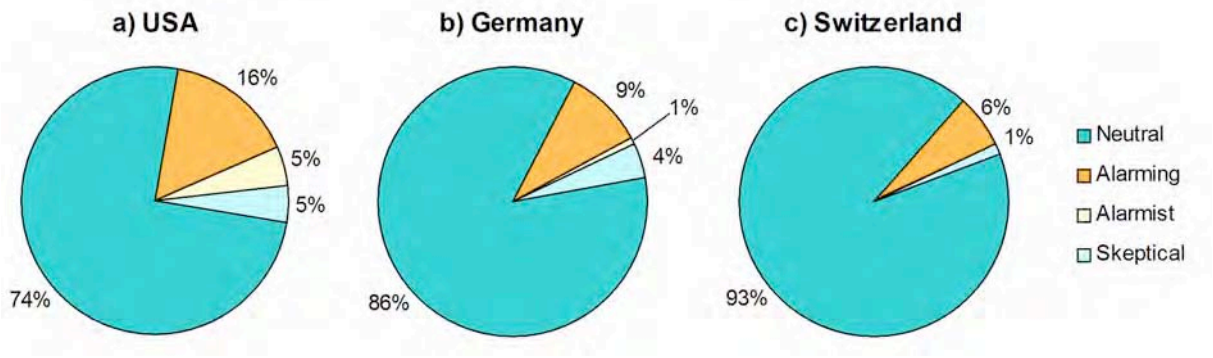


**Fig. 4.6: Results of the measure *Article Tone* in a) the United States (N=219), b) Germany (N=402) and c) Switzerland (N=77).**

respective editorial boards. In this regard, merely 40 percent of German climatologists frequently reading *Die Welt* were confident about its coverage of climate change compared to 87 percent of the readers of *Die Süddeutsche Zeitung* (Post, 2008).

The significant neutrality in the surveyed newspaper articles is nevertheless remarkable since mass media today most commonly construct climate change through the alarmist repertoire (e.g. Ereaut and Segnit, 2006). This medial discourse is partly derived from a general sense of alarmism in assessments of the magnitude and urgency of global warming (Risbey, 2008). Other studies found sensationalism to be the typical mode of communication of most of the contemporary news media, for instance by portraying climate change as an apocalyptic threat (e.g. Ladle et al., 2005). Alarmist tendencies were further observed in the language used by environmental interest groups (Hulme, 2006), in the influential documentary *An Inconvenient Truth* released in 2006 (Boykoff, 2008a), and in the terminology related to the increasingly prominent concept of tipping points (Russill and Nyssa, 2009). Moreover, a vast majority of German climatologists (85%) thought that the more disturbing the findings in climate research are, the more likely they are to be reported by news media (Post, 2008). In view of this evidence, the significant neutrality in the analyzed news coverage is especially striking.

***Viewpoint***

This measure was processed in order to assess the source of specific statements mentioned in the analyzed article content. In Figure 4.7, the distributions of the coded variables are presented for the U.S., Germany and Switzerland respectively. Statements originating from the public realm are significantly more prevalent in US newspapers (47%). These included contributions from the general public or individuals unaffiliated with any governmental institutions such as private companies, interest groups, NGOs or editorial contributions. In this re-

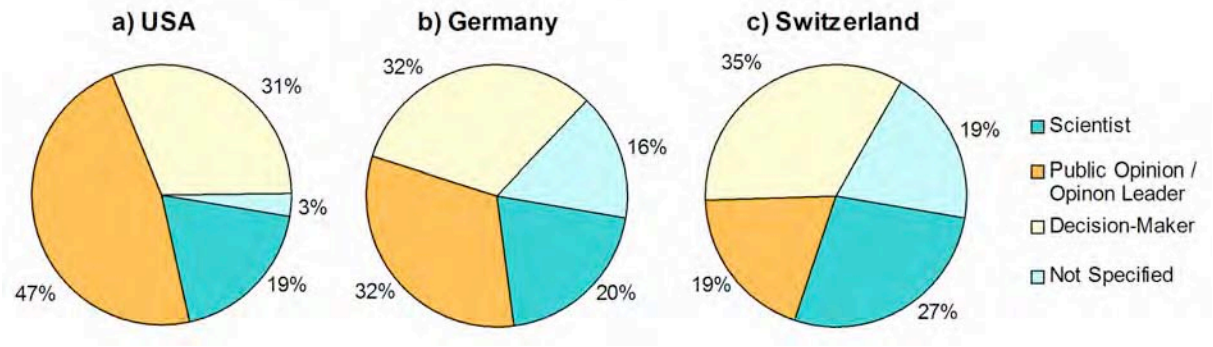


**Fig. 4.7: Results of the measure *Viewpoint* in a) the United States (N=219), b) Germany (N=402) and c) Switzerland (N=77).**

gard, Trumbo (1996) highlighted an interesting fact in his analysis of the relationship between frames and claims-makers in US coverage of climate change. Claims-makers associated with special interests were found to be strongly associated with the judgment frame, which includes general statements calling for or arguing against action and thus reflects the controversial nature of the discourse on global warming in U.S. news media (e.g. Anderson, 2009; Boykoff, 2007a). In Germany, viewpoints of the general public and of elected representatives or other members of public authorities received more or less equal coverage, whereas a majority of the citations in articles (35%) originated from governmental sources in Switzerland. Comments of scientists on the other hand, accounted for around 20 percent of the articles in the U.S. and Germany, while 27 percent of the Swiss news coverage featured a scientific viewpoint. A considerable number of news stories in Germany (16%) and Switzerland (19%) did not specify any specific sources of information compared to only 3 percent in the United States. In contrast to these results, Liu et al. (2008) found that the number of articles mentioning governmental actors exceeded the total of the combined representations of other interest groups in US news coverage of climate change.

***Geographical Context***

This measure assessed the geographical context of the respective article contents, i.e. is not related to the newspapers' countries of origin. Figure 4.8 illustrates the geographical distribution of the article contents per country. The majority of article subjects referred to events at a global scale in all countries as well as publications, with the exception of *Die Süddeutsche Zeitung*, where a majority of contributions related to a national context. Altogether, articles featuring topics with a global context accounted for 53 percent of the whole dataset. In German newspapers, most stories were embedded in the national context (43%). The significantly

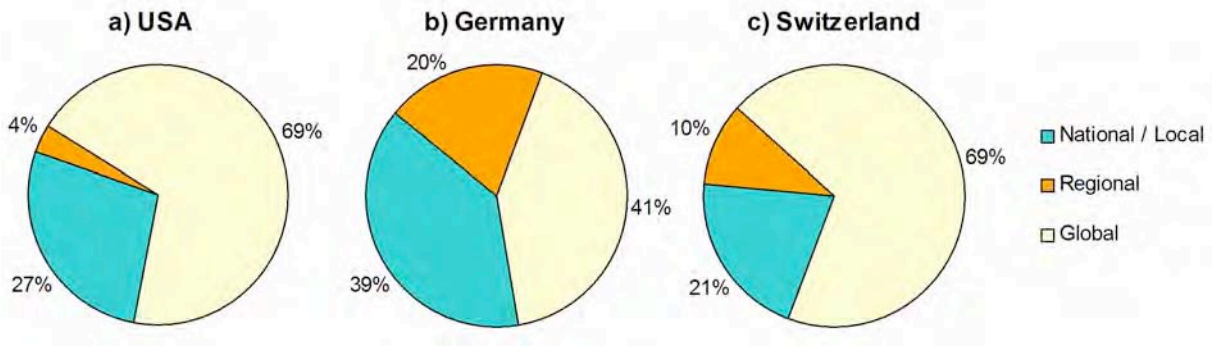


**Fig. 4.8: Results of the measure *Geographical Context* in a) the United States (N=219), b) Germany (N=402) and c) Switzerland (N=77).**

lower fraction of global coverage in Germany derives from the substantial number of articles in *Die Süddeutsche Zeitung*, which accounted for over 40 percent of the sample. The considerable media focus on international news stories in the survey suggests that climate change is indeed perceived as an unprecedented challenge of global proportions in view of its consequences as well as its scope. The international emphasis of US newspapers (69%) is especially striking since a mere 13.3 percent of the newshole in US newspapers, and 10.3 percent of all US media, was dedicated to foreign (non-US) topics according to the latest report of the Project for Excellence in Journalism, (PEW, 2009a). The observed result indicates that US newspapers were also framing climate change primarily as a global problem requiring international cooperation for a sustainable and equitable solution. Regional references were also found to be significantly higher in German articles (20%) compared to Swiss and US contributions (10% and 4% respectively), while accounting for only 14 percent in the whole dataset. Similar results concerning the geographical context in news coverage have been reported by Liu et al. (2008), where global warming was primarily portrayed as a national and global problem with an emphasis on the large-scale nature of the problem as well as to some extent, on large-scale solutions.

***Policy Preference***

This measure recorded whether an article mainly cited policies focusing on mitigating climate change, or rather elaborated on adaptation options, and represents the most crucial component in the assessment of the reviewed evidence given the first hypothesis:

*H1: Newspaper coverage of climate change generally features a bias for mitigation policy options.*

To distinctly classify the mentioned policies, the definitions according to the glossaries in Appendix I of the AR4 WGII (IPCC, 2007f), and in Annex I of the AR4 WGIII (IPCC, 2007e), were used as reference. A considerable amount of the articles did not specifically mention any of the two policy frameworks. In US newspapers, 28 percent of the articles did not mention either policy option, compared to 46 percent in German and 38 percent in Swiss articles (Fig. 4.9). In articles exclusively referring to one of the policy options, mitigation policies dominated the newspaper coverage of global warming in the U.S. (51%), Germany (38%), and Switzerland (45%). Interestingly, mitigation options were most prominently featured in US news stories. Given that the majority of the coverage of climate change in the U.S. was related to the international context (see Fig. 4.8), the result possibly reflects the con-

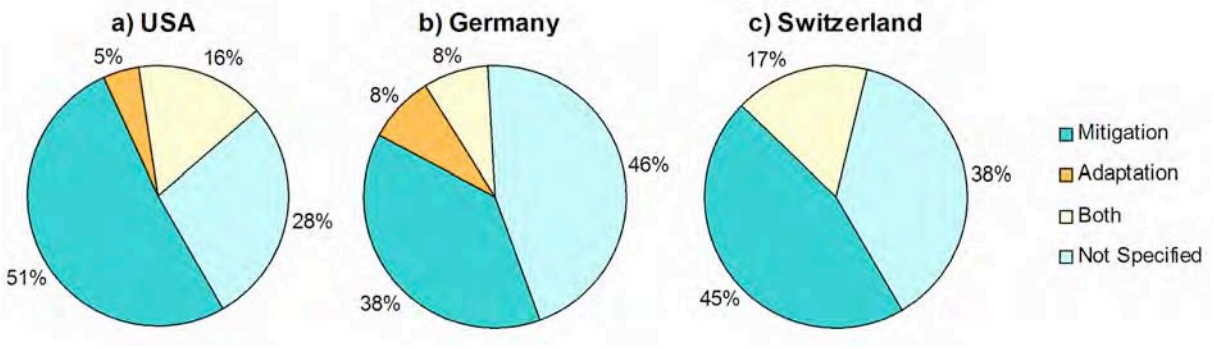


**Fig. 4.9: Results of the measure *Policy Preference* in (a) the United States (N=219), (b) Germany (N=402) and (c) Switzerland (N=77) for the whole dataset (N=698).**

troversial US position regarding its reluctance to commit to internationally binding GHG emission reduction targets (e.g. Bättig et al., 2008). In contrast, merely 10 articles (5%) in US, 34 articles (9%) in German, and none in Swiss publications exclusively referred to adaptation policies. The US (16%) and Swiss titles (17%) featured twice as much stories referring to both policy measures than the German news coverage (8%). In the entire dataset, 43 percent of the news stories mentioned mitigation policies (N=302), compared to just 6 percent referring to adaptation measures (N=44). Articles recording both policy options accounted for 12 percent (N=80), whereas 39 percent (N=272) of the total news coverage did not mention any policy option at all. Liu et al. (2008) reported similar results with 44 percent of articles relating to mitigation policies and merely 3 percent referring to adaptation measures, whereas a majority of stories (51%) did not refer to any policy option. Just over 1 percent of news contributions included references to both policy strategies in their assessment of the news coverage of climate change.

Given the first hypothesis, the following statistical analysis focuses primarily on the content analysis measure *Policy Preference* and its variables *Mitigation* and *Adaptation*. Articles with no reference to any policy options (variable: *Not specified*) have been excluded from the dataset (N=272). In addition, the 80 articles referring to both policy options (variable: *Both*) have been equally distributed among the variables *Mitigation* (N=40) and *Adaptation* (N=40) respectively. A total of 426 articles have been processed in the statistical evaluation. Descriptive statistics run on the updated sample recorded 342 articles (80%) referring to mitigation, and 84 articles (20%) mentioning adaptation policies (Table 4.2). Figure 4.10 illustrates the distribution of *Policy Preference* per newspaper and country.

The null hypothesis was that the newspaper coverage of climate change features a significant bias for mitigation policy options. The alternative hypothesis was that M&A policies are reported to about the same extent in the newspaper coverage of climate change. Pearson's chi-

**Table 4.2: Results of the measure *Policy Preference* per newspaper for the updated sample (N=426).**

| ***Policy Preference*** | **Newspapers** | | | | | | **N** | **%** |
|---|---|---|---|---|---|---|---|---|
| | **NYT** | **WSJ** | **WAP** | **DWE** | **DSZ** | **NZZ** | | |
| *Mitigation* | 59 | 35 | 36 | 55 | 116 | 41 | **342** | **80%** |
| *Adaptation* | 15 | 1 | 12 | 16 | 33 | 7 | **84** | **20%** |
| **Total** | **74** | **36** | **48** | **71** | **149** | **48** | **426** | **100%** |

square test was used to examine whether the *Policy Preference* is independent of the other measures. The degree of association between measures was also determined by Cramér's V as well as the contingency coefficient. The significance of the divergence was determined through *z*-scores that compare proportions. Table 4.3 illustrates the results of the statistical analysis of the *Policy Preference* in relation to relevant measures. A significant correlation ($p<0.05$) was observed between *Policy Preference* and the measures *Article Subject*, *Viewpoint*, and *Geographical Context*. The other measures, most notably *Publication Name* denoting the distribution in the newspapers, did not yield a significant result. The strongest correlation was found between the *Policy Preference* and the *Viewpoint*, the weakest correlation between *Policy Preference* and *Geographical Context* (see Cramér's V and Contingency coefficient in Table 4.3). The insignificant result of the measure *Article Tone* might be linked to the strong qualitative notion inherent in its variables especially in the variable *Alarmist*, which was used when an article included expressions such as "catastrophic" or "disastrous" for example. Whether something is regarded as catastrophic or not is a matter of perspective (e.g. Hulme, 2006). Risbey (2008) further noted that such terms are imprecise and may convey a

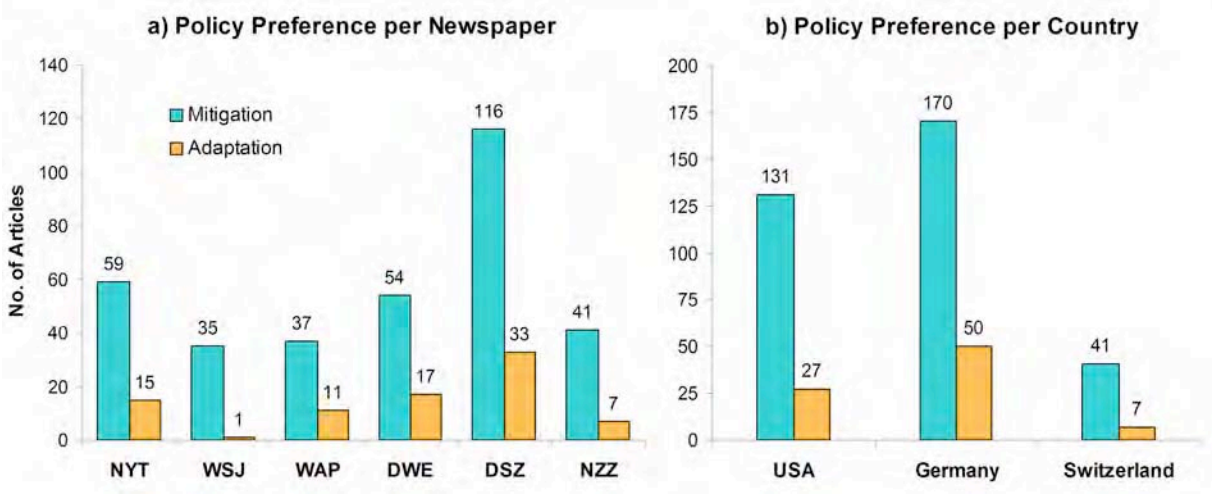


**Fig. 4.10: Results of the measure *Policy Preference* per newspaper (a) and country (b) for the updated sample (N=426).**

**Table 4.3: Statistical analysis of the measure *Policy Preference* per *Publication Name* (newspapers) as well as for other relevant measures for the updated sample (N=426).**

| ***Policy Preference*** | **Pearson's Chi$^2$ (df) *p*** | **Cramér V *p*** | **Contingency Coefficient *p*** | ***z*-score** | |
|---|---|---|---|---|---|
| | | | | **min.** | **max.** |
| *Publication Name* | 9.097 (5) ns | 0.146 ns | 0.145 ns | -0.495 ns | 2.015 ns |
| *Text Form* | 0.630 (3) ns | 0.038 ns | 0.038 ns | -0.494 ns | 3.287 ns |
| *Article Subject* | 8.080 (2) * | 0.138 * | 0.138 * | -1.231 * | 0.854 * |
| *Article Tone* | 4.131 (3) ns | 0.098 ns | 0.098 ns | -0.404 ns | 3.790 ns |
| *Viewpoint* | 10.283 (3) * | 0.155 * | 0.154 * | -1.857 * | 1.934 * |
| *Geographical Context* | 7.013 (2) * | 0.128 * | 0.127 * | -1.405 * | 0.845 * |

**df: degree of freedom; *p*: significance level**
**ns: not significant; * = *p*<0.05**

range of meanings. Although an obvious bias for mitigation strategies in the surveyed newspapers was observed (see Fig. 4.10), the findings could not be confirmed in the statistical analysis of the measure *Policy Preference*. Consequently, the null hypothesis has to be rejected. Other studies have nevertheless presented different results. Most notably, Liu et al. (2008) reported that the newspaper coverage of global warming mainly referred to mitigation strategies rather than adaptation options.

Despite the statistically insignificant result, the analyzed newspaper coverage nevertheless featured more articles specifically referring to mitigation policies, which might be due to several reasons. First, previous research has convincingly demonstrated that climate policy-making has primarily concentrated on issues of mitigation in the past (e.g. Klinsky and Dowlatabadi, 2009; Pielke, 1998). The predominant academic and political discourse has thus almost exclusively focused on mitigation strategies, especially in negotiations for an international climate regime (e.g. Paavola and Adger, 2006; Urwin and Jordan, 2008). Only recently, adaptation options have received increasing attention from political stakeholders and media alike (e.g. UNFCCC, 2009; WMO, 2009). As mass media coverage and the public understanding of global warming are primarily driven by climate change policy events (e.g. Boykoff, 2008a), the news coverage of this topic is likely to focus more on mitigation rather than adaptation strategies. Second, climate change is still predominantly framed as a global problem and thus as a large-scale and non-local issue requiring international cooperation. This perspective also emphasizes mitigation strategies, i.e. a top-down policy approach, rather than adaptation measures, which are mainly implemented at national and local levels and receive comparatively little attention, in particular from governmental agencies (e.g. Easterling et al., 2004). As a consequence, they are given little coverage in news media (Liu et al., 2008). Third, the most important international agreement to date, the Kyoto Protocol, is primarily

based on mitigating climate change, which is also likely to lead to higher coverage of mitigation strategies. Finally, adaptation to climate change takes place from day to day wherever it is required. Such local actions do not always implicitly make the headlines as they are rarely disputed and therefore do not necessarily reflect news values.

### 4.2.2. Assessment of Scientific Statements

This measure registered whether an article contained one or more scientific statements, related to *Temperature*, *Precipitation* (including snowfall), *Sea Level*, *Extreme Events*, or *Anthropogenic Global Warming*. References to any other scientific evidence were disregarded in this analysis. The article statements were coded and transcribed to investigate the accuracy of the newspaper coverage of climate change for a comparison with the available scientific evidence, and to subsequently provide an answer to the second hypothesis:

*H2: Scientific facts about global warming are accurately reported in newspapers.*

Articles containing at least one *Scientific Statement* related to the mentioned elements above were coded. Statements applying for more than one category were treated separately for each category. 89 articles (~13%) in the dataset included at least one or several scientific statements according to the definitions, yielding a total of 132 statements, which were subsequently transcribed. The complete list of transcribed statements is provided in Annex II. Figure 4.11 illustrates the transcribed statements per country and category. US newspapers contained more articles with at least one statement (~17%) compared to German (~11%) and Swiss newspapers (~9%). Statements relating to *Temperature* accounted for almost a third of all statements (31%), followed by *Sea Level* (23%), and *Extreme Events* (22%). Interestingly, statements about the anthropogenic origin of the observed planetary warming constituted only 16 percent of all the arguments (Fig. 4.11b). That a majority of recorded statements referred to temperatures suggests an increasing salience of the controversial *Two Degree Limit* outside the academic realm as well. For instance, the international community acknowledged the target in the *Copenhagen Accord* at the COP 15 (UNFCCC, 2009), and was also a topic at a recent high-level briefing of the UN Environment Programme (UNEP, 2010).

After transcription, the statements were qualitatively evaluated for their consistency with the scientific evidence presented by the three IPCC WG Contributions to the AR4 (IPCC, 2007b; e; f). If a reference included a corresponding probability of occurrence (see Footnote 1) regarding a specific transcribed statement, the estimated percentage was also recorded for each statement and subsequently averaged per category. Annex II provides the AR4 references for

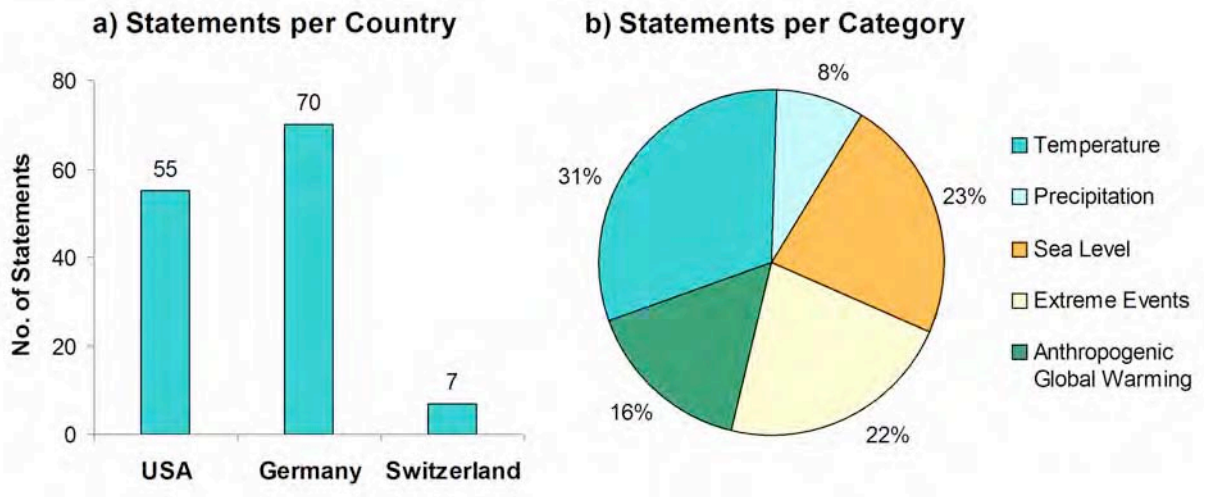


**Fig. 4.11: Distribution of the transcribed *Scientific Statements* (N=132) a) per country and b) per category.**

each statement, including the respective IPCC probabilities of occurrence where available. The fraction of correct statements in each category was then compared to the mean of the corresponding AR4 probabilities per category to examine the level of accuracy in the analyzed climate change coverage for each statement category. The difference of the compared ratios provides an indicator for the level of agreement between the analyzed newspaper coverage of climate change and the scientifically assessed likelihood of an outcome or a result reported in the surveyed articles. A small difference between the proportions denotes a more accurate portrayal of the scientific evidence about climate change or global warming in the newspapers. The null hypothesis was that scientific facts about global warming were reported accurately in newspaper coverage. The alternative hypothesis was that newspapers did not provide a proper description of scientific evidence about global warming.

Annex I presents a summary of the correct and incorrect statements per country and category (Table C), as well as per newspaper and category (Table D), including the fraction of correct statements, the mean IPCC probability of occurrence in the respective AR4 references of the correct statements, as well as the difference between the ratio of correct statements in the news coverage and the mean IPCC probability of occurrence per category. A majority of the transcribed statements in all categories and countries were accurate according to the AR4 findings, with *Sea Level* accounting for the minimum number of correct statements (67%). A total of 104 statements (79%) were observed to be consistent with the scientific evidence of the AR4. 28 statements (21%) were found to be inaccurate, either because they simply did not properly describe the scientific findings, or they exaggerated or understated specific elements, i.e. regarding temperature reconstructions or sea level projections. Only the *Wall Street*

*Journal* (31%) and *Die Welt* (48%) featured a relatively high proportion of inaccurate statements. These publications thus seemed to offer more space to skeptical viewpoints in their climate change coverage, possibly reflecting the rather conservative ideologies of their respective editorial boards. All other newspapers featured a high level of accuracy in their coverage of climate change (>80%). Previous research has in fact demonstrated that editorial preferences (Schoenfeld et al. 1979), as well as economic pressures and ownership structures, have affected news content (e.g. Herman and Chomsky 1988). The presented findings seem to confirm these arguments. A relatively high fraction of inaccurate statements was also observed in the *Temperature* (22%), *Sea Level* (33%), and *Anthropogenic Global Warming* (29%) categories, whereas not a single statement related to *Precipitation* and merely 10 percent of statements referring to *Extreme Events* were incorrect. Although the latter two elements mostly relate to singular meteorological events, they can also at least partly be attributed to climate change (e.g. Allison et al., 2009; Yohe, 2010). Yet, it is mainly the former elements that inspire the most controversial public debates since rising global temperatures and sea levels, as well as the anthropogenic interference with the planetary climate system, are directly linked to climate change in general. Consequently, they present a preferred target for criticism originating from industry lobby groups or conservative think tanks for example (e.g. Hoggan and Littlemore, 2009), and are more likely to enter the media discourse as well. The ongoing controversy concerning the millennial temperature reconstruction by Mann et al. (1998), featuring the "famous" *hockey stick*, illustrates just one of many examples of private-sector attempts to discredit climate science findings in general (e.g. McCright and Dunlap, 2000; 2003). On the opposite side, commonly referred to as "alarmist", however, global warming is frequently the subject of exaggerated or otherwise incorrect claims as well (e.g. BBC News, 2007). In Al Gore's movie *An Inconvenient Truth* for instance, it was insinuated that the melting of ice in either West Antarctica or Greenland could lead to a sea level rise of up to 20 feet (6–7 meters) "in the near future" (Gore, 2006). This number is several times higher than the direst AR4 projections for sea level rise by the end of this century (IPCC, 2007b), and thus clearly defies the scientific evidence.

Finally, the evaluation of the accuracy of the newspaper coverage of global warming revealed a surprisingly unambiguous result. Calculations of the qualitative indicator of the difference between the ratios of correct statements regarding scientific evidence on climate change and the averaged IPCC probability of occurrence in the corresponding categories yielded an overwhelmingly accurate newspaper reporting on the topic. In the United States and Switzerland, the difference between the compared proportions was only seven and eight percent re-

spectively, whereas the analyzed coverage in German newspapers, as well as for the whole sample (N=132), was observed to be almost perfect with a difference of merely two percent (see Table C). The relatively higher level of deviation observed in Switzerland is due to the low number of total statements recorded in the Swiss coverage (N=7). The finding suggests that the US coverage was more divergent from the scientific evidence in comparison to the other countries, as well as to the entire sample of statements. Although the results of this deviation index have to be taken with caution, due to the inherently qualitative nature of the comparison, they nevertheless provide a good indication concerning the overall accuracy of the media coverage of global warming in the analyzed newspapers. Numerous studies reported similar results regarding the inaccurate media representations of anthropogenic climate change (e.g. Boykoff and Mansfield, 2008; Boykoff and Roberts, 2007), the emphasis on the uncertainty of global warming (e.g. Dispensa and Brulle, 2003), the apparent lack of scientific consensus on key issues (e.g. Boykoff, 2007b), or the continuous suggestion that climate projections were exaggerated and overly pessimistic (Freudenburg and Muselli, 2010). Hence, the present analysis is generally in line with previous evidence on this subject. Given the unambiguous results, the null hypothesis was confirmed, although a more thorough evaluation of the accuracy and validity of the general newspaper coverage of climate change is certainly required for a more significant finding as well as an improved understanding of the issue.

### 4.2.3. National Public Opinions

Worldwide public awareness of the existence of global warming and of its potentially serious consequences has increased considerably since the 1980s (e.g. O'Hara, 2009). As a consequence, public demands for political actions to address the problem of climate change have markedly increased in democracies (e.g. Ward, 2008). To assess if and to what degree the domestic newspaper coverage of climate change influenced public opinion in the respective countries, this section presents the results of national public opinion polls, conducted before and after the surveyed period of the content analysis (1 July – 31 December 2008). Other societal actors with the potential to influence the public discourse, as well as constraints limiting the role of news media as information transmitters are also discussed. In addition, the role of the actual or perceived domestic vulnerability to climate change for the emerging public demand to politically address environmental problems is investigated. The assessment aims to provide an answer to the hypothesis

*H3: Media coverage of global warming influences national public opinions.*

Only representative opinion polls conducted by renowned institutions have been selected for the qualitative analysis. Questions and associated possible answers in the poll sample have further been limited to the relevant elements regarding the stated hypothesis. The selection of surveys also accounted for the polling dates, which ideally were outside the date range of the analyzed newspaper coverage. The subsequent discussion of the results concentrates on polls asking the exact same question before 1 July and after 31 December 2008. This allows for a quantitative assessment of the shift in public opinion over a given period of time, and aims at improving the validity of the analysis. The poll search yielded numerous national surveys from the U.S., but the availability of polls from Switzerland, and to a lesser extent from Germany as well, was found to be more limited. The analyzed opinion surveys per country are provided in Tables E–G in Annex I. As with the selected newspapers, the poll sample thus roughly accounts for the population size and geopolitical influence of the respective countries. The main findings of the qualitative assessment are now discussed to evaluate the extent of the media coverage of global warming influenced national public opinions. Other potential influences on the shaping of public opinions are also outlined including the importance of other actors, unrelated to news media, specific events during the surveyed period (e.g. the beginning of the financial crisis), or other given circumstances, such as the perceived domestic vulnerability to climatic changes for instance.

***United States***

The results of the analyzed public opinion surveys in the U.S., with the respective questions (Q1–Q7) and answers in the periods before 1 July and after 31 December 2008 respectively, are illustrated in Table E. In the last two years, there has been a noticeable increase in the number of Americans (+6%) who think that the seriousness of global warming is exaggerated in the news media coverage (Q1). In 2009 however, an absolute majority (53%) still thought that the effects of global warming are already happening, although the number significantly decreased (–8%) since 2008 (Q2). Public opinion on the consensus of scientists about the occurrence of climate change also decreased significantly (–13%) compared to 2008 (Q3), including a considerable increase of respondents who thought scientists were unsure (+10%). On the other hand, a solid majority of people (60%) is still personally worried to a great extent or a fair amount about global warming (Q4), or considered it as a very serious or somewhat serious problem (65%) in 2009 (Q5), although these numbers have noticeably decreased since 2008. US public demand for political actions to address climate change was further observed to be significantly lower at the end of 2009 (–15%) compared to the year 2007 (Q6).

Yet 37 percent still considered global warming a very serious problem that should be one of the highest priorities for government leaders. The number of people viewing environmental protection as a political priority has also significantly decreased (–23%) since 2007 compared to those who thought that the stimulation of the economy (+25%) was more important (Q7). In summary, significant shifts in US public opinion were observed about the seriousness of global warming (Q4–6), the media's portrayal of global warming as a problem (Q1) or in the political priorities (Q7). Over a third of Americans apparently believed that most scientists are unsure about the occurrence of global warming (Q3).

The results generally indicate a correlation of US news reporting and national public opinion, although the public perception of global warming as a serious problem, which needs to be addressed by political actions, remained remarkably high. Interestingly, the country's historical position in international negotiations for a global climate regime, as well as the ambiguous treatment of the global warming issue by government officials, especially during the Bush Administration from 2001 to 2009, did not reflect these concerns of American citizens. The surprisingly persistent level of environmental concern in the American public might be explained by the catastrophic aftermath of hurricane *Katrina* in August 2005, which figures as the costliest hurricane in US history (Knabb et al., 2005). On the other hand, the considerable number of American citizens (36%) who think that scientists are still unsure about the occurrence of climate change is striking (Q3). The finding indicates that corporate skepticism, supported by well-funded politically powerful conservative think tanks and wealthy foundations, continues to successfully focus the national public discourse on existing scientific uncertainties, and thus contributing to the ambivalent US climate legislation (Freudenburg and Muselli, 2010; Hoggan and Littlemore, 2009; Jacques et al., 2008).

The recorded changes in American public opinion since the beginning of 2007 seem to be linked to the media coverage of specific events such as the global economic downturn, which has apparently become the primary concern of the public due to the worldwide economic crisis. Most notably, the *Climategate* incident in November 2009 possibly accounts in part for the results of the *CBS News / New York Times* poll (Q6–7). These findings are generally in line with previous research. Concerning the remarkably high concern about climate change for instance, Mazur and Lee (1993) argued that the US news coverage, including the *New York Times*, was indeed effective in placing global environmental problems on the American agenda, as well as shaping national concerns during the late 1980s. The 1992 signature of the UNFCCC, the 1997 adoption of the Kyoto Protocol, as well as the releases of IPCC Second and Third Assessment Reports in 1995 and 2001, were also covered heavily in American me-

dia (Boykoff, 2008a). Al Gore's documentary *An Inconvenient Truth* and the publication of the IPCC AR4 have also resulted in unprecedented news coverage of global warming, which was subsequently regarded as one of the major policy challenges for contemporary societies (Dirikx and Gelders, 2008). All these instances arguably resulted in this still considerable public concern about climate change in the U.S., although the most recent surveys show a tendency towards more skepticism probably due to the *Climategate* incident and the mounting evidence of errors in the AR4 (e.g. Freudenburg and Muselli, 2010). The analyzed surveys further indicate that the current public demand for national climate policy-making is still substantial, but has indeed decreased considerably because of the recent global economic downturn.

***Germany***

The results of the analyzed public opinion surveys in Germany, with the respective questions (Q1–Q5) and answers in the periods before 1 July and after 31 December 2008 respectively, are illustrated in Table F. The number of German citizens, who think that the seriousness of global warming has generally been exaggerated, remained virtually unchanged in the compared periods. It even decreased slightly (–1%) compared to 2008 (Q1). Similar results were observed concerning people's perception of the seriousness of global warming and climate change. In 2009, a vast majority of people still considered climate change as a very serious (66%) or a fairly serious (23%) problem, which is merely 1 percent less than in 2008 (Q2). According to another poll (Q5), the number of respondents who believed global warming to be a very serious problem slightly increased (+1%). German public opinion was nevertheless observed to be somewhat less concerned compared to 2008 (Q2), as the number of respondents viewing global warming as a very serious problem decreased considerably (–8%), whereas more people think of global warming as a fairly serious problem (+7%) or not a serious problem (+1%). On the other hand, a strong majority of the people thought that the German government was not doing enough (48%) or was doing about the right mount (40%) to fight climate change in 2008 (Q3). These numbers have even slightly increased in 2009 (3% and 1% respectively), while only 4 percent thought that the government was doing too much, merely half as much as compared to 2008 (8%). A considerable shift from environmental to economic concerns was also observed in the German public between 2008 and 2009 (Q4), with a significant decrease of people who considered global warming as the most serious problem currently facing the world as a whole (–14%), while concerns regarding a major global economic downturn increased by almost the same ratio (+15%). In contrast to the

United States however, the German public was still more concerned about global warming (57%) than the financial crisis (46%). In summary, the analysis generally showed only minor shifts in national public opinion regarding the depiction of climate change in the public discourse (Q1), the seriousness of the issue (Q2; Q5), and the public opinion on climate policy-making (Q3). Although public concern about climate change significantly decreased because of the global economic downturn, the issue is still high on the public agenda (Q4).

The recorded changes in German public opinion since the beginning of 2007 also appear to be linked to the shift in media coverage from environmental to economic issues. The decrease in the media coverage of climate change was correlated to a decrease of public concerns about global warming, although the findings were observed to be more ambiguous compared to the results in the United States. In this regard, Weingart et al. (2000) argued that the issue of climate change has primarily been reported as a sequence of events in German news coverage. The increasing prominence of economy-related topics in the news reporting has nevertheless led to a decrease in the public perception about global warming as the most serious problem in Germany. Although a similar shift of political priorities was observed in the United States after 2008, it is important to note that the level of public concern about climate change has always been considerably higher in Germany (e.g. Nielsen, 2007; WPO, 2006), and has remained remarkably steady in the analyzed surveys. However, results of a study by Bang (2003) suggest that the high level of public concern about global warming in Germany was also accompanied with a comparatively low willingness to pay for environmental protection.

***Switzerland***

The results of the analyzed public opinion surveys in Switzerland, with the respective questions (Q1–Q4) and answers in the periods before 1 July and after 31 December 2008 respectively, are illustrated in Table G. Due to the lack of available poll data in Switzerland, one survey including two questions (Q3 and Q4) was conducted in September 2008, i.e. during the surveyed six-month period of the content analysis, which might entail a small bias in the results. Taking into account a certain time lag between the news coverage and a significant shift in public opinion, the survey was nevertheless included in the analysis to expand the otherwise sparse evidence. The questions Q1–Q3 included multiple choices, which account for the low percentages in the corresponding answers. Swiss citizens were asked to state the five currently most important problems from a selection of 30 different topics such as environmental protection, unemployment or health care (Q1), and which of those problems they thought should be addressed first (Q2). Another question asked the public to state the five

most important national problems in 10 years (Q3). As in the United States and Germany, public concerns about global warming have decreased substantially between 2007 and 2009. 25 percent depicted global warming as one of the top five national problems in 2007, compared to only 17 percent in 2009 for example (Q1). In contrast, concerns about unemployment were not only observed to be considerably stronger in both 2007 (57%) and 2009 (66%) but also significantly increased (+9%) in the same period. Moreover, only a small fraction (6%) of the public thought that global warming should be addressed first in 2007 compared to merely 3 percent in 2009 (Q2). Respondents were considerably more concerned about unemployment (9%) and health care issues (10%) in 2007, as well as in 2009 (17% and 7% respectively). Both topics thus ranked significantly higher among the most important problems compared to environmental issues. Similar results were observed concerning people's perception of the most important problems in 10 years (Q3). Again, public concerns about global warming decreased (–6%) in the period from 2008 to 2009, whereas concerns about unemployment significantly increased (+12%) with health care issues only showing a slight decrease (–3%). On the other hand, Swiss public opinion apparently embraced the political goal of stabilizing national GHG emissions during the analyzed period (Q4). In 2008, an overwhelming majority considered the stabilization of national GHG emissions as a very important (44%) or rather important (44%) political goal in 2008, as well as in 2009 (53% and 40% respectively).

The observed results in Switzerland generally reflect the findings from the United States and Germany. Public concern was also primarily focused on economic issues such as unemployment or the recent financial crisis rather than on environmental topics. Although a significant number of people also cited global warming as a serious issue today, as well as in the future, it currently seemed to have considerably lower priority in public opinion. The prominent media coverage of the global financial crisis thus seems to account for the shift from environmental to economic issues in the public opinion in Switzerland as well, although apparently it did not exert a significant influence on public concerns about global warming in general, given the overwhelming majority of Swiss citizens considering a stabilization of national GHG emissions as an important political goal in the whole period. Despite the significant shift of political priorities towards economic issues in Switzerland, the level of public concern about climate change has remained remarkably steady in the analyzed period. This finding was confirmed by a recent survey showing a strong majority of the Swiss public (72%) remained concerned about the environment, including 90 percent of the respondents citing climate change as the most serious problem (Nielsen, 2009).

In summary, the results indicate a strong correlation between the decrease in the media coverage of global warming and the decrease in public concerns about the issue in all three countries within the last three years. Conversely, the prominence of economic topics reported by news media was reflected by a significant increase in public concerns about the economy. However, the general public awareness of the existence and seriousness of climate change remained remarkably high in all countries, although it was somewhat less pronounced in the United States as compared to Germany and Switzerland, indicating that the American public generally seems to be more susceptible to the increasing controversial news coverage of global warming since the beginning of 2007. Other research reported similar results in the analysis of recent developments in US news coverage and public opinion showing a persistently high level of skepticism in climate change news coverage (e.g. Freudenburg and Muselli, 2010; Gallup, 2009; Leiserowitz et al., 2010). This might be explained by the fact that US citizens are commonly less concerned about environmental issues compared to the "potential loss of benefits from current lifestyles" than the European public (Lorenzoni and Pidgeon, 2006; p. 87). Public awareness of climate change in the analyzed countries was nevertheless considerably persistent, especially in view of the current international news situation, even though it has decreased (Tables E–G). This finding is remarkable, since Downs (1972) for instance, argued that environmental issues frequently attract widespread attention in news coverage, only to decline from public view thereafter, although they often remain largely unresolved. Sampei and Aoyagi-Usui (2009) showed that an increase in media coverage of global warming in fact had an immediate influence on public awareness, but only in the short term. Evidence from the present assessment obviously does not confirm these assumptions, which might indicate that climate change indeed constitutes a new sort of global environmental challenge that is unprecedented in history, given its comprehensive scope and worldwide repercussions. In this regard, media coverage of this problem may contribute to the public perception of the topic and subsequently transform into public pressure for climate mitigation or adaptation actions (Boykoff, 2008b).

Given that the results of the qualitative analysis of public opinion surveys suggest a direct influence of media coverage of global warming in the United States, Germany and Switzerland, the hypothesis H3 was tentatively confirmed, although this finding needs to be taken with caution, due to the strong qualitative nature of the presented assessment, and in particular the small poll sample.

### 4.2.4. National Climate Policies

This section provides an overview of the contemporary developments in national climate policy-making in the United States, Germany and Switzerland. The synopsis aims to investigate if, and to what degree, median voter preferences – expressed in national public opinion surveys – influenced climate change related policy decisions in the respective countries. The state of the current national climate legislation in each country was analyzed before 1 July and after 31 December 2008 until the COP 15 in December 2009 to provide an answer for the hypothesis

*H4: National climate policy-making usually reflects median voter preferences.*

After a brief introduction of specific national circumstances, a comparison of the domestic climate policy-making since the year 2000, as well as of the climate legislation of the different countries is provided. The assessment mainly concentrates on mitigation strategies and is further limited to the most relevant policy measures adopted at a national level. The summary of the national climate policy measures was primarily based on the countries' *Fifth National Communications under the UNFCCC* (NC5) respectively (BMU, 2010; FOEN, 2009; U.S. Department of State, 2010). Potential influences of other domestic non-governmental actors are also briefly addressed. An overview of the most important climate related policy measures in each country is presented in Annex I. The observed results are now discussed below in order to confirm or reject the hypothesis.

***United States***

The most important developments in US climate policy-making since 2000, including the respective policy instruments and their sectors or targets, are summarized in Table H. Although the country has implemented numerous climate related policies in the past decade, a strong focus on voluntary agreements such as the *Climate Savers* and *Climate VISION* partnerships, or the *Greenhouse Gas Reporting Program*, is immediately obvious (U.S. Department of State, 2010). A second component of US climate policy since 2001 focused mainly on investments in science and technology, including the promotion of R&D projects for renewable as well as nuclear energy, carbon capture and sequestration, and other technologies via expenditure and tax incentives. In 2002, the U.S. committed itself to a comprehensive strategy for reducing the GHG intensity of the national economy by 18 percent by 2012, which would amount to a 4 percent reduction in total emissions over the projected business-as-usual trend (ibid.). The national emission intensity goal and other policy measures, like the

*Energy Policy Act* of 2005 further indicate that climate change was primarily integrated with other policy priorities such as long-term national economic development and energy security (e.g. Román and Carson, 2009). In June 2007, President Bush eventually conceded that his country would fully participate in the UN process to formulate a binding agreement to follow up the Kyoto Protocol expiring in 2012 (Jobber and Sieminski, 2008). Nevertheless, the Bush Administration's focus on private-sector technological solutions, rather than regulatory instruments, persisted until the end of its term (Harris, 2009). Given the domestic political circumstances at that time, global warming has been a surprisingly prominent topic in the 2008 presidential campaign. Both candidates, Senators John McCain and Barack Obama, eventually supported legislation regarding national emission reduction targets. In addition, they also pledged to mandate a cap-and-trade system and investment subsidies into green energy technologies and R&D (Jobber and Sieminski, 2008). The candidates' positions possibly reflected the American public's widespread support (78%) for a US commitment to limit its GHG emissions within a new international climate regime (WPO, 2008). Ever since President Obama took office in January 2009, his Administration has reaffirmed its intention to vigorously push for the adoption of policies, to reduce US GHG emissions back to 1990 levels by 2020, and thereafter achieve an 80 percent reduction by 2050 (Román and Carson, 2009). In February 2009, President Obama signed the *American Recovery and Reinvestment Act*, which provided tax cuts and targeted investments to stimulate economic growth. The bill also earmarked investments aimed at doubling renewable energy production and increase the energy efficiency of public buildings (U.S. Department of State, 2010). The Executive Order *Federal Leadership in Environmental, Energy, and Economic Performance* further set sustainability goals for federal agencies, focusing on improving their environmental performance (ibid.). The U.S. Environmental Protection Agency (EPA) also issued the *Mandatory Reporting of Greenhouse Gas Emissions Rule* in September 2009, which requires the reporting of GHG emissions from large U.S. sources (EPA, 2009a). In December 2009, the EPA eventually issued the *Endangerment Finding*, which states that GHG emissions "threaten the public health and welfare of current and future generations", and represents a step towards regulating GHG emissions under the *Clean Air Act* (EPA, 2009b). The regulatory nature of the mentioned policy measures since January 2009 clearly emphasizes the intention of the Obama Administration to address the challenge of climate change, and indeed suggests a fundamental reconsideration of US climate policy-making in comparison to the Bush era. In addition, more legislative proposals related to climate change were introduced in the 110th Congress (2007-2008) than ever before (Skodvin, 2010). Although the proposals "did not result in a corresponding

increase in enacted climate-related laws" (ibid.), this finding nevertheless indicates that global warming has indeed acquired a more prominent role in national climate policy debates. A final aspect of domestic US climate policy-making worth noting is that the most comprehensive actions to address climate change in the U.S. to date have taken place at state and local levels (Litz, 2008). Regional initiatives thus represent the most significant drivers of US federal climate policy (Jobber and Sieminski, 2008). Bang et al. (2007) suggested that such initiatives by state and local governments may eventually develop into a coherent federal climate policy, and argued that a national consolidation of regional policy measures most likely represents a prerequisite for a US involvement in any future global climate regime as well. Given the strong subnational context of US climate legislation, Román and Carson (2009) also assumed that US climate change policy developments will likely be "almost entirely bound to US domestic politics and aspirations" (p. 16). Although the conditions for the adoption of consistent US climate policies currently seems more favorable than in the past, a number of domestic structural, institutional and political hurdles remain in place (e.g. Jobber and Sieminski, 2008; Skodvin, 2010). Among the factors that could provide a domestic push in US climate policy-making, Bang et al. (2007) specified a rising public demand for environmental protection measures as a result of perceived increases in the damages of extreme weather events possibly linked to climate change, breakthroughs in energy technologies such as carbon sequestration, and potential security risks associated with the US dependency on foreign oil imports. Although a remarkably high level of public concern about global warming was observed in the U.S. (WPO, 2008), economic interests and subsequent climate related political decision-making apparently remain decisive influential factors in domestic climate legislation (e.g. Bang, 2003).

In summary, the assessment of US climate policy since the beginning of 2009 revealed a significant shift towards a more regulatory climate policy framework, especially at the federal level, compared to the period prior to the analyzed news coverage. The adopted policy measures after 2008 did not indicate any correlation between the recently declining concerns about global warming in US public opinion and national climate legislation. Nevertheless, the higher level of public concern in the past has presumably exerted some influence on today's policy decisions. The observed shift in the political commitment to address global warming can rather be attributed to the replacement of the Executive Branch impersonated by Barack Obama as the newly elected U.S. President, although Americans apparently favored a universal political comeback of *change*, to use Obama's campaign slogan, rather than in relation to climate change in particular.

***Germany***

The most relevant developments in German climate policy-making since 2000, including the respective policy instruments and their sectors or targets, are summarized in Table I. Germany initiated several central measures designed to achieve its emission reduction target after signing the Kyoto Protocol in 1998. The *Ecological Tax Reform* from 1999 for example, has been aimed at creating incentives to develop energy-saving technologies and to improve the energy efficiency, while the 2000 *Renewable Energies Act* promotes the generation of power from renewable energy sources (BMU, 2006). The *National Climate Protection Programme* has been adopted in 2000 and reviewed in 2005. Its core elements include the definition of minimum standards for insulating residential and non-residential buildings, and a financial assistance program for $CO_2$ reductions and energy saving measures for older existing buildings (BMU, 2006). Since January 2005, the national energy industry and industry sectors have largely been integrated in the European ETS (ibid.). In 2007, the *Integrated Energy and Climate Programme* (IECP) has been implemented providing specific measures aimed at enhancing energy efficiency and intensifying use of renewable energies. Its key elements include minimum targets of electricity (30%) and heat demand (14%) generated from renewable sources by 2020, a doubling of energy productivity by 2020 compared with 1990, as well as a an increase of combined heat and power (25%) of electricity generated by 2020 (BMU, 2009). An additional goal of the IECP is to reduce the country's GHG emissions by 40 percent by 2020, with regard to the relevant levels in 1990 (BMU, 2010). This target goes even further than the EU pledge of a GHG emission reduction of 20–30 percent in 2020 and 80–95 percent in 2050 based on 1990 levels within the framework of an international agreement (UNEP, 2010). In contrast to the United States, climate protection can be considered as a priority area in German politics, given these reasonably ambitious goals (BMU, 2009, Schreurs, 2002). In addition to climate related legislation, the German government has further announced its intention to phase out nuclear power. An agreement with energy companies on the gradual shut down of the country's nuclear power plants by 2020 was enacted in the *Atomic Energy Act* in 2002 (BMU, 2007b). Moreover, because of the strong promotion of R&D in solar and wind technology, Germany's renewable energy industry is at the forefront of global research efforts in these fields (e.g. Hendry et al., 2010).

In summary, the assessment of German climate policy since 2000 revealed a considerable focus on regulatory instruments in comparison to the United States, although the country's national climate policy is also partly based on voluntary agreements with specific industry sectors, such as the Combined Heat and Power (CHP) agreement (Skjærseth and Wettestad,

2010). The German public, as well as political parties, are generally more supportive of regulatory measures, compared to the U.S. (e.g. Schreurs, 2002; 2003). It is no surprise that the transition to a less carbon intensive energy system is generally developed at a faster pace in Germany (Pahle, 2010), although plans for the construction of several new coal-fired power plants were recently presented (ibid.). Several national climate policy measures adopted in recent years, mostly through enforcement of EU legislation, not only focused on incentives, but also included mandatory regulations such as the EU ETS, minimum rates of taxation for energy products, and building energy performance standards (PEW, 2009b). In comparison with other countries, the precautionary principle has become increasingly institutionalized in environmental protection (Schreurs, 2002), as well as in national climate policy legislation. The high level of public awareness and concern about global warming in Germany has arguably led to a relatively determined political response in addressing climate change. When comparing the periods before and after the analyzed news coverage, however, no significant influence of the public opinion on national climate policy-making could be observed. Bang (2003) also reported that public opinion pressure was important for German climate legislation, although policy-makers generally seemed more susceptible to pressure from economically powerful interest groups than to demands from ENGOs and the public.

***Switzerland***

The most important developments in Swiss climate policy-making since 2000, including the respective policy instruments and their sectors or targets, are summarized in Table J. The *$CO_2$ Act* came into force in May 2000 and represents the centerpiece of Swiss climate policy-making, and also translates the country's commitment under the Kyoto Protocol into national emission reduction targets for energy related $CO_2$ emissions. The *$CO_2$ Act* further limits domestic $CO_2$ emissions from fossil fuel use for heating and transport to 10 percent below 1990 levels over the period from 2008-2012 (FOEN, 2009). The primary instruments to reach the targets focus on a subsidiary $CO_2$ levy for fuels, on emissions trading and complementary use of flexible cap-and-trade mechanisms, as well as on voluntary actions in various areas. In line with the *$CO_2$ Act*, the Federal Council has launched the *SwissEnergy Programme* in 2001 (ibid.). In October 2005, a *Klimarappen* (climate cent) on transport fuels, levied by mineral oil importers to fund the *Climate Cent Foundation*, was introduced. The goal of this private sector initiative was to avoid the introduction of a $CO_2$ levy on transport fuels (Arquit Niederberger, 2005). The *Electricity Supply Act* from 2007 created the legal basis for a national green energy target of supplying 10 percent of annual electricity demand from renewable en-

ergies. The $CO_2$ levy on heating and process fuels was introduced in January 2008 (FOEN, 2009). The legislative process to start shaping the future of the Swiss climate policy was initiated by a popular initiative *Für ein gesundes Klima* (for a sound climate) submitted in February 2008 (ibid.). The initiative postulates a domestic GHG emission reduction of at least 30 percent below 1990 by 2020, mainly by promoting energy efficiency measures and renewable energy (Klima-Initiative, 2010). In June 2009, the parliament earmarked a third of the revenues from the $CO_2$ levy to increase the energy efficiency of buildings and to promote the use of renewable energies in the building sector from 2010. Initially, revenues from the $CO_2$ levy were to be fully and equally refunded to the Swiss population and the business community in proportion of wages paid. Within the original *$CO_2$ Act* from 2000, which is limited to the commitment period of the Kyoto Protocol (2008–2012), the Federal Council was obliged to propose further reduction targets for the time after 2012 (FOEN, 2009). Following public consultation, it has proposed a draft $CO_2$ legislation for parliamentary discussion in August 2009 as a counter-proposal to the popular initiative, which most notably included an emission reduction target of 20 percent below 1990 in 2020, the continuation of the $CO_2$ levy on heating fuels, intensified efforts to promote energy efficiency and the use of renewable energy in the building sector, the introduction of $CO_2$ emission limits for new cars, further development of national emissions trading system, with a view to link it to the EU scheme, and the national coordination of adaptation measures. The total revision of the *$CO_2$ Act* is still subject to parliamentary discussion and planned to come into force in January 2013 (FOEN, 2009). The tax rate of the $CO_2$ levy on heating and process fuels has been increased from 12 Swiss Francs (CHF) to 36 CHF per ton of $CO_2$ per January 2010. This increase was triggered because $CO_2$ emissions from heating fuels in 2008 were above the threshold of the yearly interim targets under the *$CO_2$ Act*, and not due to legislative changes.

The assessment of Swiss national climate policy since the beginning of the year 2009 did not reveal any significant changes in comparison with the period prior to the analyzed news coverage. None of the mentioned policy measures implemented after 2008 implicitly showed any influence of public demands or political pressure directly originating from Swiss public opinion. The result indicates that the influence of the general public was either very limited or other domestic interest groups have been able to compensate the political pressure of median voter demands. However, the generally high public awareness and concern about global warming, as well as the nature of the political system in Switzerland, which provides numerous opportunities for participation and opposition, have nevertheless influenced national climate policy-making, as various forward-looking environmental concepts have been imple-

mented in the past, including market-oriented instruments (Schenkel, 2000). The legislative process to jumpstart the future national climate policy was initiated by a popular initiative (*Für ein gesundes Klima*), which demonstrates a substantial influence of environmental NGOs on both the public opinion, as well as on the political decision-making process (Schenkel, 2000), although the Federal Council has put forward a counter-proposal to the initiative in August 2009. The revision of the $CO_2$ *Act* is still subject to parliamentary discussion and it remains open whether the popular initiative or the policy proposal from parliament will pass the referendum (FOEN, 2009).

In summary, the results of the qualitative analysis of national climate policy-making in he United States showed a significant shift between the period from 2000 to 2008 and the beginning of 2009, which could be linked to domestic political developments, i.e. the election of Barack Obama as the new U.S. President. Since the Obama Administration took office in January 2009, an increasing number of adopted climate policies included regulatory instruments, whereas the Bush Administration rather focused on voluntary agreements and the promotion of R&D projects. The observed transformation in US national climate policy-making might also be linked to corresponding public demands of the American public for the adoption of more stringent climate policy instruments in the past. Domestic climate policy-making in Germany and Switzerland on the other hand, did not indicate any significant shifts regarding climate related policy outputs, due to public demands in the same periods. According to these results, the hypothesis H4 could not be confirmed, although the significant change in the U.S. arguably confirmed the initial hypothesis. It is important to note that due to the qualitative nature of the assessment, the observed findings certainly need further scrutiny to be considered significant. Also, the six-month period of the content analysis was probably too short in order to substantially influence national public opinions.

# 5. Conclusions

Global climate change is now widely recognized as one of the most pressing problems in this century and beyond, and has become an important issue on the international policy agenda (e.g. Oberheitmann, 2010). Its main drivers are intrinsically connected to human activities such as the combustion of fossil fuels or land-cover changes, for instance (e.g. UNEP, 2009). Recent observations suggest that anthropogenic global warming is already affecting human and environmental systems (e.g. Rosenzweig et al., 2008), and that the risks of potentially serious adverse impacts are increasing (Smith et al., 2009). Significant climate change is also expected to occur over the next several decades (Parry, 2009), and will be largely irreversible for centuries, given the long atmospheric residence time of $CO_2$ (Allen et al., 2009; Meinshausen et al., 2009). Current GHG emissions trends and projections further indicate that global average temperatures are likely to exceed the recently adopted temperature limit of 2 °C (e.g. Rogelj et al., 2010). The potential social and economic impacts appear to be both substantial and long-term and are unevenly distributed around the globe (e.g. Bättig et al., 2007), thereby creating winners and losers (White and Hooke, 2004). Global warming and its associated consequences are thus increasingly perceived as a security risk (e.g. WBGU, 2007), and are also projected to lead to massive human migrations (e.g. Warner, 2009). Considerable uncertainties still remain concerning the validity of projections from climate models, as well as the magnitude and geographical distribution of future changes and impacts, cost implications, and societal changes (e.g. Le Treut et al., 2008; Smith et al., 2009; Tomassini et al., 2010). To complicate matters even further, Gay and Estrada (2010) argued that objective probabilities about future climate are a matter of opinion.

Despite the overwhelming evidence for anthropogenic climate change and the large degree of scientific consensus, the topic has generated considerable scientific and political controversy (e.g. Baer and Risbey, 2009; O'Hara, 2009; Sudhakara Reddy and Assenza, 2009). The growing scientific consensus that anthropogenic interference with the climate system will lead to major global disruptions has nevertheless dramatically influenced the academic, political and public discourse since the 1980s (e.g. Anderson, 2009; Carvalho and Burgess, 2005). Since the general public relies on the mass media as main source of scientific information (e.g.

Weingart et al., 2000), investigating media representations of global warming is crucial for the understanding of people's perception of the issue and the subsequent public discourse regarding climate policy-making. Furthermore, mass media coverage of global warming and its potential consequences has increased considerably in the past 20 years, and has played an important role in shaping public understanding and concern about climate change (e.g. Boykoff, 2008a). Through extensive news coverage of the issue, media have also exerted considerable influence on the corresponding policy discourse by framing the scientific, economic, social and political dimensions of global warming (Anderson, 2009). Despite the growing scientific evidence for human induced climate change, media coverage nevertheless persistently delivers remarkably inconsistent messages about the issue. Due to the ambivalent news reporting between urgency and uncertainty, the confusion among the public and policy-makers alike is not surprising. The deciphering and reporting information emerging from the complex climate science-policy-society interface in a correct fashion also presents an enormous challenge for today's mass media to live up to their own virtues of objectivity and neutrality. The prominent news coverage of global warming has become a subject of increasing scientific interest. Numerous studies have analyzed the rise and fall of the media attention on the issue (e.g. Carvahlo and Burgess. 2005), or how media transmit scientific facts to the public (e.g. Antilla, 2005; Boykoff, 2008a; Boykoff and Boykoff, 2004). Other authors have investigated the role of mass media in shaping the public understanding of the issue, as well as its influence on the general policy discourse (e.g. Boykoff and Mansfield, 2008; Russill and Nyssa, 2009). The findings frequently suggest a gap between scientific evidence and representations of anthropogenic climate change in the media. The main objective of this study was to examine a possible gap in the media reporting on climate policies, and to determine the prominence of M&A strategies in newspaper coverage in particular. News contributions of six prestige press newspapers from the United States, Germany, and Switzerland during the second half of 2008 have been investigated by the method of content analysis. In addition, scientific statements in the surveyed sample have been qualitatively evaluated for their accuracy with the scientific evidence of the IPCC AR4. To examine a possible influence of the newspaper coverage on public opinion in the respective countries, a selection of national public opinion surveys has been analyzed before and after the surveyed news coverage. Finally, the adopted national policy measures in each country since the year 2000 were investigated to determine whether public opinion has influenced national climate policy-making.

The analyzed newspaper coverage revealed several notable findings. The average number of articles in German newspapers was more than twice the average in the other countries. Issues

related to climate change were observed feature more prominently in German newspapers than in US or Swiss titles. The overall salience of the global warming issue was correlated to significant policy events in the surveyed period. Two major peaks were observed during the G8 meeting in Japan in July, and the COP 14 in Poland in December 2008. News coverage in the *Wall Street Journal* and *Die Welt* was found to feature a higher number of articles with a distinctly skeptical note than the other titles in the survey. The results reflected the editorial preferences of both newspapers, which arguably represent more conservative as well as business oriented ideologies. In relation to the policy references featured in the articles, the finding suggests that contemporary media coverage of climate change in quality newspapers indeed shows a tendency to emphasize mitigation over adaptation strategies. A distinct majority of the news contributions with a specific reference to climate policy measures exclusively focused on mitigation options, although the result was not statistically significant. Liu et al. (2008) have reported similar results. The portrayal of global warming in the sample was nevertheless observed to accurately report the scientific evidence. The assessment of scientific statements concerning specific elements about climate change generally indicated a remarkably objective description of the subject in prestige press newspapers. However, scientific references concerning temperatures, sea levels, and anthropogenic influences on global warming still featured a relatively high number of incorrect statements. Not surprisingly, these elements also feature among the most controversial issues in the current public discourse. Most notably in the United States, the "IPCC assessments have been portrayed, repeatedly, as having overstated the scientific evidence" regarding temperatures or sea levels (e.g. Dunlap and McCright, 2010: p. 2). Another recent analysis also confirmed previous findings, namely that the US mass media consistently understate the scientific consensus about climate change (Freudenburg and Muselli, 2010).

The results from the assessment of national public opinions before and after the surveyed news coverage indicate a correlation between the decrease in the media coverage of global warming and the decrease in public concerns about the issue in all three countries within the last three years. The strong focus on economic issues in the media coverage during the six-month period apparently weakened public concerns about climate change. Significant shifts in personal priorities have been observed, with people significantly more concerned for their jobs rather than environmental protection. The general public awareness of the existence and seriousness of climate change remained remarkably high in all countries, although it was somewhat less pronounced in the United States, as compared to Germany and Switzerland. Other research reported similar results in recent developments in US news coverage and pub-

lic opinion, showing a persistently high level of skepticism in climate change news coverage (e.g. Freudenburg and Muselli, 2010; Gallup, 2009; Leiserowitz et al., 2010). In contrast, Larson et al. (2010) reported that the American public was generally more environmental friendly than commonly accepted, which indicates possible mischaracterization of public opinion. Finally, the analysis of national climate policy-making revealed a significant shift in the United States since the Obama Administration took office in January 2009. Domestic climate policy-making in Germany and Switzerland on the other hand, did not indicate any significant shifts regarding climate related policy outputs, due to public demands in the same periods.

The problem of global climate change is now widely recognized in all circles of society and the worldwide awareness of the issue is higher than ever before. The challenge now is to keep climate change from becoming a catastrophe (e.g. Lonngren and Bai, 2008). Mass-media coverage of global warming has proven to be a key contributor in shaping public understanding and raising people's awareness regarding this challenge. However, accurate news reporting on the issue is crucial to facilitate global efforts to address this imminent problem. Despite the substantial bias observed in the analysis of recent quality newspaper coverage, scientists and policy-makers have nevertheless recognized that both M&A measures are ultimately needed to confront the challenge of global warming by now (e.g. Biesbroek et al., 2009). Although the crucial importance of adaptation policies in the climate policy framework has recently been acknowledged (e.g. UNFCCC, 2009; WMO, 2009), this study aims to further emphasize the role of adaptation for the success of any climate policy framework to address the challenge of global climate change. Given its comprehensive scope and worldwide impact, climate change most likely constitutes a new form of global environmental challenge that is unprecedented in history. Although scientific evidence of the ongoing warming in the climate system and its anthropogenic causes has never been more unambiguous, climate science continues to be a "deeply contested area" with "considerable competition among (and between) scientists, industry, policymakers and non-governmental organizations" (Anderson, 2009: p. 166). As once again illustrated by the recent *Climategate* incident, the task for science should be to establish a basis for "negotiation in good faith" (Ravetz, 2006: p. 278), and researchers should refrain from acting as *issue advocates* by politicizing science (Pielke, 2007). Some members of the climate science community apparently have not always lived up to this noble task by crossing the thin line of advocacy between policy and science. Climate change also represents a prime example of a public science-policy arena that is highly contested, characterized by uncertain facts, disputed values and politicized alternatives for action

(Funtowicz and Ravetz, 1990). As mass media play a crucial role in the communication of scientific findings about global warming, news coverage of this problem may contribute to the public perception of the topic and subsequently transform into public pressure for climate mitigation or adaptation actions (Boykoff, 2008b). It is nevertheless imperative that the media reporting of climate change is reliable and accurately reflects the scientific consensus.

While this study provided some insights on the newspaper coverage of climate change in general, as well as regarding M&A policies in particular, there are several notable limitations, which need to be addressed by further research efforts. First, the number of newspapers, as well as the surveyed period of time, in this study was very limited. Also, the analysis focused only on print media and on prestige press titles in particular. As the Internet technology is rapidly replacing traditional media, a scientific evaluation of climate related information in the World Wide Web over a longer period of time would certainly be interesting. In addition, the analysis concentrated on newspapers in industrialized countries, whereas some of the most relevant geopolitical and economic developments are currently driven by emerging nations like China and India. Investigations of mass media in these countries would also provide an intriguing field for future research efforts.

According to Kevin Anderson, director of the Tyndall Centre for Climate Change Research, "[m]itigating for 2 °C is much more challenging than was previously thought, but adapting to 4 °C is also extremely challenging. There is no easy way out." (Barnett, 2009). But if anything, the findings of the thesis are aimed at helping the world to reach a simple and obvious conclusion: *Inaction is inexcusable!*

# 6. References


ADGER, W.N., Arnell, N., Tompkins, E., 2005: Successful adaptation to climate change across scales. Global Environmental Change 15, 77–86.

ADGER, W.N., Dessai, S., Goulden. M., Hulme, M., Lorenzoni, I., Nelson, D.R., Naess, L.O., Wolf, J., Wreford, A., 2009: Are there social limits to adaptation to climate change? Climatic Change 93, 335–354.

AGRAWALA, S., Andresen, S., 1999: Indispensability and indefensibility?: the United States in the climate treaty negotiations. Global Governance: A Review of Multilateralism and International Organizations 5 (4), 457–482.

ALLEN, M.R., Frame, D.J., Huntingford, C., Jones, C.D., Lowe, J.A., Meinshausen, M., Meinshausen, N., 2009: Warming caused by cumulative carbon emissions towards the trillionth tonne. Nature 458, 1163–1166.

ALLEY, R.B., Marotzke, J., Nordhaus, W.D., Overpeck, J.T., Peteet, D.M., Pielke Jr., R.A., Pierrehumbert, R.T., Rhines, P.B., Stocker, T.F., Talley, L.D., Wallace, J.M., 2003: Abrupt Climate Change. Science 299, 2005–2010.

ALLISON, I., Bindoff, N.L., Bindschadler, R.A., Cox, P.M., de Noblet, N., England, M.H., Francis, J.E., Gruber, N., Haywood, A.M., Karoly, D.J., Kaser, G., Le Quéré, C., Lenton, T.M., Mann, M.E., McNeil, B.I., Pitman, A.J., Rahmstorf, S., Rignot, E., Schellnhuber, H.J., Schneider, S.H., Sherwood, S.C., Somerville, R.C.J., Steffen, K., Steig, E.J., Visbeck, M., Weaver, A.J., 2009: *The Copenhagen Diagnosis: Updating the World on the Latest Climate Science*. The University of New South Wales Climate Change Research Centre (CCRC), Sydney, Australia, 60 pp.

ANDERSON, A., 2009: Media, Politics and Climate Change: Towards a New Research Agenda. Sociology Compass 3 (2), 166–182.

ANTILLA, L., 2005: Climate of scepticism: US newspaper coverage of the science of climate change. Global Environmental Change 15, 338–352.

AOYAGI-USUI, M., 2008: An analysis of the effective factors for promoting pro-environmental actions from the information gain and social capital point of view. Review of Environmental Economics and Policy Studies 1 (2), 37–50 (in Japanese).

ARQUIT NIEDERBERGER, A., 2005: Science for climate change policy-making: applying theory to practice to enhance effectiveness. Science and Public Policy 32 (1), 2–16.

ASPINALL, W., 2010: A route to more tractable expert advice. Nature 463, 294–295.

AUDIT BUREAU OF CIRCULATIONS, 2010: US Newspaper Circulation Averages. http://abcas3.accessabc.com/ecirc/newstitlesearchus.asp (retrieved 3 May 2010).

AXELROD, R., Keohane, R.O., 1985: Achieving Cooperation under Anarchy: Strategies and Institutions. World Politics 38 (1), 226–254.

AYERS, J.M., Huq, S., 2009: The Value of Linking Mitigation and Adaptation: A Case Study of Bangladesh. Environmental Management 43, 753–764.

BAER, P., Risbey, J.S., 2009: Uncertainty and assessment of the issues posed by urgent climate change. An editorial comment. Climatic Change 92, 31–36.

BANG, G., 2003: *Sources of Influence in Climate Change Policymaking: A Comparative Analysis of Norway, Germany, and the United States*. Ph.D. Thesis 43/04, Department of Political Science, University of Oslo, Norway.

BANG, G., Heggelund, G., Vevatne, J., 2005: *Shifting Strategies in the Global Climate Negtiations*. FNI report 6/2005. Fridtjof Nansen Institute, Lysaker, Norway, 30 pp.

BANG, G., Froyn, C.B., Hovi, J., Menz, F.C., 2007: The United States and international climate cooperation: international "pull" versus domestic "push". Energy Policy 35, 1282–1291.

BARNETT, A., 2009: Climate sizzle could come soon. http://www.nature.com/news/2009/090929/full/news.2009.959.html (retrieved 7 May 2010).

BARRETT, S., 2005: *Environment and Statecraft: The Strategy of Environmental Treaty-Making* (with new Afterword). Oxford University Press, New York, USA.

BÄTTIG, M.B., Wild, M., Imboden, D.M., 2007: A climate change index: Where climate change may be most prominent in the 21st century. Geophysical Research Letters 34, L01705.

BÄTTIG, M.B., Brander, S., Imboden, D.M., 2008: Measuring Countries' Cooperation Within the International Climate Change Regime. Environmental Science & Policy 11 (6), 478 –489.

BÄTTIG, M.B., Bernauer, T., 2009: National Institutions and Global Public Goods: Are Democracies More Cooperative in Climate Change Policy? International Organization 63, 281–308.

BAUMERT, K.A., Blanchard, O., Llosa S., Perkaus, J.F. (eds.), 2002: *Building on the Kyoto Protocol: Options for Protecting the Climate*, World Resources Institute, Washington D.C., USA.

BBC News, 2007: *Gore climate film's nine 'errors'*. http://news.bbc.co.uk/2/hi/uk_news/education/7037671.stm (retrieved 9 May 2010).

BELL, A., 1994a: Media (Mis)communication on the science of climate change. Public Understanding of Science 3, 259–275.

BELL, A., 1994b: Climate of opinion: public and media discourse on the global environment. Discourse and Society 5 (1), 33–64.

BENISTON, M., 2007: Linking extreme climate events and economic impacts – Examples from the Swiss Alps. Energy Policy 35, 5384–5392.

BERNAUER, T., Caduff, L., 2004: In Whose Interest? Pressure Group Politics, Economic Competition and Environmental Regulation. Journal of Public Policy 24 (1), 99–126.

BERNAUER, T., Koubi, V., 2009: Effects of political institutions on air quality. Ecological Economics 68 (5), 1355–1365.

BERNAUER, T., Kalbhenn, A., Koubi, V., Ruoff, G., 2010: International Entanglement and Contingent Behavior as Determinants of International Cooperation Explaining Global Environmental Treaty Ratifications, 1950-2000. British Journal of Political Science (forthcoming). http://ssrn.com/abstract=1321035 (retrieved 10 June 2010).

BEUERMANN, C., Jäger, J., 1996: Climate Change Politics in Germany: How Long Will Any Double Dividend Last? In: *Politics of Climate Change: A European Perspective* [O'Riordan, T., Jäger, J. (eds.)]. Routledge, London, UK.

BIESBROEK, G.R., Swart, R.J., van der Knaap, W.G.M., 2009: The mitigation–adaptation dichotomy and the role of spatial planning. Habitat International 33, 230–237.

BIESBROEK, G.R., Swart, R.J., Carter, T.R., Cowan, C., Henrichs, T., Mela, H., Morecroft, M.D., Rey, D., 2010: Europe adapts to climate change: Comparing National Adaptation Strategies. Global Environmental Change (article in press), doi:10.1016/j.gloenvcha.2010.03.005.

BILLETT, S., 2010: Dividing climate change: global warming in the Indian mass media. Climatic Change 99, 1–16.

BLACK, D., 1948: On the Rationale of Group Decision-making. Journal of Political Economy 56, 23–34.

BMU (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety), 2006: *Umweltbewusstsein in Deutschland 2006*. http://www.umweltdaten.de/publikationen/fpdf-l/3113.pdf (retrieved 22 April 2010).

BMU (Federal Ministry for the Environment), 2007a: *Costs and benefits of the German government's energy and climate package*. Background paper. http://www.bmu.de/english/climate/downloads/doc/40412.php (retrieved 12 March 2010).

BMU (Federal Ministry for the Environment), 2007b: *Convention on Nuclear Safety. Report by the Government of the Federal Republic of Germany for the Fourth Review Meeting in April 2008*. http://www.bmu.de/english/nuclear_safety/doc/6418.php (retrieved 2 May 2010).

BMU (Federal Ministry for the Environment), 2009: *Climate Protection Pays Off – Opportunities for Innovation, Growth and Employment*. BMU, Public Relations Division, Berlin, Germany.

BMU (Federal Ministry for the Environment), 2010: *Fifth National Communication of the Government of the Federal Republic of Germany*. Report under the Kyoto Protocol to the UNFCCC. http://unfccc.int/resource/docs/natc/deu_nc5_resubmit.pdf (retrieved 12 March 2010).

BODANSKY, D., 2001: History of the Global Climate Change Regime. In: *International Relations and Global Climate Change* [Luterbacher, U., Sprinz, D.F. (eds.)]. The MIT Press, Cambridge, Massachusetts, USA, 23–40.

BODEN, T.A., Marland, G., Andres, R.J., 2009: Global, Regional, and National Fossil-Fuel $CO_2$ Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, USA.

BÖRNER, A., 2009: Business Interest in Swiss Climate Policy. Paper presented at the 2009 Amsterdam Conference on the Human Dimensions of Global Environmental Change. http://www.earthsystemgovernance.org/ac2009/papers/AC2009-0204.pdf (retrieved 25 April 2010).

BOYKOFF, M.T., 2007a: Flogging a dead norm? Newspaper coverage of anthropogenic climate change in the United States and United Kingdom from 2003–2006. Area 39 (2), 470–481.

BOYKOFF, M.T., 2007b: From convergence to contention: United States mass media representations of anthropogenic climate change science. Transactions of the Institute of British Geographers 32, 477–89.

BOYKOFF, M.T., 2008a: Media and scientific communication: a case of climate change. In: *Communicating Environmental Geoscience* [Liverman, D.G.E., Pereira, C.P.G., Marker, B. (eds.)]. Geological Society, London, Special Publications, 305, 11–18.

BOYKOFF, M.T., 2008b: The cultural politics of climate change discourse in UK tabloids. Political Geography 27, 549–569.

BOYKOFF, M.T., 2008c: Lost in Translation? United States Television News Coverage of Anthropogenic Climate Change, 1995–2004. Climate Change 86, 1–11.

BOYKOFF, M.T., Boykoff, J. M., 2004: Balance as bias: global warming and the US prestige press. Global Environmental Change 14, 125–136.

BOYKOFF, M.T., Boykoff, J. M., 2007: Climate change and journalistic norms: A case-study of US mass-media coverage. Geoforum 38, 1190–1204.

BOYKOFF, M.T., Mansfield M., 2008: 'Ye Olde Hot Aire' - reporting on human contributions to climate change in the UK tabloid press. Environmental Research Letters 3, 024002.

BOYKOFF, M.T., Mansfield M., 2010: 2004-2009 World Newspaper Coverage of Climate Change or Global Warming. http://sciencepolicy.colorado.edu/media_coverage/ (retrieved 27 May 2010).

BOYKOFF, M.T., Rajan, S.R., 2007: Signals and noise. Mass-media coverage of climate change in the USA and the UK. European Molecular Biology Organization Reports 8 (3), 207–211.

BOYKOFF, M.T., Roberts J.R., 2007: *Media Coverage of Climate Change: Current Trends, Strengths, Weaknesses*. Human Development Report 2007/8, Occasional paper, Human Development Report Office, United Nations Development Programme.

BOYKOFF, M.T., Frame, D., Randalls, S., 2010: Discursive stability meets climate instability: A critical exploration of the concept of 'climate stabilization' in contemporary climate policy. Global Environmental Change 20, 53–64.

BRUNNÉE, J., 2008: Europe, the United States, and the Global Climate Regime - All together now? Journal of Land Use and Environmental Law 24 (1), 1–44.

BRUNNER, S., 2008: Understanding policy change: multiple streams and emissions trading in Germany. Global Environmental Change 18, 501–507.

BUENO DE MESQUITA, B., Smith, A., Siverson, R.M., Morrow, J.D., 2003: *The Logic of Political Survival*. The MIT Press, Cambridge, MA, USA.

BURGESS, J., 1990: The production and consumption of environmental meanings in the mass media: a research agenda for the 1990s. Transactions of the Institute of British Geographers 15 (2), 139–161.

CANADELL, J.G., Le Quéré, C., Raupach, M.R., Field, C.B., Buitenhuis, E.T., Ciais, P., Conway, T.J., Gillett, N.P., Houghton, R.A., Marland, G., 2007: Contributions to accelerating atmospheric CO2 growth from economic activity, carbon intensity, and efficiency of natural sinks. Proceedings of the National Academy of Sciences 104 (47), 18866–18870.

CARVALHO, A., 2005: Representing the politics of the greenhouse effect: Discursive strategies in the British media. Critical Discourse Studies 2 (1), 1–29.

CARVALHO, A., 2007: Ideological Cultures and Media Discourses on Scientific Knowledge: Re-reading News on Climate Change. Public Understanding of Science 16 (2), 223-243.

CARVALHO, A., Burgess, J., 2005: Cultural circuits of climate change in UK broadsheet newspapers, 1985–2003. Risk Analysis 25, 1457–1469.

CASPARY, G., O'Connor, D., 2002: *Beyond Johannesburg: Policies and Finance for Climate-friendly Development*. OECD Development Centre Policy Briefs 21. OECD Development Centre, Paris, France.

CBS/NEW YORK TIMES, 2009: CBS News/New York Times Poll. http://www.pollingreport.com/enviro.htm (retrieved 9 March 2010).

CHICAGO COUNCIL ON GLOBAL AFFAIRS, 2007: *World Public Opinion 2007 – Climate Change*. http://www.worldpublicopinion.org/pipa/articles/brglobalmultiregionra/372.php (retrieved 11 April 2010).

CIESIN (Center for International Earth Science Information Network), 2009: Environmental Treaties and Resource Indicators (ENTRI) Query Service. Columbia University, New York, USA. http://sedac.ciesin.columbia.edu/entri/ (retrieved 17 January 2010).

CONÇEICÃO, P., 2003: Assessing the Provision Status of Global Public Goods. In: *Providing Global Public Goods. Managing Globalization* [Kaul, I., Conceição, P., Le Gouven, K., Mendoz, R.U. (eds.)]. Oxford University Press, Oxford, UK, p. 159.

CONGLETON, R.D., 1992: Political Institutions and Pollution Control. Review of Economics and Statistics 74 (3), 412–421.

CORFEE-MORLOT, J., Maslin, M., Burgess, J., 2007: Global warming in the public sphere. Philosophical Transactions of the Royal Society A 365, 2741–2776.

COUNCIL ON FOREIGN RELATIONS, 2009: *Public Opinion on Global Issues A Web-based Digest of Polling from Around the World* (November, 2009). Publications Office, Council on Foreign Relations, New York, USA. http://www.cfr.org/thinktank/iigg/pop/ (retrieved 22 April 2010).

COX, P.M., Betts, R.A., Jones, C.D., Spall, S.A., Totterdell, I. J., 2000: Acceleration of global warming due to carbon-cycle feedbacks in a coupled climate model. Nature 408, 184–187.

COX, P., Jones, C., 2008: Climate change – illuminating the modern dance of climate and $CO_2$. Science 321, 1642–1644.

CURTIS, F., 2009: Peak globalization: Climate change, oil depletion and global trade. Ecological Economics 69 (2), 427–434.

DELLINK, R., den Elzen, M., Aiking, H., Bergsma, E., Berkhout, F., Dekker, T., Gupta, J., 2009: Sharing the burden of financing adaptation to climate change. Global Environmental Change 19, 411–421.

DEMERITT, D., 2006: Science studies, climate change and the prospects for constructivist critique. Economy and Society 35, 453–479.

DEN ELZEN, M.G.J., van Vuuren, D.P., van Vliet, J., 2010: Postponing emission reductions from 2020 to 2030 increases climate risks and long-term costs. Climatic Change 99, 313–320.

DETEC (Federal Department of the Environment, Transport, Energy and Communications), 2008: *Funding Scheme for Bali Action Plan*. A Swiss Proposal for Global Solidarity in Financing Adaptation. http://www.news-service.admin.ch/NSBSubscriber/message/attachments/13163.pdf (retrieved 22 April 2010).

DIRIKX, A., Gelders, D., 2008: *Newspaper communication on global warming: Different approaches in the US and the EU?* In: Carvalho, A. (ed.): Communicating Climate Change: Discourses, Mediations and Perceptions. Universidade do Minho, Braga, Portugal, 98–109.

DISPENSA, J.M., Brulle, R.J., 2003: Media's social construction of environmental issues: focus on global warming: a comparative study. International Journal of Sociology and Social Policy 23 (10), 74–105.

DORAN, P.T., Kendall Zimmerman, M., 2009: Examining the Scientific Consensus on Climate Change. Eos Transactions, American Geophysical Union 90 (3), 22–23.

DOULTON, H., Brown, K., 2009: Ten years to prevent catastrophe? Discourses of climate change and international development in the UK press. Global Environmental Change 19, 191–202.

DOWLATABADI, H., 2007: On integration of policies for climate and global change. Mitigation and Adaptation Strategies for Global Change 12, 651–663.

DOWNS, A., 1957: *An Economic Theory of Democracy*. Harper Collins, New York, USA.

DOWNS, A., 1972: Up and down with ecology: the issue attention cycle. The Public Interest 28, 38–50.

DOYLE, G., 2002: *Media Ownership: The Economics and Politics of Convergence and Concentration in the UK and European Media*. Sage Publications, London, UK.

DUNLAP, R., McCright, A., 2010: Climate change denial: sources, actors and strategies. In: *Routledge Handbook of Climate Change and Society* [Lever-Tracy, C. (ed.)]. Routledge, London, UK.

EASTERLING, W.E., Hurd, B.H., Smith, J.B., 2004: *Coping with Global Climate Change: The Role of Adaptation in the United States*. Pew Center on Global Climate Change, Arlington, USA.

EIA (U.S. Energy Information Administration), 2010: Forecasts and Analysis. http://www.eia.doe.gov/oiaf/forecasting.html (retrieved 1 April 2010).

EIDGENÖSSISCHE ZOLLVERWALTUNG, 2009: *Analyse des schweizerischen Aussenhandels im Jahr 2008*. EZV, Bern, Switzerland. http://www.ezv.admin.ch/themen/00504/01530/02945/index.html?lang=de (retrieved 6 April 2010).

EPA (U.S. Environmental Protection Agency), 2009a: Mandatory Reporting of Greenhouse Gases Rule. http://www.epa.gov/climatechange/emissions/ghgrulemaking.html (retrieved 5 May 2010).

EPA (U.S. Environmental Protection Agency), 2009b: Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act. http://www.epa.gov/climatechange/endangerment.html (retrieved 1 May 2010).

EREAUT, G., Segnit, N., 2006: *Warm Words. How Are We Telling the Climate Story and Can We Tell it Better?* Institute for Public Policy Research Papers, IPPR, London, UK.

EUROPEAN COMMISSION, 2008: *Special Eurobarometer 300. Europeans' attitudes towards climate change: September 2008*. http://ec.europa.eu/public_opinion/archives/ebs/ebs_300_full_en.pdf (retrieved 13 March 2010).

EUROPEAN COMMISSION, 2009: *Special Eurobarometer. Europeans' attitudes towards climate change: November 2009*. http://ec.europa.eu/public_opinion/archives/ebs/ebs_322_en.pdf (retrieved 13 March 2010).

EVERS, M., Stampf, O., Traufetter, G., 2010: *Climate Catastrophe – A Superstorm for Global Warming Research*. In: Der Spiegel, 1 April. http://www.spiegel.de/international/world/0,1518,686697,00.html (retrieved 14 April 2010).

FDFA/FDEA (Federal Department of Foreign Affairs/Federal Department of Economic Affairs), 2009: *Bilateral agreements Switzerland–EU*. Integration Office FDFA/FDEA, Bern, Switzerland.

FIELD, C.B., Mortsch, L.D., Brklacich, M., Forbes, D.L., Kovacs, P., Patz, J.A., Running, S.W., Scott, M.J., 2007: North America. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Parry, M.L., Canziani, O.F., Palutikof,

J.P., van der Linden, P.J., Hanson C.E. (eds.)]. Cambridge University Press, Cambridge, UK, 617-652.

FOEN (Federal Office for the Environment [ed.]), 2007: *Environment Switzerland 2007*. FOEN, Bern / FSO, Neuchatel, Switzerland.

FOEN (Federal Office for the Environment [ed.]), 2009: *Switzerland's Fifth National Communication under the UNFCCC*. Second National Communication under the Kyoto Protocol to the UNFCCC. FOEN Climate Division, Bern, Switzerland.

FÖG (Forschungsbereich Öffentlichkeit und Gesellschaft), 2009: *Indikatoren. Agenden öffentlicher Aufmerksamkeit – Jahresagenda 2008*. http://www.foeg.uzh.ch/downloads/downloads/indikatoren.aspx (retrieved 9 April 2010).

FRANK, D.C., Esper, J., Raible, C.C., Büntgen, U., Trouet, V., Stocker, B., Joos, F., 2010: Ensemble reconstruction constraints on the global carbon cycle sensitivity to climate. Nature 463, 527–530.

FREUDENBURG, W.R., Muselli, V., 2010: Global warming estimates, media expectations, and the asymmetry of scientific challenge. Global Environmental Change (article in press), doi:10.1016/j.gloenvcha.2010.04.003.

FUNTOWICZ, S.O., Ravetz, J.R. 1990: *Uncertainty and Quality in Science for Policy*. Kluwer Academic Publishers, Dordrecht, The Netherlands.

G5 (Group of Five), 2009: G5 Declaration. http://www.g7.utoronto.ca/summit/2009laquila/2009-g5declaration.pdf (31 May 2010).

G8 (Group of Eight), 2007: G8 Heiligendamm Summit Declaration: Growth and responsibility in the world economy. http://www.g-8.de/Webs/G8/EN/G8Summit/SummitDocuments/summit-documents.html (retrieved 11 April 2010).

G8 (Group of Eight), 2008: G8 Hokkaido Toyako Summit Leaders Declaration. http://www.mofa.go.jp/policy/economy/summit/2008/doc/doc080714__en.html (retrieved 20 September 2009).

GALLUP, 2002: Voice of the People™ Survey. http://www.voice-of-the-people.net/ContentFiles/docs%5CVOP_Environmental_Results.pdf (retrieved 22 March 2010)

GALLUP, 2008: Voice of the People™ Survey - International Earth Day. http://extranet.gallup-international.com/uploads/internet/International%20Earth%20Day%202008.pdf (retrieved 22 March 2010).

GALLUP, 2009: Gallup Environment Poll. http://www.pollingreport.com/enviro.htm (retrieved 9 March 2010).

GALLUP, 2010: Environment Survey. http://www.gallup.com/poll/1615/Environment.aspx (retrieved 6 May 2010).

GALTUNG, J., Ruge, M., 1965: The structure of foreign news. Journal of Peace Research 2 (1), 64–90.

GANS, H., 1980: *Deciding What's News*. Vintage, New York, USA.

GAY, C., Estrada, F., 2010: Objective probabilities about future climate are a matter of opinion. Climatic Change 99, 27–46.

GERMANWATCH, 2009: *The Climate Change Performance Index – Results 2010*. http://www.germanwatch.org/ccpi (retrieved 25 April 2010)

GFS, 2007: Sorgenbarometer 2007. http://www.soziotrends.ch/pub/Sorgenbarometer_2007.pdf (retrieved 22 March 2010).

GFS, 2008: Sorgenbarometer 2008. http://www.soziotrends.ch/pub/Sorgenbarometer_2008.pdf (retrieved 22 March 2010).

GFS, 2009a: Angstbarometer 2009. http://www.gfs-zh.ch/?pid=236 (retrieved 22 March 2010).

GFS, 2009b: Sorgenbarometer 2009. http://www.soziotrends.ch/pub/Sorgenbarometer_2009.pdf (retrieved 22 March 2010).

GILLIAM, F.D., Iyengar, S., 2000: Prime suspects: the influence of local television news on the viewing public. American Journal of Political Science 44 (3), 560–573.

GLADWELL, M., 2000: *The Tipping Point: How Little Things Can Make a Big Difference*. Little Brown, New York, USA.

GLEICK ET AL., 2010: Climate Change and the Integrity of Science. Science 328 (5979), 689.

GLOBESCAN, 2006: 30-Country Poll Finds Worldwide Consensus that Climate Change is a Serious Problem. http://www.worldpublicopinion.org/pipa/articles/btenvironmentra/187.php (retrieved 11 April 2010).

GLOBESCAN, 2007: All Countries Need to Take Major Steps on Climate Change: Global Poll. http://www.globescan.com/news_archives/bbc_climate/ (retrieved 19 November 2009).

GORE, A., 2006: *An Inconvenient Truth*. Directed by Davis Guggenheim. Produced by Bender, L., Burns, S.Z., and L. Lennard. Paramount Classics and Participant Productions. Hollywood, USA.

GOUGH, C., Shackley, S., 2001: The respectable politics of climate change: the epistemic communities and NGOs. International Affairs 77, 329–345.

GRASSO, M., 2004: Climate change: the global public good. Working Papers No. 75, Department of Economics, University of Milano-Bicocca, Italy.

GRASSO, M., 2007: A normative ethical framework in climate change. Climatic Change 81 (3), 223–246.

GRIECO, J.M., 1988: Anarchy and the Limits of Cooperation: A Realist Critique of the Newest Liberal Institutionalism. International Organization 42 (3), 485–508.

GRUNDMANN, R., 2007: Climate change and knowledge politics. Environmental Politics 16 (3), 414–432.

GUTERL, F., 2010: *Iceberg Ahead*. In: Newsweek, 19 February. http://www.newsweek.com/id/233887 (retrieved 15 March 2010).

HAAS, P.M., 1992: Introduction: epistemic communities and international policy coordination. International Organization 46 (1), 1–35.

HAGERMAN, S., Dowlatabadi, H., Chan, K.M.A., Satterfield, T., 2010: Integrative propositions for adapting conservation policy to the impacts of climate change. Global Environmental Change 20 (2), 351–362.

HANSEN, J., M. Sato, R. Ruedy, P. Kharecha, A. Lacis, R.L. Miller, L. Nazarenko, K. Lo, G.A. Schmidt, G. Russell, I. Aleinov, S. Bauer, E. Baum, B. Cairns, V. Canuto, M. Chandler, Y. Cheng, A. Cohen, A. Del Genio, G. Faluvegi, E. Fleming, A. Friend, T. Hall, C. Jackman, J. Jonas, M. Kelley, N.Y. Kiang, D. Koch, G. Labow, J. Lerner, S. Menon, T. Novakov, V. Oinas, Ja. Perlwitz, Ju. Perlwitz, D. Rind, A. Romanou, R. Schmunk, D. Shindell, P. Stone, S. Sun, D. Streets, N. Tausnev, D. Thresher, N. Unger, M. Yao, and S. Zhang, 2007: Dangerous human-made interference with climate: A GISS modelE study. Atmospheric Chemistry and Physics 7, 2287–2312.

HARDIN, G., 1968: The Tragedy of the Commons. Science 162 (3859), 1243–1248.

HARRIS, P.G., 2009: Beyond Bush: Environmental politics and prospects for US climate policy. Energy Policy 37 (3), 966–971.

HARVEY, F., 2009: *Recession results in steep fall in emissions*. In: The Financial Times, 20 September. http://www.ft.com/cms/s/0/a0f0331c-a611-11de-8c92-00144feabdc0.html (retrieved 9 December 2009).

HENDRY, C., Harborne, P., Brown, JAMES Brown!, 2010: So what do innovating companies really get from publicly funded demonstration projects and trials? Innovation lessons from solar photovoltaics and wind. Energy Policy 38 (8), 4507–4519.

HENRY, A.D., 2000: Public Perceptions of Global Warming. Human Ecology Review 7 (1), 25–30.

HERMAN, E., Chomsky, N., 1988: *Manufacturing consent: the political economy of the mass media*. Pantheon Books, Toronto, Canada.

HICKMAN, L., Randerson, J., 2009: *Climate sceptics claim leaked emails are evidence of collusion among scientists*. In: The Guardian, 20 November. http://www.guardian.co.uk/environment/2009/nov/20/climate-sceptics-hackers-leaked-emails (retrieved 7 January 2010).

HILLERBRAND, R., Ghil, M., 2008: Anthropogenic climate change: Scientific uncertainties and moral dilemmas. Physica D 237, 2132–2138.

HOF, A.F., de Bruin, K.C., Dellink, R.B., den Elzen, M.G.J., van Vuuren, D.P., 2009: The effect of different mitigation strategies on international financing of adaptation. Environmental science & policy 12 (7), 832–843.

HOGGAN, J., Littlemore, R., 2009: *Climate Cover-Up – The Crusade to Deny Global Warming*. Greystone Books, Vancouver, Canada.

HULME, M., 2006: *Chaotic world of climate truth*. BBC News, 4 November. http://news.bbc.co.uk/2/hi/science/nature/6115644.stm (retrieved 26 April 2010).

HULME, M., Neufeldt, H., Colyer, H., Ritchie, A. (eds.), 2009: *Adaptation and Mitigation Strategies: Supporting European Climate Policy*. The Final Report from the ADAM Project. Revised June 2009. Tyndall Centre for Climate Change Research, University of East Anglia, Norwich, UK.

HUNTINGFORD, C., Lowe, J.A., Booth, B.B.B., Jones, C.D., Harris G.R., Gohar, L.K., Meir, P., 2009: Contributions of carbon cycle uncertainty to future climate projection spread. Tellus B 61 (2), 355–360.

IEA (International Energy Agency), 2010: *Addressing Climate Change*. Policies and Measures Database. http://www.iea.org/Textbase/pm/index_clim.html (retrieved 30 April 2010).

IMF (International Monetary Fund), 2010: World Economic Outlook Database, April 2010. http://www.imf.org/external/pubs/ft/weo/2010/01/weodata/index.aspx (retrieved 6 May 2010).

INGOLD, K.M., 2009: Understanding Advocacy Coalitions, Policy Learning and Brokerage: A combination of Social Network and Multicriteria Analysis in Swiss Climate Policy. http://www.psa.ac.uk/2009/pps/Ingold.pdf (retrieved 23 April 2010).

IPCC, 1999: Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports. http://www.ipcc.ch/pdf/ipcc-principles/ipcc-principles-appendix-a.pdf (retrieved 7 January 2010).

IPCC, 2000: IPCC Special Report on Emissions Scenarios [Nakicenovic, N., Swart, R. (eds.)]. Cambridge University Press, Cambridge, UK, 570 pp.

IPCC, 2001a: Summary for Policymakers. In: *Climate Change 2001: The Scientific Basis.* Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, UK and New York, USA.

IPCC, 2001b: *Climate Change 2001: The Scientific Basis*. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, UK and New York, USA, 881 pp.

IPCC, 2007a: Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK and New York, USA.

IPCC, 2007b: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK and New York, USA, 996 pp.

IPCC, 2007c: Technical Summary. In: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK and New York, USA.

IPCC, 2007d: *Climate Change 2007: Synthesis Report*. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

IPCC, 2007e: *Climate Change 2007: Mitigation*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds.)]. Cambridge University Press, Cambridge, UK and New York, USA, 896 pp.

IPCC, 2007f: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK and New York, USA, 976 pp.

IPCC, 2009: AR5 Schedule, Outlines and Relevant Guidance Documents. http://www.ipcc.ch/activities/activities.htm (retrieved 17 January 2010).

JACQUES, P.J., Dunlap, R.E., Freeman, M., 2008: The organization of denial: conservative think tanks and environmental skepticism. Environmental Politics 17, 349–385.

JEVREJEVA, S., Grinsted, A., Moore, J.C., 2009: Anthropogenic forcing dominates sea level rise since 1850. Geophysical Research Letters 36, L20706.

JOBBER, R., Sieminski, A., 2008: *US Climate Legislation – A Brief History*. Global Markets Research Report. Deutsche Bank AG, London, UK. http://www.dbresearch.com/prod/cib_internet_EN-prod/prod0227484.pdf (retrieved 21 November 2009).

KANDLIKAR, M., Risbey, J., Dessai, S., 2005: Representing and communicating deep uncertainty in climate-change assessments. C. R. Geoscience 337, 443–455.

KARL, T.R., Melillo, J.M., Peterson, T.C. (eds.), 2009: *Global Climate Change Impacts in the United States*. Cambridge University Press, New York, USA.

KAUL, I., Conceição, P., Le Gouven, K., Mendoza, R.U., 2003: *Providing Global Public Goods. Managing Globalization*. Oxford University Press, Oxford, UK.

KAUL, I., Mendoza, R.U., 2003: Advancing the Concept of Global Public Goods. In: *Providing Global Public Goods: Managing Globalization* [Kaul, I., Conceição, P. Le Goulven, K., Mendoza, R.U., (eds.)]. Oxford University Press, New York, USA.

KELLER, K., Hall, M., Kim, S.-R., Bradford, D.F., Oppenheimer, M., 2005: Avoiding Dangerous Anthropogenic Interference with the Climate System. Climatic Change 73, 227–238.

KEOHANE, R.O., 1980: The Theory of Hegemonic Stability and Changes in International Regimes, 1967 – 1977. In: *Change in the International System* [George, A.L., Holsti, O.R., Siverson R.M. (eds.)]. Westview Press, Boulder, USA.

KIOUSIS, S., 2004: Explicating media salience: a factor analysis of *New York Times* issue coverage during the 2000 U.S. presidential election. Journal of Communication 54 (1), 71–87.

KLEIN, R.J.T., Schipper, E.L.F., Dessai, S., 2005: Integrating mitigation and adaptation into climate and development policy: three research questions. Environmental Science & Policy 8, 579–588.

KLIMA-INITIATIVE, 2010: Klima-Initiative – ein Kompromiss. http://www.klimainitiative ja.ch/Initiative.172.0.html (retrieved 27 April 2010)

KLINSKY, S., Dowlatabadi, H., 2009: Conceptualizations of justice in climate policy. Climate Policy 9, 88–108.

KNABB, R.D., Rhome, J.R., Brown, D.P., 2005: *Tropical Cyclone Report: Hurricane Katrina: 23–30 August 2005*. http://www.nhc.noaa.gov/pdf/TCR-AL122005_Katrina.pdf (retrieved 28 April 2010).

KRASNER, S.D., 1982: Structural causes and regime consequences: regimes as intervening variables. International Organization 36 (2), 185–205.

KRIPPENDORFF, K., 2004: *Content analysis: an introduction to its methodology* (2nd edition). Sage Publications, Inc., Thousand Oaks, USA.

LADLE, R., Jepson, P., Whittaker, R.J., 2005: Scientists and the Media: The Struggle for Legitimacy in Climate Change and Conservation Science. Interdisciplinary Science Review 30, 231–240.

LANGE, A., Löschel, A., Vogt, C., Ziegler, A., 2010: On the self-interested use of equity in international climate negotiations. European Economic Review 54 (3), 359–375.

LARSON, S.B., Yeager, D.S., Krosnick, J.A., Tompson, T., 2010: Accurately Measuring the American Public's Issue Priorities: Tweaking the Most Important Problem Question Reveals More Concern About Global Warming and the Environment. Working Paper May 2010 (unpublished). Stanford University, USA.

LAUKKONEN, J., Blanco, P.K., Lenhart, J., Keiner, M., Cavric, B., Kinuthia-Njenga, C., 2009: Combining climate change adaptation and mitigation measures at the local level, Habitat International 33 (3), 287–292.

LAWRENCE, D.M., Slater, A.G., Tomas, R.A., Holland, M.M., Deser, D., 2008: Accelerated Arctic land warming and permafrost degradation during rapid sea ice loss. Geophysical Research Letters 35, L11506.

LE QUÉRÉ, C., Raupach, M.R., Canadell, J.G., Marland, G., Bopp, L., Ciais, P., Conway, T.J., Doney, S.C., Feely, R.A., Foster, P., Friedlingstein, P., Gurney, K., Houghton, R.A., House, J.I., Huntingford, C., Levy, P.E., Lomas, M.R., Majkut, J., Metzl, N., Ometto, J.P., Peters, G.P., Prentice, I.C., Randerson, J.T., Running, S.W., Sarmiento, J.L., Schuster, U., Sitch, S., Takahashi, T., Viovy, N., van der Werf, G.R., Woodward, F.I., 2009: Trends in the sources and sinks of carbon dioxide. Nature Geoscience 2, 831–836.

LE TREUT, H., Gastineau, G., Li, L., 2008: Uncertainties attached to global or local climate changes. Comptes Rendus Geosciences 340, 584–590.

LEAN, J.L., Rind, D.H., 2008: How natural and anthropogenic influences alter global and regional surface temperatures: 1889 to 2006. Geophysical Research Letters 35, L18701.

LEISEROWITZ, A., 2006: Climate change risk perception and policy preferences: The role of affect, imagery, and values. Climatic Change 77, 45–72.

LEISEROWITZ, A., 2007a: *Public Perception, Opinion and Understanding of Climate Change – Current Patterns, Trends and Limitations*. Thematic Paper 31, Human Development Report Office. http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/leiserowitz_anthony.pdf (retrieved 24 September 2009).

LEISEROWITZ, A., 2007b: American Opinions on Global Warming. A Yale University / Gallup / ClearVision Institute Poll. http://environment.yale.edu/news/5305 (retrieved 22 March 2010).

LEISEROWITZ, A., Maibachand, E., Roser-Renouf, C., 2010: Climate change in the American Mind: Americans' global warming beliefs and attitudes in January 2010. Yale Project on Climate Change, New Haven, USA. http://environment.yale.edu/uploads/AmericansGlobalWarmingBeliefs2010.pdf (retrieved 5 May 2010).

LENTON, T.M., Held, H., Kriegler, E., Hall, J.W., Lucht, W., Rahmstorf, S., Schellnhuber, H.J., 2008: Tipping elements in the Earth's climate system. Proceedings of the National Academy of Sciences 105 (6), 1786–1793.

LEVY, D.L., 2005: Business and the Evolution of the Climate Regime: The Dynamics of Corporate Strategies. In: *The Business of Global Environmental Governance* [Levy D.L., Newell, P.J. (eds.)]. MIT Press, Cambridge, USA, pp. 73–105.

LITTLE, R., 2008: International regimes. In: *The Globalization of World Politics – An introduction to international relations* (4th edition) [Baylis, J., Smith, S., Owens, P. (eds.)]. Oxford University Press, New York, USA, pp. 296–310.

LITZ, F.T., 2008: *Toward a Constructive Dialogue on Federal and State Roles in U.S. Climate Policy*. Pew Center on Global Climate Change, Arlington, USA.

LIU, X., Vedlitz, A., Alston, L., 2008: Regional news portrayals of global warming and climate change. Environmental Science & Policy 11, 379–393.

LO, S.-F., 2010: The differing capabilities to respond to the challenge of climate change across Annex Parties under the Kyoto Protocol. Environmental Science & Policy 13 (1), 42–54.

LOARIE, S.R., Duffy, P.B., Hamilton, H., Asner, G.P., Field, C.B., Ackerly, D.D., 2009: The velocity of climate change. Nature 462, 1052–1055.

LOMBORG, B., 2007: *Cool It: The sceptical environmentalist's guide to global warming*. Cyan, London, UK.

LONNGREN, K.E., Bai E.-W., 2008: On the global warming problem due to carbon dioxide. Energy Policy 36, 1567–1568.

LORENZONI, I., Pidgeon, N.F., 2006: Public views on climate change: European and USA perspectives. Climatic Change 77, 73–95.

LOULERGUE, L., Schilt A., Spahni R., Masson-Delmotte V., Blunier T., Lemieux B., Barnola J.–M., Raynaud D., Stocker T.F., Chappellaz J., 2008: Orbital and millennial-scale features of atmospheric CH4 over the past 800,000 years. Nature 453, 383–386.

LOVELOCK, J., 2006: *The Revenge of Gaia. Why the Earth Is Fighting Back - and How We Can still Save Humanity*. Penguin Books Ltd., London, UK.

LOWE, J.A., Huntingford, C., Raper, S.C.B., Jones, C.D., Liddicoat, S.K., Gohar, L.K., 2009: How difficult is it to recover from dangerous levels of global warming? Environmental Research Letters 4, 014012.

LUTERBACHER, U., Sprinz, D.F., 2001: Problems of Global Environmental Cooperation. In: *International Relations and Global Climate Change* [Luterbacher, U., Sprinz, D.F. (eds.)]. The MIT Press, Cambridge, Massachusetts, USA, 1–22.

LÜTHI, D., Le Floch M., Bereiter B., Blunier T., Barnola J.–M., Siegenthaler U., Raynaud D., Jouzel J., Fischer H., Kawamura K., Stocker T.F., 2008: High-resolution carbon dioxide concentration record 650,000–800,000 years before present. Nature 453, 379–382.

LUTSEY, N., Sperling, D., 2008: America's bottom-up climate change mitigation policy. Energy Policy 36, 673–685.

MACINTOSH, A., 2010: Keeping warming within the 2 °C limit after Copenhagen. Energy Policy 38 (6), 2964–2975.

MANN, M.E., Bradley, R.S., Hughes, M.K., 1998: Global-scale temperature patterns and climate forcing over the past six centuries. Nature 392, 779–787.

MANN, M.E., Zhang, Z., Hughes, M.K., Bradley, R.S., Miller, S.K., Rutherford, S., Ni. F., 2008: Proxy-based reconstructions of hemispheric and global surface temperature variations over the past two millennia. Proceedings of the National Academy of Sciences 105, 13252–13257.

MANSFIELD, E.D., Milner, H.V., Rosendorff, P.B., 2002: Why Democracies Cooperate More: Electoral Control and International Trade Agreements. International Organization 56 (3), 477–513.

MAZUR, A., 2009: American Generation of Environmental Warnings - Avian Influenza and Global Warming. Human Ecology Review 16 (1), 17–26.

MAZUR, A., Lee, J., 1993: Sounding the global alarm: environmental issues in the US national news. Social Studies of Science 23, 681–720.

MCCHESNEY, R.W., 1999: *Rich media, poor democracy: communication politics in dubious times*. University of Illinois Press, Urbana, USA.

MCCOMBS, M.E., Shaw, D.L., 1972: The agenda-setting function of mass media. Public Opinion Quarterly 36, 176–187.

MCCRIGHT, A.M., Dunlap, R.E., 2000: Challenging Global Warming as a Social Problem: An Analysis of the Conservative Movement's Counter-Claims. Social Problems 47, 499–522.

MCCRIGHT, A.M., Dunlap, R.E., 2003: Defeating Kyoto: the conservative movement's impact on U.S. climate change policy. Social Problems 50 (3), 348–373.

MCGRAW, K.M., Ling, C., 2003: Media priming of presidential and group evaluations. Political Communication 20 (1), 23–40.

MCGUIRE, M., Olson, M., 1996: The economics of autocracy and majority rule: the invisible hand and the use of force. Journal of Economic Literature 34 (2), 72–96.

MCKIE, D., Galloway, C., 2007: Climate change after denial: Global reach, global responsibilities, and public relations. Public Relations Review 33, 368–376.

MCMANUS, P.A., 2000: Beyond Kyoto? Media representation of an environmental issue. Australian Geographical Studies 38 (3), 306–319.

MEDIEN-DATEN VERLAG, 2009: https://www.mediadaten-online.com/mediadaten/index.do (retrieved 3 May 2010).

MEEHL, G.A., Washington, W.M., Collins, W.D., Arblaster, J.M., Hu, A., Buja, L.E., Strand, W.G., Teng, H., 2005: How much more global warming and sea level rise? Science 307, 1769–1772.

MEINSHAUSEN, M., Hare, B., 2008: Missing the turn towards a low-emission path? Climatic Change 91, 233–236.

MEINSHAUSEN, M., Meinshausen, N., Hare, W., Raper, S.C.B., Frieler, K., Knutti, R., Frame, D.J., Allen, M.R., 2009: Greenhouse-gas emission targets for limiting global warming to 2 °C. Nature 458, 1158–1162.

MENZ, F.C., 2005: Green electricity policies in the United States: case study. Energy Policy 33 (18), 2398–2410.

MICHAELOWA, A., 2001: *Mitigation versus adaptation - The political economy of competition between climate policy strategies and the consequences for developing countries*. HWWA Discussion Paper 153, Hamburg Institute of International Economics, Hamburg, Germany, 34 pp.

MILLENIUM ECOSYSTEM ASSESSMENT, 2005: *Ecosystems and Human Well-Being: Synthesis*. Island Press, Washington D.C., USA.

MOSER, S., Dilling, L., 2004: Making Climate Hot: Communicating the Urgency and Challenge of Global Climate Change. Environment 46 (10), 32-46.

MOSS, R.H., 2007: Improving information for managing an uncertain future climate. Global Environmental Change, 17, 4–7.

MOSS, R.H., Schneider, S.H., 2000: Uncertainties in the IPCC TAR: Recommendations to lead authors for more consistent assessment and reporting. In: *Guidance Papers on the Cross Cutting Issues of the Third Assessment Report of the IPCC* [Pachauri, R., Taniguchi, T., Tanaka, K. (eds.)], World Meteorological Organization, Geneva, 33–51.

NATIONAL ACADEMY OF SCIENCES, 2001: *Climate Change Science: An Analysis of Some Key Questions*. National Academy Press, Washington D.C., USA, 42 pp.

NEUMAYER, E., 2002: Do Democracies Exhibit Stronger International Environmental Commitment? A Cross-Country Analysis. Journal of Peace Research 39 (2), 139–164.

NEVERLA, I., 2008: *The IPCC-reports 1990-2007 in the media. A case-study on the dialectics between journalism and natural sciences*. Paper presented in the panel “A global dialogue on climate change?” to the ICA-Conference “Global Communication and Social Change”, Montreal, 22–26 May 2008. http://www.wiso.uni-hamburg.de/fileadmin/sowi/journalistik/PDFs/IPCC-Reports-1990-2007.pdf (retrieved 4 May 2010).

NEWELL, P., Paterson, M., 1998: A climate for business: global warming, the State and capital. Review of International Political Economy 5, 679–703.

NIELSEN, 2007: Global Nielsen survey: consumers look to governments to act on climate change. http://www.eci.ox.ac.uk/news/press-releases/070605pr-nielsensurvey.pdf (retrieved 11 April 2010).

NIELSEN, 2009: In der Krise sinkt der Wille zum Umweltschutz. 15 Dezember 2009. http://ch.de.nielsen.com/site/NielsenPressemitteilung-15.12.09-Klimawandel.shtml (retrieved 28 April 2010).

NISBET, M.C., Myers, T., 2007: The Polls – Trends. Twenty Years of Public Opinion About Global Warming. Public Opinion Quarterly 71 (3), 444–470.

NOAA (National Oceanic and Atmospheric Administration), 2009: The NOAA Annual Greenhouse Gas Index (AGGI). http://www.esrl.noaa.gov/gmd/aggi/ (retrieved 1 October 2009).

NOAA (National Oceanic and Atmospheric Administration), 2010: Warmest April Global Temperature on Record. http://www.noaanews.noaa.gov/stories2010/20100517_globalstats.html (retrieved 26 May 2010).

O'HARA, P.A., 2009: Political economy of climate change, ecological destruction and uneven development. Ecological Economics 69, 223–234.

OBERHEITMANN, A., 2010: A new post-Kyoto climate regime based on per-capita cumulative CO2-emission rights – rationale, architecture and quantitative assessment of the implication for the CO2-emissions from China, India and the Annex-I countries by 2050. Mitigation and Adaptation Strategies for Global Change 15 (2), 137–168.

OBERTHÜR S., Ott, H.E., 1999: *The Kyoto Protocol – International Climate Policy for the 21st Century*. Springer Verlag, Berlin, Germany, 359 pp.

OCCC (Advisory Body on Climate Change), 2007: *Climate Change and Switzerland 2050 – Expected Impacts on Environment, Society and Economy*. OcCC / ProClim–, Bern, Switzerland.

OIKONOMOU, V., Jepma, C., 2008: A framework on interactions of climate and energy policy instruments. Mitigation and Adaptation Strategies for Global Change 13 (2), 131–156.

OLSON, M., 1965: *The Logic of Collective Action*. Harvard University Press, Cambridge, Massachusetts, USA.

OLSON, M., 1993: Dictatorship, democracy and development. American Political Science Review 87 (3), 567–576.

ORESKES, N., 2004: Science and public policy: what's proof got to do with it? Environmental Science and Policy 7, 369–383.

ORESKES, N., 2005: Beyond the ivory tower: the scientific consensus on climate change. Science 306 (5702), 1686.

OSTROM, E., Burger, J., Field, C.B., Norgaard, R.B., Policansky, D., 1999: Revisiting the commons: local lessons, global challenges. Science 284, 278–282.

PAAVOLA, J., Adger, W.N., 2006: Fair adaptation to climate change. Ecological Economics 56 (4), 594–609.

PAHLE, M., 2010: Germany's dash for coal: Exploring drivers and factors. Energy Policy 38 (7), 3431–3442.

PARRY, M., 2009: Closing the loop between mitigation, impacts and adaptation. An editorial essay. Climatic Change 96, 23–27.

PARRY, M., Lowe, J., Hanson, C., 2009: Overshoot, adapt and recover. Nature 458, 1102–1103.

PATT, A., 2007: Assessing model-based and conflict-based uncertainty. Global Environmental Change 17, 37–46.

PAYNE, R.A., 1995: Freedom and the Environment. Journal of Democracy 6 (3), 41–55.

PERREZ, F., 2009: Switzerland's International Environmental Policy – An Active, Reliable and Constructive Partner. In: *environment* 04/09 [Federal Office for the Environment (ed.)]. FOEN, Communications Division, Bern, Switzerland.

PEW (Project for Excellence in Journalism), 2009a: *The State of the News Media 2009. An Annual Report on American Journalism*. http://www.stateofthemedia.org/2009 (retrieved 9 April 2010).

PEW (Center on Global Climate Change), 2009b: *Climate Change Mitigation Measures in the European Union*. International Brief 3, December 2009. http://www.pewclimate.org/brief/international/mitigation-measures-european-union (retrieved 17 April 2010).

PIELKE, R.A., 1998: Rethinking the role of adaptation in climate policy. Global Environmental Change 8 (2), 159–170.

PIELKE, R.A., 2004: When scientists politicize science: making sense of controversy over *The Skeptical Environmentalist*. Environmental Science and Policy 7, 405–417.

PIELKE, R.A., 2005: Misdefining "climate change": consequences for science and action. Environmental Science and Policy 8, 548–561.

PIELKE, R.A., 2007: *The Honest Broker: Making Sense of Science in Policy and Politics*. Cambridge University Press, Cambridge UK.

PIELKE, R.A., Prins, G., Rayner, S., Sarewitz, D., 2007: Lifting the taboo on adaptation. Nature 445, 597–598.

PIK (Potsdam Institute for Climate Impact Research), 2006: Potsdam climate expert Hans Joachim Schellnhuber becomes Chief Government Advisor. http://www.pik-potsdam.de/news/in-short/archive/2006/ (retrieved 21 April 2010).

PITTEL, K., Rübbelke, D.T.G., 2008: Climate policy and ancillary benefits: A survey and integration into the modelling of international negotiations on climate change. Ecological Economics 68 (1-2), 210–220.

POST, S., 2008: *Klimakatastrophe oder Katastrophenklima? - Die Berichterstattung über den Klimawandel aus Sicht der Klimaforscher*. Verlag Reinhard Fischer, München, Germany.

PRATHER, M.J., Hsu J., 2008: NF3, the greenhouse gas missing from Kyoto. Geophysical Research Letters 35, L12810.

PRITTWITZ, V.v., 1990: *Das Katastrophenparadox – Elemente einer Theorie der Umweltpolitik*. Leske and Budrich, Opladen, Germany.

PUTNAM, R.D., 1988: Diplomacy and Domestic Politics: The Logic of Two-Level Games. International Organization 42 (3), 427–460.

RABE, B.G., 2002: Greenhouse and statehouse. *The evolving State Government role in climate change*. Pew Center Report, Pew Center on Global Climate Change, Arlington, USA. http://www.pewclimate.org/docUploads/statesgreenhouse.pdf (retrieved 5 May 2010).

RAMANATHAN, V., Feng Y., 2008: On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead. Proceedings of the National Academy of Sciences 105 (38), 14245–14250.

RAUSTIALA, K., 1997: States, NGOs, and international environmental institutions. International Studies Quarterly 42 (4), 719–740.

RAUSTIALA, K., 2001: Nonstate Actors in the Global Climate Regime. In: *International Relations and Global Climate Change* [Luterbacher, U., Sprinz, D.F. (eds.)]. The MIT Press, Cambridge, Massachusetts, USA, pp. 95–117.

RAVETZ, J.R., 2006: Post-Normal Science and the complexity of transitions towards sustainability. Ecological Complexity 3 (4), 275–284.

RISBEY, J.S., 2008: The New Climate Discourse: Alarmist or Alarming? Global Environmental Change 18, 26–37.

ROCKSTRÖM, J., W. Steffen, K. Noone, Å. Persson, F. S. Chapin, III, E. Lambin, T. M. Lenton, M. Scheffer, C. Folke, H. Schellnhuber, B. Nykvist, C. A. De Wit, T. Hughes, S. van der Leeuw, H. Rodhe, S. Sörlin, P. K. Snyder, R. Costanza, U. Svedin, M. Falkenmark, L. Karlberg, R. W. Corell, V. J. Fabry, J. Hansen, B. Walker, D. Liverman, K. Richardson, P. Crutzen, and J. Foley., 2009: Planetary boundaries: exploring the safe operating space for humanity. Ecology and Society 14 (2), 32 (online). http://www.ecologyandsociety.org/vol14/iss2/art32/ (retrieved 13 January 2010).

ROGELJ, J., Nabel, J., Chen, C., Hare, W., Markmann, K., Meinshausen, M., Schaeffer, M., Macey, K., Höhne, N., 2010: Copenhagen Accord pledges are paltry. Nature 464, 1126–1128.

ROMÁN, M., Carson, M., 2009: *Sea Change: US Climate Policy Prospects Under the Obama Administration*. Stockholm Environmental Institute, Commission on Sustainable Development, Stockholm, Sweden.

ROSENZWEIG, C., Karoly D., Vicarelli M., Neofotis P., Wu Q., Casassa G., Menzel A., Root T.L., Estrella N., Seguin B., Tryjanowski P., Liu C., Rawlins S., Imeson A., 2008: Attributing physical and biological impacts to anthropogenic climate change. Nature 435, 353–358.

ROWLANDS, I.H., 1995: Explaining national climate change policies. Global Environmental Change 5 (3), 235–249.

ROWLANDS, I.H., 2001: Classical Theories of International Relations. In: *International Relations and Global Climate Change* [Luterbacher, U., Sprinz, D.F. (eds.)]. The MIT Press, Cambridge, Massachusetts, USA, 43–65.

RUSSILL, C., Nyssa, Z., 2009: The tipping point trend in climate change communication. Global Environmental Change 19, 336–344.

SAMPEI, Y., Aoyagi-Usui, M., 2009: Mass-media coverage, its influence on public awareness of climate-change issues, and implications for Japan's national campaign to reduce greenhouse gas emissions. Global Environmental Change 19, 203–212.

SAMUELSON, P.A., 1954: The Pure Theory of Public Expenditure. The Review of Economics and Statistics 36 (4), 387–389.

SANDMO, A., 2003: International Aspects of Public Goods Provision. In: *Providing Global Public Goods – Managing Globalization* [Kaul, I., Conceição, P., Le Gouven, K., Mendoz, R.U., (eds.)]. Oxford University Press, Oxford, UK.

SAREWITZ, D., 2004: How science makes environmental controversies worse. Environmental Science and Policy 7, 385–403.

SBSTA (Subsidiary Body for Scientific and Technological Advice), 2005: Decision 2/CP.11. Five-year programme of work of the Subsidiary Body for Scientific and Technological Advice on impacts, vulnerability and adaptation to climate change. http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/decision_2cp11.pdf (retrieved 14 April 2010).

SCHÄFER, W., 2009: Some Talk, No Action (Yet): Interdependence, Domestic Interests and Hierarchical EU Governance in Climate Policy. Swiss Political Science Review 15 (4), 683–713.

SCHELLNHUBER, H.J., 2008: Global warming: Stop worrying, start panicking? Proceedings of the National Academy of Sciences 105 (38), 14239–14240.

SCHENK, N.J., Lensink, S.M., 2007: Communicating uncertainty in the IPCC's greenhouse gas emission scenarios. Climatic Change 82, 239–308.

SCHENKEL, W., 2000: From Clean Air to Climate Policy in the Netherlands and Switzerland: How Two Small States Deal with a Global Problem. Swiss Political Science Review 6 (1), 159–184.

SCHNEIDER, S.H., 2004: Abrupt non-linear climate change, irreversibility and surprise. Global Environmental Change 14, 245–258.

SCHNEIDER, S.H., 2009: The worst-case scenario. Nature 458, 1104–1105.

SCHOENFELD, A.C., Meier, R.F., Griffin, R.J., 1979: Constructing a social problem: the press and the environment. Social Problems 271, 38–61.

SCHREURS, M.A., 2002: *Environmental Politics in Japan, Germany, and the United States*. Cambridge University Press, UK.

SCHREURS, M.A., 2003: Divergent paths – environmental policy in Germany, the United States and Japan. Environment 45 (8), 8–17.

SCIENTIFIC EXPERT GROUP, 2007*: Confronting Climate Change: Avoiding the Unmanageable and Managing the Unavoidable*. Report prepared for the United Nations Commission on Sustainable Development [Bierbaum, R.M., Holdren, J.P., MacCracken, M.C., Moss, R.H., Raven, P.H. (eds.)]. Sigma Xi, Research Triangle Park, NC, and United Nations Foundation, Washington, USA.

SHEEHAN, P., Jones, R.N., Jolley, A., Preston, B.L., Clarke, M., Durack, P.J., Islam, S.M.N., Whetton, P.H., 2008: Climate change and the new world economy: Implications for the nature and timing of policy responses. Global Environmental Change 18, 380–396.

SHOGREN, J., Toman, M., 2000: *Climate Change Policy*. Resources for the Future, Washington D.C., USA.

SHRESTHA, R.M., Pradhan, S., 2010: Co-benefits of CO2 emission reduction in a developing country. Energy Policy 38 (5), 2586–2597.

SIEBENHÜNER, B., 2003: The changing role of nation states - the case of the IPCC. Global Environmental Change 13, 113–123.

SKJAERSETH, J.B., Wettestad, J., 2010: Making the EU Emissions Trading System: The European Commission as an entrepreneurial epistemic leader. Global Environmental Change 20 (2), 314-321.

SKODVIN, T., 2010: “Pivotal politics” in US energy and climate legislation. Energy Policy 38 (8), 4214–4223.

SMIT, B., Pilifosova, B., 2001: Adaptation to climate change in the context of sustainable development and equity. In: *Climate Change 2001: Impacts, Adaptation and Vulnerability*. [McCarthy, J.J., Canziani, O.F., Leary, N.A., Dokken, D.J., White, K.S. (eds.)]. Cambridge University Press, Cambridge, pp. 892–912.

SMITH, J., 2005: Dangerous News: Media Decision Making about Climate Change Risk. Risk Analysis 25 (6), 1471–1481.

SMITH, J.B., Schneider, S.H., Oppenheimer, M., Yohe, G.W., Hare, w., Mastrandrea, M.D., Patwardhan, A., Burton, I., Corfee-Morlot, J., Magadza, C.H.D., Füssel, H.-M., Pittock, A.B., Rahman, A., Suarez, A., van Ypersele, J.-P., 2009: Assessing dangerous climate change through an update of the Intergovernmental Panel on Climate Change (IPCC) ‘‘reasons for concern’’. Proceedings of the National Academy of Sciences 106 (11), 4133–4137.

SNIDAL, D., 1991a: International Cooperation among relative Gains Maximizers. International Studies Quarterly 35, 387–402.

SNIDAL, D., 1991b: Relative Gains and the Pattern of International Cooperation. American Political Science Review 85, 701–727.

SOLOMON, S, Plattner, G.-K., Knutti, R, Friedlingstein, P., 2009: Irreversible climate change due to carbon dioxide emissions. Proceedings of the National Academy of Sciences 106, 1704–1709.

SOROKA, S.N., 2003: Media, public opinion, and foreign policy. Harvard International Journal of Press/Politics 8 (1), 27–48.

SOVACOOL, B.K., Brown, M.A., 2009: Scaling the policy response to climate change. Policy and Society 27, 317–328.

SPRINZ, D.F., Luterbacher, U., 1996: *International Relations and Global Climate Change*. PIK Report No 21 [Sprinz, D.F., Luterbacher, U. (eds.)]. Potsdam Institute for Climate Impact Research, Potsdam, Germany.

SPRINZ, D.F., Weiß, M., 2001: Domestic Politics and Global Climate Policy. In: *International Relations and Global Climate Change* [Luterbacher, U., Sprinz, D.F. (eds.)]. The MIT Press, Cambridge, Massachusetts, USA, pp. 67–94.

STAMM, K.R., Clark, F., Reynolds Eblacas, P., 2000: Mass communication and public understanding of environmental problems: the case of global warming. Public Understanding of Science 9 (3), 219–237.

STARR, P., 2004: *The Creation of the Media: Political Origins of Modern Communications*. Basic Books, New York, USA.

STERN, N., 2007: Written Testimony to the U.S. Senate Committee on Energy and Natural Resources. Stern Review of the Economics of Climate Change. 110th Congress, 1st session, February 13, 2007.

STEWART, R.B., Wiener, J.B., 2003: *Reconstructing Climate Policy: Beyond Kyoto*. AEI Press, Washington D.C., USA.

SUDHAKARA REDDY, B., Assenza, G.B., 2009: The great climate debate. Energy Policy 37 (8), 2997–3008.

TANS, P., Conway, T., 2009: NOAA/ESRL – Global Trends in Atmospheric Carbon Dioxide. www.esrl.noaa.gov/gmd/ccgg/trends/ (retrieved 1 October 2009).

THE ROYAL SOCIETY, 2009: *Geoengineering the climate: science, governance and uncertainty*. The Royal Society, London, UK.

TOMASSINI, L., Knutti, R., Plattner, G.-P., van Vuuren, D.P., Stocker, T.F., Howarth, H.B., Borsuk, M.E., 2010: Uncertainty and risk in climate projections for the 21st century: comparing mitigation to non-intervention scenarios. Climatic Change, Published online: 9 January, 2010, doi:10.1007/s10584-009-9763-3.

TRUMBO, C.W., 1996: Constructing climate change: claims and frames in US news coverage of an environmental issue. Public Understanding of Science 5, 269–283.

TRUMBO, C.W., Shanahan, J., 2000: Social research on climate change: where we have been, where we are, and where we might go. Public Understanding of Science 9, 199–204.

UNEP, 2009a: *Climate Change Science Compendium 2009*. UNEP, New York, USA. http://www.unep.org/COMPENDIUM2009/ (retrieved 4 May 2010).

UNEP, 2009b: Evolution of the Montreal Protocol. Status of Ratification. http://ozone.unep.org/Ratification_status/index.shtml (retrieved 17 January 2010).

UNEP, 2010: *How Close Are We to the Two Degree Limit?* (Information Note). UNEP Governing Council Meeting & Global Ministerial Environment Forum 24-26 February 2010, Bali, Indonesia. http://www.unep.org/PDF/PressReleases/temperature-briefing-21-02-10-final-e.pdf (retrieved 8 May 2010).

UNESCO, 2010: UNESCO Institute for Statistics. Daily newspapers: Total average circulation per 1,000 inhabitants. http://data.un.org/Data.aspx (retrieved 30 April 2010).

UNFCCC, 1992: *United Nations Framework Convention on Climate Change*. United Nations, Geneva, Switzerland.

UNFCCC, 1993: Status of Ratification of the Convention (UNFCCC). http://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php (retrieved 19 April 2010).

UNFCCC, 1998: *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. United Nations, Geneva, Switzerland.

UNFCCC, 2008: *Investment and Financial Flows to Address Climate Change: an Update*. United Nations, Geneva, Switzerland.

UNFCCC, 2009: Draft decision to the Fifteenth Session of the Conference of the Parties. Proposal by the President. *Copenhagen Accord*. United Nations, Geneva, Switzerland.

URWIN, K., Jordan, A., 2008: Does public policy support or undermine climate change adaptation? Exploring policy interplay across different scales of governance. Global Environmental Change 18 (1), 180–191.

U.S. Department of State, 2010: *U.S. Climate Action Report 2010. 5th edition*. Global Publishing Services, Washington D.C., USA.

VICTOR, D.G., 2006: Toward effective international cooperation on climate change: numbers interests and institutions. Global Environmental Politics 6 (3), 90–103.

VIGNOLA, R., Locatelli, B., Martinez, C., Imbach, P., 2009: Ecosystem-based adaptation to climate change - what role for policy-makers, society and scientists. Mitigation and Adaptation Strategies for Global Change 14, 691–696.

VIRGOE, J., 2009: International governance of a possible geoengineering intervention to combat climate change. Climatic Change 95, 103–119.

VON STEIN, J., 2008: The International Law and Politics of Climate Change: Ratification of the United Nations Framework Convention and the Kyoto Protocol. Journal of Conflict Resolution 52 (2), 243–268.

VON STORCH, H., 2009: Climate research and policy advice: scientific and cultural constructions of knowledge. Environmental Science and Policy 12, 741–747.

VORMEDAL, I., 2008: The Influence of Business and Industry NGOs in the Negotiation of the Kyoto Mechanisms: the Case of Carbon Capture and Storage in the CDM. Global Environmental Politics 8 (4), 36–65.

WALKER, B.H., Barrett, S., Galaz, V., Polasky, S., Folke, C., Engström, G., Ackerman, F., Arrow, K., Carpenter, S.R., Chopra, K., Daily, G., Ehrlich, P., Hughes, T., Kautsky, N., Levin, S.A., Mäler, K.–G., Shogren, J., Vincent, J., Xepapadeous, T., de Zeeuw, A., 2009: Looming Global-Scale Failures and Missing Institutions. Science 325, 1345–1346.

WALTER, K., Zimov, S., Chanton, J., Verbyla, D., Chapin III, F., 2006: Methane bubbling from Siberian thaw lakes as a positive feedback to climate warming. Nature 443, 71–75.

WALTZ, K., 1979: *Theory of International Politics*. McGraw Hill, New York, USA.

WARD, H., 2006: International Linkages and Environmental Sustainability: The Effectiveness of the Regime Network. Journal of Peace Research 43 (2), 149–166.

WARD, H., 2008: Liberal Democracy and Sustainability. Environmental Politics 17 (3), 386–409.

WARNER, K., 2009: Global environmental change and migration: Governance challenges. Global Environmental Change (article in press), doi:10.1016/j.gloenvcha.2009.12.001.

WASHINGTON, W.M., Knutti, R., Meehl, G.A., Teng, H., Tebaldi, C., Lawrence, D., Buja, L., Strand, W.G., 2009: How much climate change can be avoided by mitigation? Geophysical Research Letters 36, L08703.

WBGU (German Advisory Council on Global Change), 1995: *Scenario for the Derivation of Global $CO_2$ Reduction Targets and Implementation Strategies*. Statement on the Occasion of the First Conference of the Parties to the Framework Convention on Climate Change in Berlin. Special Report 1995. WBGU, Bremerhaven, Germany, 40 pp.

WBGU (German Advisory Council on Global Change), 2007: *Climate Change as a Security Risk*. Springer-Verlag, New York, USA.

WBGU (German Advisory Council on Global Change), 2009: *Solving the climate dilemma: The budget approach*. Berlin, Germany, 65 pp.

WEINGART, P., 1998: Science and the media. Research Policy 27, 869–879.

WEINGART, P., Engels, A., Pansegrau, P., 2000: Risks of communication: discourses on climate change in science, politics, and the mass media. Public Understanding of Science 9, 261–283.

WEISS, R., Mühle, J., Salameh, P., Harth, C., 2008: Nitrogen trifluoride in the global atmosphere. Geophysical Research Letters 35, L20821.

WEMF (AG für Werbemedienforschung), 2009: http://www.wemf.ch/de/pdf/Bulletin-2009_D.pdf (retrieved 3 May 2010).

WHITE, D.M., 1950: The "Gate-Keeper": A case study in the selection of News. Journalism Quarterly 27, 383–396.

WHITE, R.M., Hooke, W., 2004: Climate science, technology and politics: a tangled web. Technology in Society 26, 375–384.

WILBANKS, T.J., Sathaye, J., 2007: Integrating mitigation and adaptation as responses to climate change: a synthesis. Mitigation and Adaptation Strategies for Global Change 12, 957–962.

WILKINS, L., 1993: Between facts and values: print media coverage of the greenhouse effect, 1987–1990. Public Understanding of Science 2, 71–84.

WILSON, K.M., 1995: Mass media as sources of global warming knowledge. Mass Communications Review 22 (1&2), 75–89.

WILSON, K.M., 2000: Communicating climate change through the media: predictions, politics, and perceptions of risk. In: *Environmental Risks and the Media* [Allan, S., Adam, B., Carter, C. (eds.)]. Routledge, London, UK, 201–217.

WMO (World Meteorological Organization), 2009: World Climate Conference-3 – Vision. http://www.wmo.int/wcc3/vision_en.php (retrieved 18 February 2010).

WOODS, N., 2008: International political economy in an age of globalization. In: *The Globalization of World Politics – An introduction to international relations* (4th edition) [Baylis, J., Smith, S., Owens, P. (eds.)]. Oxford University Press, New York, USA, pp. 242–260.

WORLD BANK, 2009: *World Development Report 2010: Development and Climate Change*. The International Bank for Reconstruction and Development / The World Bank, Washington D.C., USA, 439 pp.

WPO (World Public Opinion), 2006: 30-Country Poll Finds Worldwide Consensus that Climate Change is a Serious Problem. http://www.worldpublicopinion.org/pipa/articles/btenvironmentra/187.php (retrieved 25 March 2010).

WPO (World Public Opinion), 2008: McCain and Obama Supporters Largely Agree on Approaches to Energy, Climate Change. http://www.worldpublicopinion.org/pipa/articles/btenvironmentra/542.php (retrieved 5 May 2010).

WPO (World Public Opinion), 2009: Publics Want More Government Action on Climate Change: Global Poll. http://www.worldpublicopinion.org/pipa/articles/btenvironmentra/631.php (retrieved 14 February 2010).

WRI (World Resources Institute), 2010: Climate Analysis Indicators Tool (CAIT UNFCCC) Version 3.0. World Resources Institute, Washington D.C., USA. http://cait.wri.org/

YOHE, G., 2010: "Reasons for concern" (about climate change) in the United States – A letter. Climatic Change 99, 295–302.

ZEHR, S.C., 2000: Public representations of scientific uncertainty about global climate change. Public Understanding of Science 9, 85–103.

# Annex I

## Comprehensive Tables

# Table A: Content Analysis Measures

**Content analysis measures and their respective variables used in the analysis of the surveyed data set.**

| Coding Measures | Variables |
|---|---|
| ***Publication Name*** | *The New York Times* [NYT]<br>*The Wall Street Journal* [WSJ]<br>*The Washington Post* [WAP]<br>*Die Welt* [DWE]<br>*Die Süddeutsche Zeitung* [DSZ]<br>*Neue Zürcher Zeitung* [NZZ] |
| ***Article Date*** | *Date Format: DD.MM.YY* |
| ***Article Length*** | *Word Count per Article* |
| ***Text Form*** | *Article / Agency Report*<br>*Editorial / Opinion*<br>*Op-Ed / Column*<br>*Letter* |
| ***Article Subject*** | *Climate Change News*<br>*Science / Technology*<br>*Politics / Policies* |
| ***Article Tone*** | *Neutral*<br>*Alarming*<br>*Alarmist*<br>*Skeptical* |
| ***Viewpoint*** | *Scientist*<br>*Public Opinion / Opinion Leader*<br>*Decision-Maker*<br>*Not Specified* |
| ***Geographical Context*** | *National / Local*<br>*Regional*<br>*Global* |
| ***Policy Preference*** | *Mitigation*<br>*Adaptation*<br>*Both*<br>*Not Specified* |
| ***Scientific Statement*** | *Statement Applicable*<br>*Not Applicable* |

# Table B: Content Analysis Results

**Content analysis results of climate change related articles per coding measure and variables for each newspaper in the surveyed period (1 July – 31 December 2008). Newspaper abbreviations see Table A.**

| Coding Measures and Variables | Newspapers | | | | | | N | % |
|---|---|---|---|---|---|---|---|---|
| ***Publication Name*** | **NYT** | **WSJ** | **WAP** | **DWE** | **DSZ** | **NZZ** | | |
| *Number of Articles* | 99 | 47 | 73 | 121 | 281 | 77 | **698** | |
| *Percentage* | 14% | 7% | 11% | 17% | 40% | 11% | | **100%** |
| ***Article Date* (see Figure 3.2)** | | | | | | | | |
| ***Article Length*** | | | | | | | | |
| *Words per Article (Mean)* | 676 | 755 | 664 | 405 | 453 | 456 | **519** | |
| ***Text Form*** | | | | | | | | |
| *Article / Agency report* | 67 | 32 | 51 | 96 | 235 | 68 | **549** | **79%** |
| *Editorial / Opinion* | 20 | 6 | 8 | 11 | 21 | 4 | **70** | **10%** |
| *Op-Ed / Column* | 4 | 4 | 8 | 13 | 17 | 1 | **47** | **7%** |
| *Letter* | 8 | 5 | 6 | 1 | 8 | 4 | **32** | **4%** |
| ***Article Subject*** | | | | | | | | |
| *Climate Change news* | 39 | 22 | 34 | 46 | 157 | 41 | **341** | **49%** |
| *Science / Technology* | 17 | 3 | 11 | 28 | 26 | 8 | **93** | **13%** |
| *Politics / Policies* | 43 | 21 | 28 | 47 | 97 | 28 | **264** | **38%** |
| ***Article Tone*** | | | | | | | | |
| *Neutral* | 76 | 35 | 54 | 92 | 252 | 71 | **580** | **83%** |
| *Alarming* | 18 | 2 | 14 | 13 | 25 | 5 | **77** | **11%** |
| *Alarmist* | 3 | 2 | 5 | 1 | 2 | 0 | **13** | **2%** |
| *Skeptical* | 2 | 8 | 0 | 15 | 2 | 1 | **28** | **4%** |
| ***Viewpoint*** | | | | | | | | |
| *Scientist* | 26 | 3 | 12 | 35 | 45 | 21 | **142** | **20%** |
| *Public Opinion / Opinion Leader* | 47 | 27 | 30 | 43 | 86 | 15 | **248** | **36%** |
| *Decision-Maker* | 25 | 15 | 28 | 34 | 96 | 26 | **224** | **32%** |
| *Not Specified* | 1 | 2 | 3 | 9 | 54 | 15 | **84** | **12%** |
| ***Geographical Context*** | | | | | | | | |
| *National / Local* | 25 | 6 | 29 | 33 | 122 | 16 | **231** | **33%** |
| *Regional* | 1 | 4 | 3 | 22 | 59 | 8 | **97** | **14%** |
| *Global* | 73 | 37 | 41 | 66 | 100 | 53 | **370** | **53%** |
| ***Policy Preference **** | | | | | | | | |
| *Mitigation* | 49 | 35 | 29 | 46 | 108 | 35 | **302** | **43%** |
| *Adaptation* | 5 | 1 | 4 | 9 | 25 | 0 | **44** | **6%** |
| *Both* | 20 | 0 | 15 | 16 | 16 | 13 | **80** | **12%** |
| *Not Specified* | 25 | 11 | 25 | 50 | 132 | 29 | **272** | **39%** |
| ***Scientific Statements*** | | | | | | | | |
| *Statement Applicable* | 17 | 7 | 14 | 16 | 28 | 7 | **89** | **13%** |
| *Not Applicable* | 82 | 40 | 59 | 105 | 253 | 70 | **609** | **87%** |
| ***Statements per Category*** | | | | | | | | |
| *Temperature* | 5 | 4 | 7 | 8 | 16 | 1 | **41** | **31%** |
| *Precipitation* | 0 | 0 | 1 | 2 | 8 | 0 | **11** | **8%** |
| *Sea Level* | 3 | 5 | 5 | 11 | 6 | 0 | **30** | **23%** |
| *Extreme Events* | 5 | 2 | 4 | 4 | 11 | 3 | **29** | **22%** |
| *Anthropogenic Global Warming* | 9 | 2 | 3 | 2 | 2 | 3 | **21** | **16%** |

# Table C: Scientific Statements per Country

**Summary of the analysis of transcribed *Scientific Statements* extracted from the surveyed newspaper coverage (1 July – 31 December 2008) per country and category, including the total number of statements, the fraction of correct statements, the mean IPCC probability of occurrence in the respective AR4 references of the correct statements, as well as the difference between the fraction of correct statements in the news coverage and the mean AR4 probability of occurrence per category (see Annex II for a complete list of transcribed statements including the corresponding AR4 references and IPCC probabilities of occurrence).**

| Categories per Country | Number of Statements (min. N=1) | | | IPCC Reference | |
|---|---|---|---|---|---|
| **USA** | **Total (N)** | **Correct (N)** | **Correct (%)** | **AR4 Mean (%)** | **Difference** |
| *Temperature* | 16 | 12 | 75% | 90% | 15% |
| *Precipitation* | 1 | 1 | 100% | 66% | 34% |
| *Sea Level ** | 13 | 12 | 92% | 78% | 14% |
| *Extreme Events* | 11 | 11 | 100% | 66% | 34% |
| *Anthro. Global Warming* | 14 | 10 | 71% | 84% | 13% |
| **Total** | **55** | **46** | **84%** | **77%** | **7%** |
| **Germany** | | | | | |
| *Temperature ** | 24 | 19 | 79% | 66% | 13% |
| *Precipitation* | 10 | 10 | 100% | 66% | 34% |
| *Sea Level ** | 17 | 8 | 47% | 90% | 43% |
| *Extreme Events* | 15 | 12 | 80% | 66% | 14% |
| *Anthro. Global Warming* | 4 | 3 | 75% | 90% | 15% |
| **Total** | **70** | **52** | **74%** | **76%** | **2%** |
| **Switzerland** | | | | | |
| *Temperature* | 1 | 1 | 100% | - | - |
| *Extreme Events* | 3 | 3 | 100% | 66% | 34% |
| *Anthro. Global Warming* | 3 | 2 | 67% | 90% | 23% |
| **Total** | **7** | **6** | **86%** | **78%** | **8%** |
| **Total (all Countries)** | **132** | **104** | **79%** | **77%** | **2%** |

*** Denotes a low number of statements with a corresponding AR4 probability reference in this category (see Annex II)**

# Table D: Scientific Statements per Newspaper

**Summary of the analysis of transcribed *Scientific Statements* extracted from the surveyed newspaper coverage (1 July – 31 December 2008) per newspaper and category. For definitions see Table C.**

| Categories per Newspaper | Number of Statements (min. N=1) | | | IPCC Reference | |
|---|---|---|---|---|---|
| ***New York Times*** | **Total (N)** | **Correct (N)** | **Correct (%)** | **AR4 Mean (%)** | **Difference** |
| *Temperature* | 5 | 4 | 80% | 90% | 10% |
| *Sea Level* | 3 | 3 | 100% | 78% | 22% |
| *Extreme Events* | 5 | 5 | 100% | 66% | 34% |
| *Anthro. Global Warming* | 9 | 6 | 67% | 84% | 17% |
| **Total** | **22** | **18** | **82%** | **80%** | **2%** |
| ***Wall Street Journal*** | | | | | |
| *Temperature* | 4 | 2 | 50% | 66% | 16% |
| *Sea Level ** | 5 | 4 | 80 | 90% | 10% |
| *Extreme Events* | 2 | 2 | 100% | 66% | 34% |
| *Anthro. Global Warming* | 2 | 1 | 50% | 90% | 40% |
| **Total** | **13** | **9** | **69%** | **78%** | **9%** |
| ***Washington Post*** | | | | | |
| *Temperature* | 7 | 6 | 86% | 66% | 20% |
| *Precipitation* | 1 | 1 | 100% | 66% | 34% |
| *Sea Level ** | 11 | 6 | 55% | 90% | 35% |
| *Extreme Events* | 4 | 4 | 100% | 68% | 32% |
| *Anthro. Global Warming* | 3 | 3 | 100% | 77% | 23% |
| **Total** | **20** | **19** | **95%** | **69%** | **26%** |
| ***Die Welt*** | | | | | |
| *Temperature* | 8 | 3 | 38% | - | - |
| *Precipitation* | 2 | 2 | 100% | 66% | 34% |
| *Sea Level* | 5 | 5 | 100% | - | - |
| *Extreme Events* | 4 | 1 | 25% | 66% | 41% |
| *Anthro. Global Warming* | 3 | 3 | 100% | 77% | 23% |
| **Total** | **20** | **19** | **95%** | **69%** | **26%** |
| ***Die Süddeutsche Zeitung*** | | | | | |
| *Temperature ** | 16 | 16 | 100% | 66% | 34% |
| *Precipitation* | 8 | 8 | 100% | 69% | 31% |
| *Sea Level* | 6 | 2 | 33% | - | - |
| *Extreme Events* | 2 | 2 | 100% | 66% | 34% |
| *Anthro. Global Warming* | 2 | 1 | 50% | 90% | 40% |
| **Total** | **43** | **38** | **88%** | **73%** | **16%** |
| ***Neue Zürcher Zeitung*** | | | | | |
| *Temperature* | 1 | 1 | 100% | - | - |
| *Extreme Events* | 3 | 3 | 100% | 66% | 34% |
| *Anthro. Global Warming* | 3 | 2 | 67% | 90% | 23% |
| **Total** | **7** | **6** | **86%** | **78%** | **8%** |

*** Denotes a low number of statements with a corresponding AR4 probability reference in this category (see Annex II)**

# TABLE E: United States Public Opinion Polls



**Selected US opinion polls on issues related to climate change / global warming before 1 July 2008 and after 31 December 2008 (Sources: Council on Foreign Relations, 2009; CBS News/New York Times, 2009; Gallup, 2009; adoption by the author).**

| Polls (Respondents; Margin of Error*), Questions and Corresponding Poll Dates | | Answers in % ** | | | |
|---|---|---|---|---|---|
| **Gallup Poll (N=1,014; MoE: ± 4%)** | | | | | |
| Q1: "Thinking about what is said in the news, in your view, is the seriousness of global warming generally (*answer*)?" | | **Exaggerated** | **Correct** | **Under-estimated** | **Unsure** |
| **Poll dates (Period)** | 03/2008 (before) | 35 | 33 | 29 | 2 |
| | 03/2009 (after) | 41 | 29 | 28 | 2 |
| Q2: "Which of the following statements reflects your view of when the effects of global warming will begin to happen?" | | **Already hap-pening** | **Within a few years** | **Within your lifetime** | **Future generations (Never)** |
| **Poll dates (Period)** | 03/2008 (before) | 61 | 4 | 10 | 13 (11) |
| | 03/2009 (after) | 53 | 5 | 10 | 15 (16) |
| Q3: "Just your impression, which one of the following statements do you think is most accurate? Most scientists believe that global warming (*answer*)?" | | **Is occurring** | **Is not occur-ring** | **Are unsure** | **No opinion** |
| **Poll dates (Period)** | 03/2008 (before) | 65 | 7 | 26 | 3 |
| | 03/2010 (after) | 52 | 10 | 36 | 2 |
| **Gallup Poll (N=1,012; MoE: N/A)** | | | | | |
| Q4: "How much do you personally worry about global warming?" | | **A great deal** | **Fair amount** | **Only a little** | **Not at all** |
| **Poll dates (Period)** | 03/2008 (before) | 37 | 29 | 16 | 17 |
| | 03/2009 (after) | 34 | 26 | 20 | 19 |
| **Pew Global Attitudes Project (N=1,500; MoE: ± 4%)** | | | | | |
| Q5: "In your view, is global warming a (*answer*) problem?" | | **Very serious** | **Somewhat serious** | **Not too serious** | **Not a problem (Unsure)** |
| **Poll dates (Period)** | 04/2008 (before) | 44 | 29 | 13 | 11 (3) |
| | 10/2009 (after) | 35 | 30 | 15 | 17 (3) |
| **CBS News/New York Times Poll (N=1,031; MoE: ± 3%)** | | | | | |
| Q6: "Which comes closer to your view? Global warming is a very serious problem and should be (answer) for government leaders. Global warming is (*answer*)." | | **One of highest priorities** | **Serious, not high priority** | **Not serious, address later** | **Not serious, never need to address (Unsure)** |
| **Poll dates (Period)** | 04/2007 (before) | 52 | 37 | 8 | 1 (2) |
| | 12/2009 (after) | 37 | 33 | 23 | 4 (3) |
| Q7: "Often there are trade-offs or sacrifices people must make in deciding what is important to them. Generally speaking, when a trade-off has to be made, which is more important to you?" | | **Stimulating economy** | **Protecting environment** | **Both** | **Unsure** |
| **Poll dates (Period)** | 04/2007 (before) | 36 | 52 | 8 | 4 |
| | 12/2009 (after) | 61 | 29 | 8 | 2 |

*** Margin of error is provided if available**

**** Where percentages do not add up to exactly 100% this may be due to rounding error or exclusion of 'don't know' responses.**

# TABLE F: German Public Opinion Polls



**Selected German opinion polls on issues related to climate change / global warming before 1 July 2008 and after 31 December 2008 (Sources: Council on Foreign Relations, 2009; European Commission, 2008; 2009; adoption by the author).**

| Poll (Respondents; Margin of Error*), Questions and Corresponding Poll Dates | Answers in % ** (DK/R: Don't know/Refused to answer) | | | |
|---|---|---|---|---|
| **Special Eurobarometer (2008: N=1,534 / 2009: N=1,549; MoE: ± 3.1%)** | | | | |
| Q1: "The seriousness of climate change has been exaggerated." | **Agree** | **Disagree** | **Don't know** | |
| **Poll dates** 03-04/2008 (before) | 24 | 74 | 2 | |
| 08-09/2009 (after) | 23 | 75 | 2 | |
| Q2: "How serious a problem do you think global warming / climate change is at this moment?" | **A very serious problem** | **A fairly serious problem** | **Not a serious problem** | **Don't know** |
| **Poll dates** 03-04/2008 (before) | 74 | 16 | 9 | 1 |
| 08-09/2009 (after) | 66 | 23 | 10 | 1 |
| Q3: "In your opinion, is your government (answer) to fight climate change?" | **Not doing enough** | **Doing about the right amount** | **Doing too much** | **Don't know** |
| **Poll dates** 03-04/2008 (before) | 48 | 40 | 8 | 4 |
| 08-09/2009 (after) | 51 | 41 | 4 | 4 |
| Q4: "In your opinion, which of the following do you consider to be the most serious problem currently facing the world as a whole?" | **Global warming / climate change** | **A major global economic downturn** | | |
| **Poll dates** 03-04/2008 (before) | 71 | 31 | | |
| 08-09/2009 (after) | 57 | 46 | | |
| **Pew Global Attitudes Project (2008: N=750 / 2009: N=751; MoE: ± 4%)** | | | | |
| Q5: "In your view, is global warming a very serious problem, somewhat serious, not too serious, or not a problem?" | **Very serious** | **Somewhat serious** | **Not too serious** | **Not a problem (DK/R)** |
| **Poll dates** 03-04/2008 (before) | 60 | 30 | 6 | 2 (1) |
| 05-06/2009 (after) | 61 | 29 | 7 | 2 (1) |

*** Margin of error is provided if available**

**** Where percentages do not add up to exactly 100% this may be due to rounding error or exclusion of 'don't know' responses.**

# TABLE G: Swiss Public Opinion Polls



**Selected Swiss opinion polls on issues related to climate change / global warming before 1 July 2008, during the surveyed period, and after 31 December 2008 (Sources: gfs, 2007; 2008; 2009b; adoption by the author).**

| Poll (Respondents; Margin of Error*), Questions** and Corresponding Poll Dates | | Answers in % *** (DK: Don't know) | | | |
|---|---|---|---|---|---|
| **Gfs Sorgenbarometer (2007: N=1,030 / 2009: N=1,009; MoE: ± 3.1%)** | | | | | |
| Q1: "In your opinion, what are the five most important problems in Switzerland today?" (Multiple choices)**** | | **Environmental protection / Global warming** | **Unemployment** | **Health care** | |
| **Poll dates** | 08/2007 (before) | 25 | 57 | 38 | |
| | 09/2009 (after) | 17 | 66 | 36 | |
| Q2: "In your opinion, which of these five problems should be addressed first?" | | **Environmental protection / Global warming** | **Unemployment (Economic crisis)** | **Health care** | |
| **Poll dates** | 08/2007 (before) | 6 | 9 | 10 | |
| | 09/2009 (after) | 3 | 17 (12) | 7 | |
| **Gfs Sorgenbarometer (2008: N=1,008 / 2009: N=1,009; MoE: ± 3.1%)** | | | | | |
| Q3: "In your opinion, what are the five most important problems in Switzerland in ten years from now?" (Multiple choices)**** | | **Environmental protection / Global warming** | **Unemployment (Economic crisis)** | **Health care** | |
| **Poll dates** | 09/2008 (before) | 23 | 46 | 35 | |
| | 09/2009 (after) | 17 | 58 (16) | 32 | |
| Q4: "Do you personally consider the current political goal of stabilizing Swiss greenhouse gas emissions ($CO_2$) as (*answer*)?" | | **Very important** | **Rather important** | **Rather unimportant** | **Not important (DK)** |
| **Poll dates** | 09/2008 (before) | 44 | 44 | 10 | 1 (1) |
| | 09/2009 (after) | 53 | 40 | 6 | 0 (1) |

*** Margin of error is provided if available**

**** Questions translated by the author. Original questions see below.**

***** Where percentages do not add up to exactly 100% this may be due to rounding error or exclusion of 'don't know' responses.**

****** Respondents had to select the five most important problems from a list of 30 different topics.**

Q1: "*Welches sind heute Ihrer Meinung nach die fünf wichtigsten Probleme der Schweiz?*" (Mehrfachnennungen)

Q2: "*Welches dieser fünf Probleme müsste Ihrer Ansicht nach an erster Stelle gelöst werden?*"

Q3: "*Welches sind in 10 Jahren Ihrer Meinung nach die fünf wichtigsten Probleme der Schweiz?*" (Mehrfachnennungen)

Q4: "*Wie wichtig ist für sie das aktuelle politische Ziel einer Stabilisierung der Schweizer Treibhausgasemissionen ($CO_2$)*?"

# Table H: United States Climate Policy Measures

**The most important US national climate policy measures adopted since 2000 including the particular kind of policy instrument planned or implemented (Policy Type) and the particular sector or target of the policy instrument (Policy Target) in chronological order (Source: IEA, 2010; adoption by the author).**

| Year | Policies prior to 1 July 2008 | Policy Type | Policy Target |
|---|---|---|---|
| **2000** | Public-Private Partnership - Climate Savers | • Voluntary Agreement<br>• Education and Outreach<br>• Regulatory Instruments<br>• RD & D | • Industry |
| **2002** | National Goal to Reduce Emissions Intensity | • Policy Processes | • Framework Policy<br>• Multi-sectoral Policy |
| **2003** | Climate VISION | • RD & D<br>• Voluntary Agreement | • CCS<br>• Energy Production<br>• Industry<br>• Multi-sectoral Policy |
| **2005** | Energy Policy Act of 2005 (Energy Bill) | • Financial<br>• Incentives/Subsidies<br>• Policy Processes<br>• RD & D<br>• Regulatory Instruments | • Framework Policy |
| **2006** | Voluntary Greenhouse Gas Reporting Program (Revised Guidelines for the Energy Policy Act of 1992) | • Voluntary Agreement | • Multi-sectoral Policy |
| **2007** | Renewable Fuel Program (or Renewable Fuel Standard) | • Policy Processes<br>• Regulatory Instruments<br>• Tradable Permits | • Energy Production |
| | **Policies after 31 December 2008** | | |
| **2008** | Energy Improvement and Extension Act 2008 - Tax Incentives | • Financial | • Buildings<br>• CCS<br>• Energy Production<br>• Transport |
| **2008** | Mandatory Reporting of GHG Emissions | • Regulatory Instruments | • Framework Policy |
| **2009** | American Recovery and Reinvestment Act of 2009: Appropriations for Clean Energy / Tax-Based Provisions | • Financial<br>• Incentives/Subsidies<br>• Public Investment<br>• RD & D | • Buildings<br>• CCS<br>• Energy Production<br>• Industry<br>• Multi-sectoral Policy<br>• Transport |
| **2009** | Federal Leadership in Environmental, Energy, and Economic Performance | • Policy Processes<br>• Public Investment | • Buildings<br>• Energy Production<br>• Multi-sectoral Policy<br>• Transport |
| **2010** | Reporting of Greenhouse Gases Rule | • Regulatory Instruments | • Energy Production<br>• Industry<br>• Multi-sectoral Policy |

**CCS: Carbon Capture and Storage; RD & D: Research, Development and Demonstration**

# Table I: German Climate Policy Measures

**The most important German national climate policy measures adopted since 2000 including the particular kind of policy instrument planned or implemented (Policy Type) and the particular sector or target of the policy instrument (Policy Target) in chronological order (Source: IEA, 2010; adoption by the author).**

| Year | Policies prior to 1 July 2008 | Policy Type | Policy Target |
|---|---|---|---|
| **2000** | Renewable Energy Sources Act (amended 2004 and 2008) | • Incentives/Subsidies | • Energy Production |
| **2001** | CHP Agreements with Industry | • Voluntary Agreement | • Energy Production |
| **2001** | Transport Initiatives | • Policy Processes | • Transport |
| **2004** | Solarthermie 2000Plus (amended 2008) | • Incentives/Subsidies<br>• RD & D | • Buildings<br>• Energy Production |
| **2005** | Fifth Energy Research Programme | • RD & D | • Multi-sectoral Policy |
| **2005** | National Climate Protection Programme | • Policy Processes | • Framework Policy<br>• Multi-sectoral Policy |
| **2005** | EU Emissions Trading Scheme (ETS) | • Financial<br>• Regulatory Instruments | • Industry<br>• Multi-sectoral Policy |
| **2006** | Coaltion Agreement: Target to Double Energy Productivity by 2020 | • Financial<br>• Incentives/Subsidies<br>• Policy Processes<br>• Regulatory Instruments | • Multi-sectoral Policy |
| **2007** | Energy Efficiency Action Plan | • Policy Processes | • Multi-sectoral Policy |
| **2007** | Integrated Energy and Climate Programme (IECP) | • Policy Processes | • Multi-sectoral Policy |
| **2008** | Climate Protection Investment from Sale of Carbon Allowances | • RD & D | • Energy Production<br>• Multi-sectoral Policy |
| | **Policies after to 31 December 2008** | | |
| **2009** | Renewable Energies Heat Act | • Incentives/Subsidies | • Buildings |
| **2009** | KfW-Programme Energy-Efficient Rehabilitation | • Incentives/Subsidies | • Buildings<br>• Energy Production |
| **2009** | KfW Renewable Energies Programme | • Incentives/Subsidies | • Energy Production |
| **2009** | Old Vehicle Scrappage Scheme | • Incentives/Subsidies | • Transport |
| **2009** | Partnership for Climate Protection and Energy | • Education and Outreach<br>• Financial | • Multi-sectoral Policy |

**CHP: Combined Heat and Power; RD & D: Research, Development and Demonstration**

# Table J: Swiss Climate Policy Measures

**The most important Swiss national climate policy measures adopted since 2000 including the particular kind of policy instrument planned or implemented (Policy Type) and the particular sector or target of the policy instrument (Policy Target) in chronological order (Source: IEA, 2010; adoption by the author).**

| Year | Policies prior to 1 July 2008 | Policy Type | Policy Target |
|---|---|---|---|
| **2000** | $CO_2$ Act (adopted in 1999) | • Financial<br>• Incentives/Subsidies<br>• Policy Processes<br>• Regulatory Instruments<br>• Voluntary Agreement | • Buildings<br>• Framework Policy<br>• Energy Production<br>• Industry<br>• Multi-sectoral Policy<br>• Transport |
| **2001** | SwissEnergy Programme | • Education and Outreach<br>• Incentives/Subsidies<br>• Voluntary Agreement | • Buildings<br>• Energy Production<br>• Multi-sectoral Policy |
| **2005** | Climate Cent (Climate Cent Foundation) | • Financial<br>• Policy Processes<br>• Regulatory Instruments | • Multi-sectoral Policy<br>• Transport |
| **2006** | Second term of SwissEnergy programme (2006-2010) | • Education and Outreach<br>• Incentives/Subsidies<br>• Voluntary Agreement | • Buildings<br>• Energy Production<br>• Multi-sectoral Policy |
| **2007** | Electricity Supply Act | • Incentives/Subsidies<br>• Regulatory Instruments | • Energy Production |
| **2008** | $CO_2$ Levy on Heating and Process Fuels (12CHF per ton of $CO_2$) | • Financial<br>• Incentives/Subsidies<br>• Policy Processes<br>• Regulatory Instruments | • Buildings<br>• Energy Production<br>• Industry<br>• Multi-sectoral Policy |
| **2008** | Energy Efficiency Action Plan | • Policy Processes | • Framework Policy<br>• Multi-sectoral Policy |
| **2008** | Swiss Interdepartmental Committee for Climate Policy (SICCP) | • Policy Processes<br>• RD & D | • Multi-sectoral Policy |
| | **Policies after to 31 December 2008** | | |
| **2009** | Building Refurbishment Programme | • Financial<br>• Incentives/Subsidies | • Buildings<br>• Energy Production<br>• Multi-sectoral Policy |
| **2009** | Revised $CO_2$ Act (planned to come into force in January 2013) | • Financial<br>• Incentives/Subsidies<br>• Policy Processes<br>• Regulatory Instruments<br>• Voluntary Agreement | • Buildings<br>• Framework Policy<br>• Energy Production<br>• Industry<br>• Multi-sectoral Policy<br>• Transport |
| **2010** | Increase of $CO_2$ Levy on Heating and Process Fuels (36CHF per ton of $CO_2$) | • Financial<br>• Incentives/Subsidies<br>• Policy Processes<br>• Regulatory Instruments | • Buildings<br>• Energy Production<br>• Industry<br>• Multi-sectoral Policy |

**CHF: Swiss Francs; RD & D: Research, Development and Demonstration**

# Annex II

## Transcribed Scientific Statements

**Transcribed statements from articles in the analyzed newspapers (Pub.) including the *Scientific Statement* number (SN), the article number (AN), the Statement Category (SC), as well as the qualitatively assessed correctness (Yes/No) including the AR4 likelihood of occurrence if available (AR4 %), and the corresponding reference in the IPCC AR4 (NYT: *New York Times*). See Appendix I for the sample of coded newspaper articles.**

| Pub. | SN | AN | SC* | Statement Transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **NYT** | 1 | 3 | T | Greenland is still losing more ice through melting than it gains through snowfall, other measurements show. (Dutch study) | Y | 90% | SPM WGI, p.5 |
| | 2 | 3 | S | But Dr. Alley and other experts said the new study showed that it was unlikely that Greenland's ice had already become destabilized in ways that could cause a surge in sea levels. | Y | 66% | WGI, p.818 |
| | 3 | 17 | A | In one particularly jarring line, a narrator says: ''Everywhere you are told that man-made climate change is proved beyond doubt. But you are being told lies.'' (The Great Global Warming Swindle) | N | 10% | SPM WGI, p.3 |
| | 4 | 20 | S | Greenland's ice sheet represents one of global warming's most disturbing threats. The vast expanses of glaciers - massed, on average, 1.6 miles deep - contain enough water to raise sea levels worldwide by 23 feet. | Y | 90% | WGI, p.341 |
| | 5 | 21 | A | These questions endure even as the basic theory of a rising human influence on climate has steadily solidified: accumulating greenhouse gases will warm the world, erode ice sheets, raise seas and have big impacts on biology and human affairs. | Y | 90% | SPM WGI, p.3 |
| | 6 | 24 | T | Surveying a wide range of climate models, he (Martin Weitzman, economist) argues that, over all, they suggest about a 5 percent chance that world temperatures will eventually rise by more than 10 degrees Celsius (that is, world temperatures will rise by 18 degrees Fahrenheit). | N | N/A | WGI, p.749 |
| | 7 | 27 | T | There has been a 30 percent increase in the melting of the Greenland ice sheet between 1979 and 2007, and in 2007, the melt was 10 percent bigger than in any previous year, said Konrad Steffen, director of the Cooperative Institute for Research in Environmental Sciences at the University of Colorado, which monitors the ice. | Y | 90% | WGII, p. 657, 663 |
| | 8 | 29 | E | Other studies have already measured a rise in recent decades in heavy rains in areas as varied as North America and India, and climatologists have long forecast more heavy rainstorms in a world warmed by accumulating greenhouse gases. | Y | 66% | WGI, p. 879, 891 |
| | 9 | 29 | E | While a general relationship between warming and more flooding rains is already widely accepted, the new paper is important ''because it uses observations to demonstrate the sensitivity of extreme rainfall to temperature,'' said Anthony J. Broccoli, the director of the Center for Environmental Prediction at Rutgers University. | Y | 66% | SPM WGI, p.8 |

*** Statement Categories: T: *Temperature*; P: *Precipitation*; S: *Sea Level*; E: *Extreme Events*; A: *Anthropogenic Global Warming***

**Transcribed statements continued… (NYT: *New York Times*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **NYT** | 10 | 29 | E | Overall, the work paints a portrait of a warming world producing more of the most destructive tropical flash floods than climatologists had realized, Dr. Soden said. | Y | 66% | WGI, p.315 |
| | 11 | 36 | E | A new study finds that the strongest of hurricanes and typhoons have become even stronger over the last two and a half decades, adding grist to the contentious debate over whether global warming has already made storms more destructive. | Y | 66% | WGI, p.315 |
| | 12 | 37 | A | Global warming from the continuing buildup of human-generated greenhouse gases is almost certainly contributing to the ice retreats, many Arctic specialists now agree, although they hold a variety of views on how much of the recent big ice retreats is due to human activity. | Y | 66% | WGI, p.369 |
| | 13 | 38 | A | Emissions from fossil fuels - not just oil but the coal and natural gas used in power plants - are the main drivers of global warming. | Y | 100% | WGI, p.511 |
| | 14 | 40 | A | Global warming from the buildup of human-generated greenhouse gases almost certainly contributes to the Arctic ice retreats, according to a host of Arctic specialists. | Y | 66% | WGI, p.369 |
| | 15 | 42 | T | By the end of the century, if no action is taken, he (Ron Burke, Director Union of concerned Scientists) said, Chicago is likely to face 30 more days of 100-degree weather per year, as well as stretches of severe drought. | Y | N/A | WGII, p. 632 |
| | 16 | 54 | A | Meanwhile, Ms. Palin continues to express doubts about the human causes of climate change. Her insistence, in the debate, that she didn't "want to argue about the causes" was also alarming. | N | 10% | SPM WGI, p.3 |
| | 17 | 57 | T | Produced in abundance by an industrial urban world that depends on the burning of coal and oil, this gas has so increased its atmospheric presence and has so clear a "greenhouse effect" - preventing heat from escaping the Earth - that, the show argues, the sun's energy is already raising the planet's temperature (about 1.4 degrees Fahrenheit in the last century), with doleful consequences to follow. | Y | N/A | WGI, p.249 |
| | 18 | 57 | A | 'Climate has changed throughout Earth's long history," but this time is different, the exhibition says, because "for the first time, humans are causing it." (cc exhibition statement) | Y | 90% | SPM WGI, p.3 |
| | 19 | 57 | E | 'Many experts think," we are told, that warmer ocean waters will make hurricanes more powerful. But "it is difficult to predict how much more intense hurricanes could become." (cc exhibition statement) | Y | N/A | WGI, p.305 |
| | 20 | 58 | A | Both candidates (Obama & McCain) say that human-caused climate change is real and urgent, and that they would sharply diverge from President Bush's course by proposing legislation requiring sharp cuts in greenhouse gas emissions by midcentury. | Y | 90% | SPM WGI, p.3 |

*** Statement Categories: T: *Temperature*; P: *Precipitation*; S: *Sea Level*; E: *Extreme Events*; A: *Anthropogenic Global Warming***

**Transcribed statements continued… (NYT: *New York Times*; WSJ: *Wall Street Journal*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **NYT** | 21 | 65 | A | She (Sarah Palin) has repeatedly expressed doubts that humans and their industrial activities have done anything to cause climate change. | N | 10% | SPM WGI, p.3 |
| | 22 | 67 | S | In its latest report, the Intergovernmental Panel on Climate Change of the United Nations projected that sea levels worldwide could rise up to two feet by 2100 as ice sheets eroded and warming seawater expanded. | Y | N/A | WGI, p.820 |
| **WSJ** | 23 | 100 | T | NASA now begrudgingly confirms hottest year on record in the continental 48 was not 1998 but 1934, and 6 of the 10 hottest years since 1880 antedate 1954. | N | N/A | WGI, p.237 |
| | 24 | 100 | T | The Arctic ice cap may be thinning, but the extent of Antarctic sea ice has been expanding for years. | N | N/A | WGI, p.365/6 |
| | 25 | 117 | E | One theory holds that global warming caused by human activity is producing windier and wetter hurricanes by raising ocean temperatures and creating more water vapor for the storms to feed upon. | Y | N/A | WGI, p.305 |
| | 26 | 117 | E | There is "pretty widespread agreement that global warming will increase the intensity of hurricanes and wind speed", said Massachusetts Institute of Technology atmospheric-science professor Kerry Emanuel. | Y | 66% | WGI, p.305 |
| | 27 | 118 | A | Let's be clear. Global warming is real and man-made. (Lomborg) | Y | 90% | SPM WGI, p.3 |
| | 28 | 118 | S | In essence, he's (Friedman) trumping Mr. Gore five-fold, coming to claim that sea levels might rise a hundred feet, whereas the U.N. expects between six inches and two feet this century. | Y | N/A | WGI, p.820 |
| | 29 | 118 | S | None of Mr. Friedman's interview subjects mentions that the global sea-level rise has remained steady since satellite measurements began, pointing toward an increase of one foot by the end of the century. (Lomborg) | Y | N/A | WGI, p.820 |
| | 30 | 118 | S | In 22 years (til 2030) - when according to most responsible projections sea levels will have risen fewer than three inches - (...). (Lomborg) | N | N/A | WGI, p.820 |
| | 31 | 129 | T | The United Nations science consensus expects temperature increases of 3 to 7 degrees Fahrenheit by the end of the century, leading to (for example) sea-level increases of between one-half and two feet. | Y | 66% | WGI, p.749 |
| | 32 | 129 | S | The United Nations science consensus expects temperature increases of 3 to 7 degrees Fahrenheit by the end of the century, leading to (for example) sea-level increases of between one-half and two feet. | Y | N/A | WGI, p.820 |

*** Statement Categories: T: *Temperature*; P: *Precipitation*; S: *Sea Level*; E: *Extreme Events*; A: *Anthropogenic Global Warming***

**Transcribed statements continued… (WSJ: *Wall Street Journal*; WAP: *Washington Post)***

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **WSJ** | 33 | 131 | S | Should Greenland's 2.17 million square miles of ice ever melt completely, the water could raise sea level by 24 feet, swamping coastal cities that are home to millions of people. | Y | 90% | WGI, p.341 |
| | 34 | 132 | T | Eliminating the cloud would rapidly increase global temperatures two degrees Celsius, which coupled with the already measured rise of 0.75 degrees in the 20th century, could push world climate past what scientists consider a dangerous threshold. | Y | N/A | WGI, p.237 |
| | 35 | 146 | A | The company (Exxon), which once funded a think tank that argued carbon-dioxide emissions were helpful to human life, today acknowledges that burning fossil fuels is a significant source of greenhouse-gas emissions and increases the risks of climate change -- although it remains unsure about the exact role of human activity in global warming. | N | 10% | SPM WGI, p.3 |
| **WAP** | 36 | 148 | A | In recent years, Bush has shifted to some degree, accepting the scientific conclusion that human action is contributing to global warming. | Y | 90% | SPM WGI, p.3 |
| | 37 | 159 | S | With this melting from ice sheets and glaciers - and the natural expansion of warmer water - the global sea level is rising about 3 millimeters a year, 75 percent more than the average of the past century. | Y | N/A | WGI, p.387 |
| | 38 | 163 | T | Depending on the level of greenhouse gases and the uncertain science of cloud cover, climatologists predict increases in global temperature during this century in a range from 2 degrees to 11 degrees Fahrenheit. | Y | 66% | WGI, p.749 |
| | 39 | 163 | E | For example, global warming might cause a breakdown in ocean circulation, leading to major climate shocks. According to the Intergovernmental Panel on Climate Change, this scenario is “very unlikely” - which means a probability of less than 10 percent. | Y | 90% | WGI, p.397 |
| | 40 | 167 | A | The Administrator (EPA) believes that there is compelling and robust evidence that observed climate change can be attributed to the heating effect caused by global anthropogenic greenhouse gas emissions. | Y | 90% | SPM WGI, p.3 |
| | 41 | 169 | E | Global warming increases the probabilities of floods and strong hurricanes, and that is all that you can say. (Kerry Emanuel, MIT climatologist) | Y | 66% | WGI, p.305/15 |
| | 42 | 176 | T | The Earth is on a trajectory to warm more than 4.5 degrees Fahrenheit by around mid-century. (Exceeding that threshold could trigger a series of phenomena: Arable land will turn into desert, higher sea levels will flood coastal areas, and changes in the convection of the oceans will alter currents, such as the Gulf Stream, that determine regional weather patterns.) | Y | 66% | WGI, p.749 |
| | 43 | 180 | E | Scientists say the planet is warming, threatening to make droughts more widespread, heat waves more punishing and hurricanes more severe. | Y | 66% | WGI, p.315 |

*** Statement Categories: T: *Temperature*; P: *Precipitation*; S: *Sea Level*; E: *Extreme Events*; A: *Anthropogenic Global Warming***

**Transcribed statements continued… (WAP: *Washington Post*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **WAP** | 44 | 180 | T | Scientists around the world have concluded that average temperatures could rise 3 degrees or more by 2100, as mounting levels of carbon dioxide and pollutants trap heat in the Earth's atmosphere. That change is expected to raise sea levels, alter long-established weather patterns and affect plant and animal life. | Y | 66% | WGI, p.749 |
| | 45 | 183 | T | The state (Alaska) has warmed by 4 degrees Fahrenheit over the past 50 years - far outpacing the global and national temperature rise. | Y | N/A | WGII, p.661 |
| | 46 | 184 | T | In 2007, carbon released from burning fossil fuels and producing cement increased 2.9 percent over that released in 2006, to a total of 8.47 gigatons, or billions of metric tons, according to the Australia-based Global Carbon Project, an international consortium of scientists that tracks emissions. This output is at the very high end of scenarios outlined by the Intergovernmental Panel on Climate Change (IPCC) and could translate into a global temperature rise of more than 11 degrees Fahrenheit by the end of the century, according to the panel's estimates. | Y | N/A | WGI, p.749 |
| | 47 | 184 | E | The IPCC has warned that an increase of between 3.2 and 9.7 degrees Fahrenheit could trigger massive environmental changes, including major melting of the Greenland ice sheet, the Himalayan-Tibetan glaciers and summer sea ice in the Arctic. | Y | 50% | WGI, p.818/9 |
| | 48 | 189 | T | So much carbon was released around the world from burning fossil fuels in 2007 that it could lead to a sweltering 11-degree Fahrenheit increase in the Earth's temperature by the end of the century, according to data recently unveiled by the Global Carbon Project. | Y | 66% | WGI, p.749 |
| | 49 | 189 | S | A rise of 11 degrees Fahrenheit, as estimated by the Global Carbon Project, would lead to a rise in sea level that would swamp major population centers and wreak other havoc on the planet. | Y | N/A | WGI, p.341 |
| | 50 | 190 | T | Records indicate that Alaska has experienced the largest regional warming of any U.S. state: an average 5 degrees Fahrenheit since the 1960s and about 8 degrees in the interior of the state during winter months. | N | N/A | WGII, p.661 |
| | 51 | 192 | S | Sea level rose about eight inches in the last century. By most accounts, it could rise four or five times that much by 2100 as climate change exacts its toll, melting polar ice caps and glaciers in the high latitudes, north and south. | Y | N/A | WGI, p.387 |
| | 52 | 196 | S | The 2007 Fourth Report of the U.N. Intergovernmental Panel on Climate Change gives its least pessimistic projected sea-level rise as 18 to 38 centimeters (0.60 to 1.2 feet) and its most pessimistic projection as 26 to 59 centimeters (0.85 to 1.9 feet). | Y | N/A | WGI, p.820 |

*** Statement Categories: T: *Temperature*; P: *Precipitation*; S: *Sea Level*; E: *Extreme Events*; A: *Anthropogenic Global Warming***

**Transcribed statements continued… (WAP: *Washington Post*; DWE: *Die Welt*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **WAP** | 53 | 219 | S | The IPCC had projected a sea level rise of no more than 1.5 feet by that time, but satellite data over the past two years show the world's major ice sheets are melting much more rapidly than previously thought. | Y | N/A | WGI, p.820 |
| | 54 | 219 | A | They (USGS scientists) said it is impossible to determine yet whether human activity is responsible for the drought the Southwestern United States has experienced over the past decade, but every indication suggests the region will become consistently drier in the next several decades. | Y | 50% | WGI, p.732 |
| | 55 | 219 | P | “If the models are correct, it will transition in the coming years and decades to a more arid climate, and that transition is already underway,” (Richard Seager, Columbia University) Seager said, adding that such conditions would probably include prolonged droughts lasting more than a decade. | Y | 66% | WGI, p.783/4 |
| **DWE** | 56 | 222 | A | Dass der Mensch zuviel CO2-Ausstoß verursacht, gilt gemeinhin als Grund für den Klimawandel mit all seinen Folgen. | Y | 90% | SPM WGI, p.3 |
| | 57 | 235 | A | Es findet eine Klimaerwärmung statt, und sie ist vom Menschen verursacht, weil der durch zu hohen Ausstoß von Kohlendioxid aus Schornsteinen und Auspuffen aus der Atmosphäre ein Treibhaus geschaffen habe - die Lesart also, die heute den Diskurs weitgehend bestimmt. | Y | 90% | SPM WGI, p.3 |
| | 58 | 252 | T | Wegen des Klimawandels habe etwa Berlin mit einer durchschnittlichen Erwärmung von drei Grad Celsius zu rechnen und werde damit die "Verhältnisse von Neapel erreichen". (Hans Joachim Schnellnhuber) | Y | N/A | WGI, p.875 |
| | 59 | 257 | S | Danach mü ssen sich die Niederlande auf ein Ansteigen des Meeresspiegels zwischen 65 und 130 Zentimetern bis zum Jahr 2100 einrichten und sogar von zwei bis vier Meter bis 2200. | N | N/A | WGI, p.820 |
| | 60 | 262 | T | Folgerichtig messen wir seit Beginn des letzten Jahrhunderts eine Erwärmung von weltweit etwa 0,8 Grad Celsius, einen Anstieg des Meeresspiegels um circa 20 Zentimeter, einen dramatischen Rü ckgang der Eis- und Schneebedeckung sowie eine Zunahme der Wetterextreme. Das Kohlendioxid besitzt dabei den größten Anteil. | Y | N/A | WGI, p.237 |
| | 61 | 262 | S | Folgerichtig messen wir seit Beginn des letzten Jahrhunderts eine Erwärmung von weltweit etwa 0,8 Grad Celsius, einen Anstieg des Meeresspiegels um circa 20 Zentimeter, einen dramatischen Rü ckgang der Eis- und Schneebedeckung sowie eine Zunahme der Wetterextreme. Das Kohlendioxid besitzt dabei den größten Anteil. | Y | N/A | WGI, p.387 |

*** Statement Categories: T: *Temperature*; P: *Precipitation*; S: *Sea Level*; E: *Extreme Events*; A: *Anthropogenic Global Warming***

**Transcribed statements continued… (DWE: *Die Welt*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **DWE** | 62 | 262 | P | Folgerichtig messen wir seit Beginn des letzten Jahrhunderts eine Erwärmung von weltweit etwa 0,8 Grad Celsius, einen Anstieg des Meeresspiegels um circa 20 Zentimeter, einen dramatischen Rückgang der Eis- und Schneebedeckung sowie eine Zunahme der Wetterextreme. Das Kohlendioxid besitzt dabei den größten Anteil. | Y | 66% | WGI, p.315 |
| | 63 | 262 | E | Folgerichtig messen wir seit Beginn des letzten Jahrhunderts eine Erwärmung von weltweit etwa 0,8 Grad Celsius, einen Anstieg des Meeresspiegels um circa 20 Zentimeter, einen dramatischen Rü ckgang der Eis- und Schneebedeckung sowie eine Zunahme der Wetterextreme. Das Kohlendioxid besitzt dabei den größten Anteil. | Y | 66% | WGI, p.315 |
| | 64 | 270 | T | Jü ngste Schätzungen gehen von einem Temperaturanstieg in Europa von 1,0 bis 5,5 Grad Celsius aus, während die globale Erwärmung auf maximal vier Grad Celsius geschätzt wird. (study EEA/WJO/JRC) | Y | N/A | WGI, p.875 |
| | 65 | 273 | T | Seit zehn Jahren zeigen die Nasa-Messungen keinen weiteren globalen Temperaturanstieg, trotz erheblicher Zunahme von CO2-Emissionen durch menschliche Aktivitäten. Der letzte Winter war einer der kältesten auf der Nordhalbkugel. (letter) | N | N/A | WGI, p.237 |
| | 66 | 281 | S | Sie (die Klimaforscher) haben gerade erklärt, noch in diesem Jahrhundert werde der Meeresspiegel um einen Meter ansteigen -eine Nachricht, die in den Niederlanden, deren halbes Territorium unterhalb der Meereshöhe liegt, kaum willkommen ist. | N | N/A | WGI, p.820 |
| | 67 | 281 | S | Die Kommission (Delta-Kommission) kommt jetzt zu dem Ergebnis, dass der Meeresspiegel sich bis zum Jahre 2100 um 0,65 Meter bis 1,3 Meter erhöht - das deckt sich mit der Prognose des Potsdam-Instituts für Klimafolgenforschung. | N | N/A | WGI, p.820 |
| | 68 | 287 | T | Das Jahr 2008 ist das dritte in Folge, in dem die globale Durchschnittstemperatur fiel. In der gesamten laufenden Dekade ist es, im Gegensatz zu vorherigen, nicht mehr signifikant wärmer geworden, sagen auch diejenigen, die in England die Temperaturen für den Weltklimarat messen. | N | N/A | WGI, p.237 |
| | 69 | 291 | S | Der Meeresspiegel steigt minimal und seit zwei Jahren gar nicht mehr. (Michael Miersch) | N | N/A | WGI, p.820 |
| | 70 | 291 | T | Fakt ist: Am Nordpol schwindet die Eisdecke, doch am Südpol wird es kälter. (Michael Miersch) | N | N/A | WGI, p.248 |
| | 71 | 291 | T | Die globale Temperatur stagniert seit 1999, was keine der Prognosen vorhersah. (Michael Miersch) | N | N/A | WGI, p.248 |
| | 72 | 291 | E | Und es gibt auch nicht jedes Jahr mehr Wirbelstürme. (Michael Miersch) | N | N/A | WGI, p.308/9 |
| | 73 | 294 | T | Seit 1999 stagniert die globale Durchschnittstemperatur. (Michael Miersch) | N | N/A | WGI, p.237 |

*** Statement Categories: T: *Temperature*; P: *Precipitation*; S: *Sea Level*; E: *Extreme Events*; A: *Anthropogenic Global Warming***

**Transcribed statements continued… (DWE: *Die Welt*; DSZ: *Die Süddeutsche Zeitung*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **DWE** | 74 | 294 | S | Der Meeresspiegel stieg seit 1992 lediglich um 3,2 Millimeter jährlich an und bleibt seit zwei Jahren unverändert. (Michael Miersch) | Y | N/A | WGI, p.387 |
| | 75 | 294 | E | Wirbelstürme nahmen nicht zu. Auf das "Katrina"-Desaster von 2005 folgten besonders ruhige Jahre. (Michael Miersch) | N | N/A | WGI, p.308/9 |
| | 76 | 299 | S | Nach Vorhersagen der Vereinten Nationen kann der Meeresspiegel bis zum Jahr 2100 um knapp 60 Zentimeter ansteigen. | Y | N/A | WGI, p.820 |
| | 77 | 308 | S | Für das Eis rund um den Nordpol gilt dies nicht, es schwimmt bereits heute auf dem Wasser. Schätzungen besagen, dass die Ozeane weltweit um 60 Meter steigen würden, falls das gesamte antarktische Eis abschmilzt. Verschwindet der grönländische Eisschild komplett, kämen sieben Meter hinzu. | Y | 90% | WGI, p.341 |
| | 78 | 308 | S | Zuletzt lag der erwartete Mittelwert bis zum Jahr 2100 bei 38 Zentimeter. | Y | N/A | WGI, p.820 |
| | 79 | 312 | E | Für diese Region (Karibik) liegen überdies die am weitesten zurückreichenden, verlässlichen Statistiken vor, was Wirbelstürme angeht. Und die zeigen seit immerhin 1850 mancherlei Auf und Ab im Rhythmus von einem oder mehreren Jahrzehnten. Nur eines zeigen sie überhaupt nicht: einen längerfristigen Trend zu stärkeren oder häufigeren Hurrikans. | N | N/A | WGI, p.306 |
| | 80 | 323 | S | Der Meeresspiegelanstieg bewegt sich seit Jahren im Millimeterbereich und ist in jüngster Zeit ganz zum Stillstand gekommen. (Michael Miersch) | N | N/A | WGI, p.387 |
| | 81 | 335 | P | Die Erwärmung (in D) werde vor allem im Winter durch mehr Niederschläge zu spüren sein, heißt es in dem Entwurf. Dagegen werden die Niederschläge im Sommer zurückgehen. | Y | 66% | WGI, p.783/4 |
| | 82 | 335 | S | Vor allem in zentralen Teilen Ostdeutschlands werde es trockener, in den Alpen gingen die Gletscher zurück, an den Küsten steige der Meeresspiegel. | Y | N/A | WGI, p.387 |
| **DSZ** | 83 | 342 | E | Es gibt immer häufiger Unwetter, und sie verursachen immer höhere Kosten. | Y | 66% | WGI, p.315 |
| | 84 | 342 | A | Dass dieser Klimawandel durch den Ausstoß von Treibhausgasen ausgelöst wird, sei aus meteorologischen Analysen immer deutlicher zu erkennen, sagt Höppe (Meteorologe, Leiter Georisiko-Forschung Münchner Rück). | Y | 90% | SPM WGI, p.3 |
| | 85 | 357 | T | Im Mittel erwärmt sich die Welt nach Sterls (Meteorologe) Rechnung durch den Ausstoß von Treibhausgasen um 3,5 Grad Celsius, was gut zu den Aussagen des Weltklimarats IPCC passt. Die Extremwerte steigen aber fast überall auf der Welt stärker an als die mittleren. Besonders ausgeprägt ist dieser Effekt in Frankreich, Deutschland und Osteuropa. | Y | N/A | WGI, p.749/875 |

*** Statement Categories: T: *Temperature*; P: *Precipitation*; S: *Sea Level*; E: *Extreme Events*; A: *Anthropogenic Global Warming***

**Transcribed statements continued… (DSZ: *Die Süddeutsche Zeitung*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **DSZ** | 86 | 366 | P | "Der Klimawandel führt in den Alpen vermehrt zu Starkregen", sagte Bayerns Umweltminister Otmar Bernhard (CSU) bei der Vorstellung des Projektes "AdaptAlp" in der Umweltforschungsstation Schneefernerhaus auf der Zugspitze (2962 Meter). | Y | 66% | WGI, p.783/4 |
| | 87 | 367 | E | Die meisten Dorfbewohner (Chila, village at coast of Bangladesh) stimmen darin überein, dass Zyklone und Sturmfluten häufiger und heftiger werden. Klimaforscher bestätigen das. | Y | 66% | WGI, p.315 |
| | 88 | 367 | S | So erwartet der Weltklimarat einen Anstieg um 15 bis 18 Millimeter pro Jahr. Demnach würde der Meeresspiegel bis zum Jahr 2100 um eineinhalb Meter steigen. | N | N/A | WGI, p.820 |
| | 89 | 367 | E | Die andere große Sorge bereiten die immer heftigeren Wetterphänomene. "Überschwemmungen, Dürren und Zyklone sind nichts Neues für Bangladesch", sagt Nishat (environmental activist, Dhaka), "aber ihre Häufigkeit und Wucht haben sich vervielfacht." | Y | 66% | WGI, p.315 |
| | 90 | 381 | T | Jeder Mensch auf der Welt darf die gleiche Menge CO2 in die Luft pusten. (...) Im Durchschnitt sind das vier Tonnen pro Kopf pro Jahr. Wir müssen aber auf die Hälfte herunter, sonst steigt die Temperatur um vier Grad, das Grönlandeis schmilzt und der Wasserspiegel steigt um sieben Meter. (Felix Finkbeiner, 11yrs, UNEP) | Y | N/A | WGI, p.749 |
| | 91 | 381 | S | Jeder Mensch auf der Welt darf die gleiche Menge CO2 in die Luft pusten. (...) Im Durchschnitt sind das vier Tonnen pro Kopf pro Jahr. Wir müssen aber auf die Hälfte herunter, sonst steigt die Temperatur um vier Grad, das Grönlandeis schmilzt und der Wasserspiegel steigt um sieben Meter. (Felix Finkbeiner, 11yrs, UNEP) | N | N/A | WGI, p.820 |
| | 92 | 413 | T | Der Klimawandel kommt: Spätestens 2070 ist es im Voralpenland im Durchschnitt um zwei bis drei Grad wärmer als heute. | Y | N/A | WGI, p.875 |
| | 93 | 413 | P | Der Forstbetrieb München rechnet mit stärkeren Winden, weniger Niederschlag und mehr Hochwasser, kurzum: mit Verhältnissen "wie in Kroatien oder Nordspanien". | Y | 66% | WGI, p.783/4 |
| | 94 | 424 | T | Über einen Zeitraum von etwa 30 Jahren gab es eine Steigerung der maximalen und minimalen Temperatur (Westkap-Province, South Africa). Je nach Ort fiel sie unterschiedlich groß aus, der Durchschnitt lag jedoch bei ungefähr einem Grad Celsius. | Y | N/A | WGI, p.868 |
| | 95 | 424 | T | 2006 wertete die Universität von Pretoria die Wetterdaten von 26 meteorologischen Stationen in Südafrika aus. Das Ergebnis: Zwischen 1996 und 2003 stieg die Durchschnittstemperatur um ungefähr 0,5 Grad Celsius; die gleiche Steigerung weisen auch minimale und maximale Temperatur auf. | Y | N/A | WGI, p.868 |

*** Statement Categories: T: *Temperature*; P: *Precipitation*; S: *Sea Level*; E: *Extreme Events*; A: *Anthropogenic Global Warming***

**Transcribed statements continued… (DSZ: *Die Süddeutsche Zeitung*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **DSZ** | 96 | 439 | T | Im Mittel dürfte sich das Land (Deutschland) demnach um 2,5 bis 3,5 Grad Celsius erwärmen. Besonders stark steigen die Temperaturen demnach im Winter im Süden Deutschlands. Im Jahr 2100 könnte es dort um mehr als vier Grad wärmer sein als im Vergleichszeitraum 1961 bis 1990. | Y | N/A | WGI, p.875 |
| | 97 | 440 | E | Die Stärke tropischer Wirbelstürme hat in den vergangenen 25 Jahren zugenommen. Am deutlichsten sei der Trend über dem Atlantik und dem nördlichen Teil James Elsner von der Universität Florida in Tallahassee. | Y | 66% | WGI, p.305/15 |
| | 98 | 465 | T | Zwischen 1,1 und 6 Grad Celsius wird sich die Erde bis zum Jahr 2100 erwärmen. (IPCC) | Y | 66% | WGI, p.749 |
| | 99 | 468 | S | Bis zum Ende des Jahrhunderts könnten die Meere um 59 Zentimeter anschwellen, warnt der Klimarat der Vereinten Nationen. | Y | N/A | WGI, p.820 |
| | 100 | 473 | E | Dabei warnt der Russische Dienst für Hydrometeorologie schon für die kommenden zehn Jahre vor "riesigen sozial-ökonomischen Verlusten" infolge einer Zunahme von Extremwetter-Ereignissen. So sollen die Erträge der russischen Landwirtschaft bei Getreide aufgrund von Dürrekatastrophen bis 2015 um etwa elf Prozent und in den folgenden Jahren um bis zu 20 Prozent zurückgehen. | Y | 66% | WGI, p.303/15 |
| | 101 | 476 | T | Europa hat sich in den vergangenen Jahrzehnten stärker erwärmt als der Rest der Welt. Während die Temperaturen im globalen Mittel seit der Industrialisierung um durchschnittlich 0,8 Grad Celsius angestiegen sind, ist es zwischen Kreta und Nordkap, Portugal und Polen um ein ganzes Grad wärmer geworden. | Y | N/A | WGI, p.237 |
| | 102 | 476 | P | Am Mittelmeer ist die Regenmenge in manchen Regionen während des vergangenen Jahrhunderts bereits um ein Fünftel gesunken. | Y | 90% | WGI, p.255/6 |
| | 103 | 476 | P | Auch auf Europas Flüssen und Seen gibt es immer weniger Eis: Zwölf Tage kürzer als zu Beginn des 20. Jahrhunderts sind die Gewässer heute im Winter-Durchschnitt zugefroren. Die Schneedecke ist um fünf Prozent während der vergangenen 40 Jahre geschrumpft. | Y | N/A | WGI, p.339 |
| | 104 | 476 | E | Die Menschen müssen sich auf zunehmende Wetterextreme, Fluten und Hitzewellen einstellen und vor Insekten und Parasiten schützen, die nach Norden vorankommen. | Y | 66% | WGI, p.315 |
| | 105 | 482 | S | Viele Gletscher in Grönland haben sich in den letzten Jahren beschleunigt. Ob sich der rapide Abfluss fortsetze, sei allerdings ungewiss, betonen Glaziologen. James Hansen, ein Klimaforscher von der Nasa, warnte deshalb vor einem "5-Meter-Meeresspiegelanstieg in diesem Jahrhundert". | N | N/A | WGI, p.820 |

*** Statement Categories: T: *Temperature*; P: *Precipitation*; S: *Sea Level*; E: *Extreme Events*; A: *Anthropogenic Global Warming***

**Transcribed statements continued… (DSZ: *Die Süddeutsche Zeitung*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **DSZ** | 106 | 482 | S | Doch so schlimm werde es nicht kommen, haben andere Experten festgestellt. Die Grönlandgletscher könnten gar nicht so schnell abfließen. Vorstellbar sei bis 2100 maximal ein Meeresspiegelanstieg um zwei Meter. | N | N/A | WGI, p.820 |
| | 107 | 491 | T | Mit Hilfe eines mathematischen Modells berechneten sie (Gunnar Brehm et al., Insektenforscher), wie sich eine Erwärmung von 3,2 Grad Celsius, die der Weltklimarat für die Region (North of Costa Rica) in den nächsten 100 Jahren vorhergesagt hat, auf diese Organismen auswirken würde. | Y | N/A | WGI, p.894 |
| | 108 | 529 | T | Sollte die Welt weiter ungehemmt Energie verbrauchen, könnte die Durchschnittstemperatur der Erdatmosphäre bis 2100 um sechs Grad Celsius steigen. (World Energy Outlook, IEA) | Y | N/A | WGI, p.749 |
| | 109 | 536 | T | Werden weiter so viele klimaschädliche Treibhausgase in die Atmosphäre geblasen wie bisher, erhöhe sich die durchschnittliche Temperatur auf der Erde langfristig um sechs Grad Celsius, mit verheerenden Folgen für die Umwelt, heißt es weiter. (OECD World Energy Report) | Y | N/A | WGI, p.749 |
| | 110 | 556 | T | Laut Voigt (Holger Voigt, Germanwatch) könne es zu einer Erderwärmung von vier bis fünf Grad kommen - wenn man weltweit nicht entgegensteuere und weitreichende Maßnahmen treffe. | Y | N/A | WGI, p.749 |
| | 111 | 569 | P | Der Klimawandel "kommt zu rasch für unsere Systeme", sagte Menzel (TU-Professorin Annette Menzel). Im Alpenraum werde er vermutlich eine höhere Variabilität zur Folge haben, mit langen Trockenphasen und höheren Niederschlägen. | Y | 66% | WGI, p.783/4 |
| | 112 | 572 | T | Die Jahresmitteltemperatur stieg dort (Alpen) in den letzten Jahren um etwa 1,5 Grad Celsius an, doppelt so stark wie auf dem gesamten Globus. Bis zum Ende des Jahrhunderts rechnen Forscher sogar mit einem weiteren Anstieg von bis zu 4,5 Grad. | Y | N/A | WGI, p.875 |
| | 113 | 574 | A | Es ist keinesfalls bewiesen, dass der Klimawandel menschengemacht wäre. Wer sich die Mühe macht, auch abweichende Meinungen zu lesen, dem werden bald echte Zweifel kommen, ob menschengemachte CO2-Emissionen Ursache der Erderwärmung sein können. | N | 10% | SPM WGI, p.3 |
| | 114 | 593 | T | In dieser Zeit (1978 - 2008) hat sich der Globus im Durchschnitt um 0,4 bis 0,5 Grad Celsius erwärmt - das ist mehr als die Hälfte der Zunahme, die der Weltklimarat der Vereinten Nationen für das 20. Jahrhundert insgesamt festgestellt hat. (NOAA) | Y | N/A | WGI, p.237 |

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**Transcribed statements continued… (DSZ: *Die Süddeutsche Zeitung*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **DSZ** | 115 | 605 | T | In Südeuropa droht es in diesem Szenario bis zum Ende des Jahrhunderts bis zu 3,6 Grad wärmer zu werden, in Skandinavien 3,3 Grad. Deutschland wird demnach durchschnittlich 3,1 Grad wärmer; der Süden des Landes erwärmt sich stärker als der küstennahe Norden. Am deutlichsten erhöhen sich die Wintertemperaturen in Skandinavien: Sie steigen um bis zu fünf Grad. (CLM TU Cottbus) | Y | N/A | WGI, p.875 |
| | 116 | 605 | P | Südeuropa muss den Simulationen zufolge mit ernsten Problemen rechnen: Dort dürfte im Sommer bis zu 60 Prozent weniger Regen fallen; akuter Wassermangel droht. Der Norden wird dagegen deutlich feuchter. In Mitteleuropa sind im Jahresmittel kaum Veränderungen zu erwarten. (CLM TU Cottbus) | Y | 66% | WGI, p.783/4 |
| | 117 | 605 | P | Im Sommer fällt zum Ende des Jahrhunderts in Deutschland den neuen Simulationen zufolge ein Drittel weniger Regen. Zwar wird der Verlust im Jahresmittel durch eine Zunahme der Niederschläge in den anderen Jahreszeiten ausgeglichen; Wassermangel sei mithin nicht zu befürchten, berichtet Michael Lautenschlager vom Max-Planck-Institut für Meteorologie. | Y | 66% | WGI, p.783/4 |
| | 118 | 611 | S | Er (der Klimawandel) wird in diesem Jahrhundert den Meeresspiegel Prognosen zufolge um etliche Dezimeter ansteigen lassen (...). | Y | N/A | WGI, p.820 |
| | 119 | 611 | E | Er (der Klimawandel) wird in diesem Jahrhundert den Meeresspiegel Prognosen zufolge um etliche Dezimeter ansteigen lassen und womöglich die Gewalt schwerer Winterstürme in der Nordsee verstärken, die das Wasser in die Elbe schieben und in Hamburg Sturmfluten auslösen. | Y | 66% | WGI, p.315 |
| | 120 | 611 | E | Da die Winter in Deutschland den Prognosen zufolge wärmer und regnerischer werden, wird es mehr Fluss-Hochwasser geben. (Bericht "Deutsche Anpassungsstrategie an den Klimawandel") | Y | 66% | WGI, p.783/4 |
| | 121 | 611 | P | Trockene und heiße Sommer werden die Ernten gefährden, und Menschen werden unter der Hitze leiden. (Bericht "Deutsche Anpassungsstrategie an den Klimawandel") | Y | 66% | WGI, p.783/4 |
| | 122 | 612 | T | "Seit 2001 gehören sämtliche Jahre zu den zehn wärmsten in der Statistik", sagt er (Phil Jones, Uni East Anglia, Norwich). "Im globalen Durchschnitt sind sie 0,2 Grad wärmer als die 1990er-Jahre", zu denen immerhin das Rekordjahr 1998 zählt. | Y | N/A | WGI, p.237 |
| | 123 | 618 | E | Von sintflutartigen Überschwemmungen in der Monsunzeit redet er (Atiq Rahman, Klimaforscher India) und von verheerenden Dürren in der Trockenzeit. | Y | N/A | WGI, p.883 |

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**Transcribed statements continued… (DSZ: *Die Süddeutsche Zeitung*; NZZ: *Neue Zürcher Zeitung*)**

| Pub. | SN | AN | SC* | Statement transcriptions | Correct | AR4 % | IPCC Reference |
|---|---|---|---|---|---|---|---|
| **DSZ** | 124 | 618 | E | Immer öfter und stärker werden Wirbelstürme über das Land fegen, so wie 2007, als Sidr 3500 Menschen in den Tod riss und zwei Fluten den Rest zerstörten. (Atiq Rahman, Klimaforscher India) | Y | 66% | WGI, p.315 |
| | 125 | 618 | E | Es werde immer mehr und immer stärkere Zyklonen geben, die Gletscher im Himalaya werden immer schneller abschmelzen, es wird immer weniger Anbaufläche geben und somit auch immer weniger Essen. (Atiq Rahman, Klimaforscher India) | Y | 66% | WGI, p.315 |
| **NZZ** | 126 | 622 | A | Seit etwa 1850 erwärmt sich das Klima wieder, nach einer 400-jährigen "kleinen Eiszeit". Es ist nicht bekannt, ob und in welchem Ausmass dies auf natürliche Phänomene oder auf menschliche Beeinflussungen zurückzuführen ist. (Rudolf Sommer, Letter!) | N | 10% | SPM WGI, p.3 |
| | 127 | 623 | E | Dürren, Hochwasser und Krankheiten sind als Folge des Klimawandels zu erwarten. Sie werden viele Länder mit mittleren und tiefen Einkommen besonders stark belasten. | Y | 66% | WGI, p.783 |
| | 128 | 629 | A | Aber zu warm werden soll es, andererseits, eben auch nicht; die zwei noch verkraftbaren Grad, auf welche die vom Menschen (mit) "gemachte" Klimaerwärmung sich nach verschiedenen Szenarien soll beschränken lassen können, haben der Ausstellung den Titel gegeben. | Y | 90% | SPM WGI, p.3 |
| | 129 | 639 | E | Bereits jetzt gebe es mehr Dürren und Überschwemmungen. (Rajendra Pachauri) | Y | 66% | WGI, p.315 |
| | 130 | 642 | T | Dennoch seien die Temperaturen des letzten Jahrzehnts auf der Nordhalbkugel "wahrscheinlich anomal" im Vergleich mit den letzten 1300 Jahren. (Michael E. Mann) | Y | N/A | WGI, p. 474 |
| | 131 | 664 | E | In der Schweiz rechnet man infolge der Klimaerwärmung mit einer Zunahme von Stürmen, Dürren im Sommer und feuchtmilden Wintern. | Y | 66% | WGI, p.783 |
| | 132 | 693 | A | Darin (IPCC AR4) kam das IPCC zum Schluss, die Aussage, der Klimawandel der letzten 50 Jahre werde zum grössten Teil vom Menschen verursacht, sei nicht nur mit einer Wahrscheinlichkeit von über 66 Prozent, wie es dies 2001 errechnet hatte, sondern von über 90 Prozent richtig. | Y | 90% | SPM WGI, p.3 |

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