Media Attention for Climate Change around the World: Data from 27 Countries

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Abstract

Climate change is a global phenomenon, and its outcomes affect societies around the world. So far, however, studies on media representations of climate change have mostly concentrated on Western societies. This paper will go beyond this limited geographical scope by presenting a comparative analysis of issue attention in 27 countries worldwide. Our sample includes, among others, countries which commited themselves to greenhouse gas emission reductions under the Kyoto Protocol (such as Germany) and countries that are strongly affected by the consequences of climate change (e.g. India). First, we describe the development of media attention for climate change in these countries from 1996 to 2010. Second, we use time-series analysis to explain the issue attention cycles of Australia, Germany and India. Our analyses show that climate change coverage has increased in all countries, although the extent of that growth differs. Our explanation of issue attention in Australia, Germany and India revealed that weather phenomena only play a subordinate role for media attention, while social factors are more important. Particularly international political events and the activities of international environmental NGOs are important drivers of media attention for climate change.

The news media are "important agents in the production, reproduction, and transformation of the meaning" of anthropogenic climate change (Carvalho, 2010: 172). After all, it is a complex phenomenon with many uncertainties attached, and with causes and consequences that lie beyond the immediate life-worlds and biographical horizons of most people. The media have therefore proven to be the main sources for information about climate change (e.g. Schäfer, 2012a; Stamm, Clark, & Eblacas, 2000; Synovate, 2010), from whom the "public draws most of its knowledge" (Anderson, 2011: 535; see Smith, 2005: 1471) about the issue.

Accordingly, many studies have analyzed the media's representation of climate change in the past years. This article will add to this literature by analyzing issue attention cycles for climate change in a comparative, cross-national study that includes countries with different degrees of responsibility for climate change and vulnerability to its consequences.

1 Conceptual Framework and Research Question

Because the "carrying capacity" (Henry & Gordon, 2001: 157; Hilgartner & Bosk, 1988: 58f) of news media is limited due to finite numbers of newspaper pages or airtime minutes, they can only give attention to a small number of issues at any point in time. Issue attention measures the amount of attention given to one issue in relation to the amount of attention given to other issues at the same time. Typically, it peaks for rather short periods of time, after which it subsedes. This might create "issue attention cycles" with successive attention phases, from early or latency over peak to decline phases (Downs, 1972; Luhmann, 1971; Nisbet & Huge, 2006; Rödder & Schäfer, 2010), which might occur repeatedly over time (see Newig, 2004: 158).

While issue attention is a basic characteristic of media coverage, it is also highly relevant, because it signals an issue's perceived importance to the media's audience and has effects on them (Hilgartner & Bosk, 1988). The attention for an issue relative to others, i.e. its rank on the media "agenda", has "agenda setting" effects (e.g. Dearing & Rogers, 1996; for agenda setting on the climate change issue see Sampei & Aoyagi-Usui, 2009; Shah, McLeod, Gotlieb, & Lee, 2009): the more attention an issue gets, the more important it seems – ceteris paribus – to the audience. Therefore, issue attention may influence how audience members act upon these issues, including "the actions governments and parliaments take in the areas of public concern" (Newig, 2004: 151).

Accordingly, a number of studies on climate change communication have touched upon issue attention so far (see Table 1 for an overview), but the respective literature still has some crucial gaps.

1. First, issue attention has only rarely been the main issue of existing studies. While many studies have analysed how stakeholders try to get their views represented in the media (for overviews see McCright & Dunlap, 2000, 2003; Schlichting, 2012, in press; Schmidt, 2012), how journalists view climate change and how the media subsequently frame it (e.g. M. T. Boykoff, 2007; M. T. Boykoff & Boykoff, 2007; Carvalho, 2007), or what people learn from that (e.g. Arlt, Hoppe, & Wolling, 2011; Ryghaug, Holtan Sørensen, & Næss, 2011; Zhao, 2009), analyses focussing on issue attention in particular are less numerous. Most studies address issue attention in passing.
2. Second, most of these analysis are single-case studies (see Schäfer, 2012b). They provide data on issue attention development for certain countries, e.g. Australia (Farbotko, 2005), Canada (Ahchong & Dodds, 2012; Young & Dugas, 2011),

Finland (Lyytimäki & Tapio, 2009), Germany (Weingart, Engels, & Pansegrau, 2000), India (Jogesh, 2012), Switzerland (Besio & Pronzini, 2010), the UK (M. T. Boykoff & Mansfield, 2008; Carvalho & Burgess, 2005) or the US (M. T. Boykoff & Boykoff, 2007; Liu, Lindquist, & Vedlitz, 2011). But because of their different analytical perspectives, research questions, analyzed time frames and media, data and methods, their results are difficult to compare.[1] Comparative research, in turn, is missing, albeit it has been described as particularly necessary in climate change communication (Anderson, 2009: 176f). After all, the phenomenon itself affects practically all countries worldwide, although to different degrees: On the one hand, increases in average temperatures are measurable on all continents (IPCC, 2007: e.g. 11), will have worldwide consequences (see Dryzek, Norgaard, & Schlosberg, 2011; WBGU, 2008), and political measures designed to mitigate them are pursued on the global level (Gupta, 2010; Keohane & Victor, 2011). On the other hand, causes and effects of climate change are distributed unequally across countries (e.g. Füssel, 2010).

3. Third, these studies focus almost exclusively on industrialized countries. Even most of the existing comparative studies analyze industrialized countries only (e.g. M. T. Boykoff, 2007; M. T. Boykoff & Rajan, 2007; Brossard, Shanahan, & McComas, 2004), with only few exceptions such as Boykoff/Mansfield (2012), Eide et al. (2010), Schäfer et al. (2011), and Shanahan (2009) which include emerging economies such as Brazil or India, or non-industrialized societies such as Namibia (see also Jogesh, 2012; Miah, Kabir, Koike, & Akther, 2011).
4. Fourth, not all studies couple their descriptions of the issue's ups and downs with explanations (for exceptions see M. T. Boykoff, 2011; Brossard, et al., 2004; Liu, et al., 2011). Only very few studies have "examined the relationship between long-term, system-level, climate change indicators and national media […] attention" (Liu, et al., 2011: 406).

We will address these gaps in scholarship by providing a comparative analysis of media attention for climate change in 27 countries across the world. For these countries, we

[1] For example, Carvalho's "Critical discourse analysis" (2007) compares three British newspapers from 1985 to 2001 and finds that scientific uncertainties in describing climate change are a major theme. Gordon et al. (2010) find, in contrast, that uncertainty is hardly an issue at all and that "scientific conflict/controversy" accounts for less than five percent of all comments made about climate change in the Mexican newspaper "Reforma" from 2004-2006. It is difficult to know, however, whether these differences are attributable to the country or to the different methodologies, analytical time frames, or sampling methods used.

have acquired comparable data over similar time periods, which we will analyse with similar research methods.[2] Furthermore, we will explain the media attention characteristics for three countries.

Table 1: Overview over studies on climate change communication which address issue attention

Study	**Case**	**Media** (unless otherwise stated: newspapers) **and article sample**	**Results**
Farbotko, 2005	Australia 1990-2004	Media: *Sydney Morning Herald* Search Keywords: "Tuvalu", then manual check for climate change; N = 38	Biggest share of articles in 2001, followed by 2002, all other years with only minor attention
Miah, et al., 2011	Bangladesh 2006-2009	Media: *The Daily Prothom Alo, The Daily Ittefaq*, *The Daily Star;* search Keywords: ?; N = 1992	Fluctuating attention, gradual increase from the beginning of 2009
Ahchong & Dodds, 2012	Canada 1988-2007	Media: *Toronto Star, Globe and Mail*; search keywords: "greenhouse gas", "climate change", "global warming"; N = 2893	Overall increasing attention, peaks in 1990, 2002 and 2007 coincident with international events (COPs), similar distribution in both newspapers
Lyytimäki & Tapio, 2009	Finland 1990-2009	Media: *Helsingin Sanomat;* search keyword: "ilmastonmuutos"; N = 44238	Relatively stable distribution in the 1990s, increase since 2000 and esp. since 2004, peaks in 1997, 2001, January 2007 and February 2008
Lyytimäki, 2011	Finland 1990-2010	Media: *Helsingin Sanomat,Keskisuomalainen, Aamulehti, Ilta-Sanomat, Iltalehti, Maaseudun Tulevaisuus*; search keyword: „ilmastonmuutos"; N = ?	Modestly rising attention until 2006, sharp increase in 2007, decline since 2009, peaks coincident with international events, similar patterns in national and regional broadsheet newspapers
Aykut, Comby, & Guillemot, 2012	France 1986-2006	Media: *Le Monde, Sud-Ouest*, *L'Express*; search keywords: "changement(s) climatique(s)", "effet de serre", "réchauffement global", "réhauffement de la planéte"; N = ?	Overall increasing attention, moderate attention before 2000, then marked increase, peaks coincident with international events, domestic weather events and national political events, similar distribution in all three newspapers
Brossard, et al., 2004	France, USA 1987-1997	Media: *Le Monde, New York Times; search keywords*: "global warming" or "climate change" or "greenhouse effect"; N = 530	France: attention cycles with peaks in 1989/1997; US: many peaks coincident with political events, highest: 1997
Weingart, et al., 2000	Germany 1975-1995	Media: *Der Spiegel*, *Süddeutsche Zeitung, Frankfurter Allgemeine Zeitung* N = 478	Low attention until 1987, then rise, peak in 1992 (Rio Earth Summit), afterwards attention remains on higher level
Grundmann & Krishnamurthy, 2010	France, Germany, UK, USA 1980-2007	Media: full text search in data base Nexis; search keywords: "climate change", "global warming", "greenhouse effect" (and German and French equivalents); N = 599361	Rising issue attention in all countries, exponential rise after 2005, peak in 2007
Jogesh, 2012	India 2004 - 2009	Media: *The Indian Express, The Hindu, Hindustan Times, The Times of India*; search keywords: "climate change", "global warming", "greenhouse gas emissions", "IPCC", "Copenhagen"; N = 1938	Steady rise of attention until 2009, sharp rise in December, peaks coincident with international events
Sampei & Aoyagi-Usui, 2009	Japan 1998-2007	Media: *Yomiuri, Asahi*, and *Mainichi* Search keywords: "chikyu ondanka" (global warming), "kiko hendo" (climate change); N = 25532	Overall increasing attention, peaks coincident with international political events, sometimes also with domestic events

[2] The results presented here stem from the "Global Media Map on Climate Change" project, conducted by the research group "Media Constructions of Climate Change" at the University of Hamburg. The project was funded by the German Science Foundation (DFG) through the German Federal Cluster of Excellence "Climate System Prediction and Analysis" (EXC 177), and Mike S. Schäfer profited from a Research Grant from the US Fulbright Foundation for a stay at the Center for Global Communications Studies of the University of Pennsylvania's Annenberg School for Communication. The authors would like to thank Jan Murmann and Sarah Pleger for supporting several stages of the project, Linny Bieber, Hana Sowjanya Mutopalli, Navina Neverla, Audrius Paura, Edu Schreuders and Kukuli Tenorio Polo for collecting and cleaning the data for individual countries, and Jana Tereick for her advice on database searches and computer-assisted data cleansing.

Gordon, et al., 2010	Mexico 2004-2006	Media: *Reforma*; search keywords: “calentamiento global” (global warming) or “cambio climático” (in headline or first paragraph); N = 144	Cyclical nature of coverage, peaks coincident with international events (COPs), greatest peak in 2006
Takahashi & Meisner, 2012	Peru 2000-2010	Media: *Correo, El Comercio, El Peruano, Expreso, La Primera, La Razon, La Republica, Gestion, Ojo, Peru21; search keywords*: “climate change,” “global warming,” “greenhouse effect,”, “greenhouse gases”; N = 459	Low attention until 2006, then rising attention with peaks in 2007 and 2008, decrease in 2009 and 2010
Shehata & Hopmann, 2012	Sweden, USA 1998-2007	Media: *Dagens Nyheter* and *Svenska Dagbladet, New York Times, Washington Post; search keywords*: “kyoto*”, “klimatför*”, “växthuseffekt*”, “växthusgas*” / “Kyoto”, “climate change”, “global warming”; N = 1781	Overall increasing attention in both countries, esp. since 2005, more attention in US than in Sweden, similar distribution of ups and downs
Besio & Pronzini, 2010	Switzerland 1987-2006	Media: *Neue Züricher Zeitung*, *Tages-Anzeiger*; search keywords: ?; N = ?	Overall increasing attention, peaks in 1990, 1992, 1995, 1997, 2001, 2005 and 2006 coincident with national and international political events, similar distribution in both newspapers
Carvalho & Burgess, 2005	UK 1985-2003	Media: *The Guardian, The Independent, The Times*; search keywords: “climate change“, “global warming”, “greenhouse effect.”; N = 5913 articles	First increase in 1990, then decline 1991-1996, another rise from 1997, peak in 2001, similar distribution in all newspapers
Doulton & Brown, 2009	UK 1997-2007	Media: *The Guardian, The Independent, The Telegraph*, *The Times* (Newspapers); search keywords: ?; N = 158	Overall rising attention, peaks in 2000/20001 (Guardian: 2001/2002) and 2006/2007, decline around 2003
M. T. Boykoff & Mansfield, 2008	UK 2000-2008	Media: *The Sun, Daily Mail, Daily Express*, and *Mirror*; search keywords: “climate change” or “global warming”; N = 974	Trend shows increasing attention, with three peaks: November/December 2000, June/July 2005 and September/November 2006
Liu, et al., 2011	USA 1969-2005	Media: *New York Times*; search keywords: “climate change”, “global warming”, “greenhouse gas”; N = 4197	Overall rising attention, very little coverage pre-1980s, steep increase in 1988, fluctuations in 1990s, highest attention in 2000s
McComas & Shanahan, 1999	USA 1980-1995	Media: *New York Times, Washington Post*; search keywords: “climate change”, “global warming”, “greenhouse”; N = 376	Very low attention until 1987, sharp increase in 1988, peak in 1989, afterwards decline until 1994, small rise in 1995
Trumbo, 1996	USA 1985-1995	Media: *New York Times, Washington Post, the Los Angeles Times, Christian Science Monitor, Wall Street Journal;* search keywords: “global warming”, ”greenhouse effect”, “climate change”; N = 252	Low attention until 1988, then increase with peaks e.g. coincident with Rio Earth Summit, decline after 1992
M. T. Boykoff & Boykoff, 2007	USA 1988-2004	Media: *New York Times, Los Angeles Times, Washington Post, Wall Street Journal*; *ABC World News Tonight, CBS Evening News, NBC Nightly News* (TV); search keywords: “global warming”, “climate change”; N = 4887 articles, 293 segments (TV)	Overall increasing attention, five time periods with most coverage: 1990, 1992, 1997, 2001–2002, and 2004, peaks coincident with major international events (reports and conferences)
M. T. Boykoff, 2008	USA 1995-2004	Media: *ABC World News Tonight, CBS Evening News, NBC Nightly News*, *CNN WorldView, CNN Wolf Blitzer Reports, CNN NewsNight* (TV); search keywords: “global warming”, “climate change”; N = 213	Low attention in 1995 and 1996, increase in 1997, where the biggest share of segments occur, decline and raise to another peak in 2000, again decline (lowest point 2003) and small raise in 2004
M. T. Boykoff & Mansfield, 2012	World (organized by continent, 2004-2012)	Media: *approx. 50 newspapers; search keywords*: “climate change”, “global warming”; N = ?	Europe and North America: rising attention with peak in 2007, then decrease except remarkable peak in 2009 (COP 15), Oceania: similar trend with less peaks, South America, Africa and Asia: less attention, later rise, no decrease
Corfee-Morlot, Maslin, & Burgess, 2006	World 1993-2006	Media: *“major global newspapers”* Search keywords: ?; N = ?	Upwards trend with peaks in 1997/1998, 2000/2001 and general rise since 2004

Thus, we will be tackling two research questions in our article:

RQ 1: *How did media attention to climate change develop in different countries?*

RQ 2: *Which factors influence the development of media attention for climate change?*

2 Hypotheses

For both research questions, we can formulate hypotheses based on theoretical considerations and existing data. For RQ 1, i.e. for the description of media attention for climate change in different countries, we have developed two hypotheses:

> ***H1: Issue attention for climate change has increased in all countries over the analysed timespan (1996-2010).***
>
> While generally, there are always "ebbs and flows in reporting climate change over time" (Anderson 2009: 167), we assume that there is a rising trend overall. This assumption rests on a number of developments: First, the climate-related agenda building efforts of various actors outside the media have increased. Over the 15 years analysed here, the number of scientific publications mentioning climate change mushroomed (Weingart, et al., 2000), climate science become increaingly institutionalized (Schützenmeister, 2008), new political institutions and national climate policies or strategies were established (Townshend, et al., 2011: 5), many environmental NGOs made climate change their focal issue (e.g. DeLuca, 2009; Hopf, 2012), celebrities took stances on it (Anderson, 2011) etc. These agenda building efforts made it easier and more relevant for the media to cover climate change, and other developments might furthered climate change's media appeal: the certainty about climate change and its anthropogenic causes – at least in mainstream climate science – was pointed out (Oreskes, 2004), making it a more robust case on which to report (e.g. Evans & Pearson-Merkowitz, 2012: 6) as well as interesting when a deviant position came up. Also, more negative diagnoses about the problem and its consequences were published in the IPCC ARs (Duffey & Dincer, 2010), and such negative consequences are specifically likely to get environmental issues into the mass media (Brossard, et al., 2004; also Downs, 1972; Newig, 2004: 164). In addition, existing data also point to a rising trend in several countries and regions – such as Boykoff and Mansfield's data on the number of articles written about climate change by continent from 2004 onwards (M. T. Boykoff, 2011: 20f; M. T. Boykoff & Mansfield, 2012; see table 1).

H2: Issue attention differs from country to country – it is higher in countries which are affected by climate change as well as in countries responsible for climate action.

Despite the general rise in issue attention, we assume that there will be country differences both in the amount of media attention for climate change and in its growth rates. Some countries' responsibility for climate change and their related pressures are high, as evident in the "differentiated responsibility" principle in the Kyoto Protocoll which only requires action from industrialized countries listed in Annex B of the treaty (Moellendorf, 2009). These countries face more international pressure to reduce greenhouse gas emissions along with domestic activities and costs of all kinds. Also, some countries, like Bangladesh, Papua New Guinea or Yemen, are particularly vulnerable to climate change's negative effects (DARA & Climate Vulnerable Forum, 2010: 231). In both country groups, media can be expected to devote a lot of attention to climate change, albeit focusing on different events and developments. In contrast, in countries like Brunei, Jordan or Singapore, which are neither strongly affected nor under particular political pressure, climate change should be a less important topic in the media.

The second, explanatory research question acknowledges that issue-attention is not determined by qualities inherent in a given issue, but influenced by a variety of factors. Liu et al. (2011: 405f), in their analysis of media and congressional attention for global warming in the US, have proposed an explanatory model based on agenda setting theory, multiple streams theory, and punctuated equilibrium theory that organizes these factors into three groups:[3]

The first are "problem indicators", meaning "factual indicators surrounding the problem" (Liu, et al., 2011: 406; see also the „real-world indicators" by Vliegenthart & Boomgaarden, 2007). In the case of climate change, these might be "factual and baseline information indicators" such as average temperatures or "short-term extreme weather conditions" (Liu, et al., 2011: 406), particularly because the latter have high news value due to the potential damage they do, and are often connected to anthropogenic climate change in the media (Neverla & Schäfer, 2010: 10f; Ungar, 1992), even though this connection may not be fully established scientifically (Stehr & von Storch, 1999: 17f).

[3] In addition to media attention, Liu et al. (2011: 416) also analyze political attention for climate change. Therefore, their analysis includes a fourth group of influential factors which includes the interactions between political and media attention, and which is left out here.

The second are "focusing events" which "push concern above the noise threshold of other issues" (also Cobb & Elder, 1983; Dearing & Rogers, 1996; Liu, et al., 2011: 406). These can be "natural or manmade crises and disasters" (Liu, et al., 2011: 406) such as September 11, 2001, Hurricane Katrina, or – which Liu et al. suggest for the case of climate change – "high-profile international events" (2011: 407) such as the annual, international Conferences of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC).

Liu et al. labelled the third group of factors potentially influencing issue attention "feedback". With this, they refer to the constant feedback that diverse stakeholder and pressure groups give on societal matters, such as "citizen complaints, interest group pressures, and opinion leaders", or "the scientific community" (Liu, et al., 2011: 407) which continuously comment on topics that concern them.

Liu et al. have demonstrated the usefulness of this model by explaining the New York Times' attention to climate change. We will also employ this model, but adapt it for our purposes in two ways: On the one hand, Liu et al. focus strongly on political and scientific factors as drivers of media attention. This has to be supplemented, in our view, by the activities of other stakeholders, most importantly NGOs, but also from the realms of the economy and culture. All of these fields have increasingly tried to build the media and public agenda on climate change and have, at least partly and in specific settings, succeeded (e.g. Gavin, 2010; Ihlen, 2009; McCright & Dunlap, 2000; Schlichting, 2012, in press). Therefore, we will include political and scientific events, but also hybrid political/scientific events such as the publication of the „Intergovernmental Panel on Climate Change's" (IPCC) Assessment Reports, cultural events like the premieres of movies such as "An Inconvenient Truth" (see M. T. Boykoff, 2011: 20f; Hart & Leiserowitz, 2009; Lofgren & Nordblom, 2010; Williams & Carpini, 2012: 171f, 209f) etc. On the other hand, we will include both international and national factors (cf. Olausson, 2009) – in order to be able to distinguish between country specific and transnational drivers for media attention.[4] Again, we can formulate two hypotheses here:

[4] We underestimate journalistic intervention in our analysis, such as "elements of institutional constraints (Sigal 1973), news values (Golding 1981), and journalistic professional standards, individual or collectively internalized moral values associated with the social role as journalist (Gans 1979) and work routines (Tuchman 1972; Shoemaker and Reese 1991)" (Brandenburg, 2002: 39), but a) this has received quite a lot of attention already and b) its role may not be so strong in issue attention anyway (see already Baerns, 1987), and c) we could not do this in so many countries over time because journalistic cultures are hard to assess and change over time – we aimed to minimize these effects by selecting the same kinds of newspapers as much as possible in all countries.

H3 Extreme weather phenomena have strong positive effects on issue attention.

Regarding the "factual indicators" dimension, we assume that only some of them will influence issue attention. The available evidence suggests that some "factual" developments do not influence issue attention (Newig, 2004: 151): Long-term, slowly developing phenomena tend to be omitted by the news media, which "have traditionally had difficulty with 'creeping' environmental problems that lack abrupt events and often blur the boundaries between geographic scales" (cf. M. T. Boykoff, 2007; Young & Dugas, 2011: 4).[5]

Instead, a number of studies indicate that "short-term, weather-related, extreme conditions […] contribute to increase[d] attention to the climate change issue" (Liu, et al., 2011). This seems to be true for weather events such as heat waves and droughts, extreme precipitation and storms (Aykut, et al., 2012: 162; Corfee-Morlot, et al., 2006: 2766; Gordon, et al., 2010: 147, 164; Ungar, 1992) as well as for floods (Gavin, Leonard-Milsom, & Montgomery, 2011: 428).

H4 Politicical activity has strong positive effects on issue attention.

Apart from "factual indicators", the "agenda building" (Brandenburg, 2002; Petrocik, 1996) from different societal stakeholders is important, maybe even increasingly so in recent years.[6] Amongst these stakeholders, we assume that political actors are most influential (Anderson, 2009: 535). They are, first of all, the societal sphere that organizes collectively binding decisions, and that therefore is generally strongly represented in the media (Gerhards & Schäfer, 2006: 21; cf. Newig, 2004: 177). Also, the "indexing hypothesis states that news coverage of political issues is driven by, and dependent on, elite political actors, while unofficial actors tend to have a secondary role at best" (Shehata & Hopmann, 2012: 177) Regarding climate change, political solutions are the ones that are most often expected because the market can not solve the problem (Stern, 2007). Accordingly, international political events, particularly COPs, have proven to influence media coverage in the US (e.g. Anderson, 2009: 168; J. Boykoff, 2012:

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5 Although it has to be noted that Shanahan/Good (2000) find some evidence for a connection between local New York temperatures and New York Times coverage on climate change (there were no such effects for the Washington Post, however).

6 The rationale behind this assumption is that of a "lazy media" (Bolt in Lockwood, 2008: 3) in which "[e]conomic pressures and organizational pressures have led to [environmental] journalism that is increasingly desk-bound, which in turn has increased the scope for proactive news sources and news-providers to 'subsidize' the work of news organizations and their journalists with ready-packaged and advantageously framed 'information', while at the same time depriving journalists of some of their most traditional networking and source-checking strategies based around 'face-to-face' interviews or contacts with sources" (Hansen, 2011: 12; cf. Ladle, Jepson, & Whittaker, 2005: 239).

256; M. T. Boykoff & Boykoff, 2007; Mazur, 2009), in Switzerland (Besio & Pronzini, 2010: 290), Mexico (Gordon, et al., 2010: 210), India (Billett, 2010: 5), Canada (Ahchong & Dodds, 2012: 54), Japan (Sampei & Aoyagi-Usui, 2009: 205) or Germany (Schäfer, et al., 2011).

For the case of climate change, however, we assume that there will be a specific to the predominance of political actors: Environmental non-governmental organizations (ENGOs), i.e. representatives of the political periphery, are also likely to be important and active catalysts of issue attention as well. Many of them have been "at the forefront of climate change communication and action ever since the Intergovernmental Panel on Climate Change (IPCC) published its first assessment report in 1990[,] central to its politicisation, providing interpretive frameworks [and acting] as sources for mediatization of climate change"(Brunnengräber, 1997; Doyle, 2009: 103f.; cf. Young & Dugas, 2011: 11).

3 Research Design, Data and Methodology

We will tackle our research questions in a two-step approach: First, we will describe media attention to climate change in 27 countries worldwide. Second, we will explain media attention, using time series analysis, in three selected country cases: in Germany, Australia and India.

3.1 Descriptive Part of the Study

We analyze media attention to climate change in 27 countries' leading media from 1996 through 2010. We selected countries representing different levels of responsibility (both in terms of its causes, esp. different levels of CO2 emissions, cf. Watkins, 2007: 310f, and for action, i.e. obligations under the Kyoto Protocol), as well as varying degrees of vulnerability to its consequences (e.g. extreme weather events, like floods, cf. Harmeling, 2011). According to our hypotheses, these two factors lead to differentiated developments in the media attention to climate change – because they potentially provide occasions for journalists to report on the topic and trigger activities by social actors which in turn might influence media attention. Finally, in order to account for the global character of the issue, we selected countries from all continents. The subsequent sample includes industrialized countries, emerging economies and developing countries: Algeria, Australia, Brazil, Brunei, Canada, China, France, Germany, Great Britain, India, Indonesia, Ireland, Israel, Jordan, Malaysia, Mexico, Namibia, Netherlands, New Zealand, Papua New Guinea, Russia, Singapore, South Africa, Spain, Thailand, USA, Yemen.

We chose – depending on availability[7] – one or two leading print media from each country for the analysis, which we define as media that have a "guiding societal function" (Wilke, 1999: 302) based, for example, on their circulation, reputation or quality of journalism. Print media were selected since they offer a simpler means of methodically collecting and analyzing data, with respect to the geographic and temporal reach of the study. However, in some countries, print media may have a smaller influence than television, for example. Using reputable sources (e.g. Hans-Bredow-Institut, 2009), leading print publications were selected for each country which a) are preferably published daily b) have a universal and national coverage, c) a large circulation, and d) high journalistic standards ('quality newspapers').

The basic population of this study was defined as all articles of these newspapers which explicitly mention climate change (even without climate as the main focus of the article). A reference to climate change exists when: a) the keyword 'climate' appears in connection with words indicating change (i.e. change, development, warming, cooling); b) the article includes words synonymous to climate change, such as 'greenhouse effect' or 'global warming'; or c) when a global change of temperature is discussed. These conditions were operationalized by broadly-defined search-strings[8] which subsequently were employed for full-text searches in electronic databases.

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[7] We aimed to sample two leading print media per country in order to represent different political positions and "ideological cultures" (Carvalho, 2007) that are represented in most national media systems. In some countries, however, sampling two newspapers over our rather long time period was not possible. For these countries, we sampled one newspaper, which can be justified, we believe, because newspaper with different ideological positions have still proven to exhibit very similar issue attention pattern (Ahchong & Dodds, 2012; Aykut, et al., 2012; Besio & Pronzini, 2010: 289; Carvalho & Burgess, 2005: 1462; Lyytimäki, 2011; Sampei & Aoyagi-Usui, 2009), even though they may differ in content. Similarly, Newig (2004: 157, 176) shows that FAZ and taz, two very different German newspapers, had very similar attention cycles on Lady Di's death and that they were also very similar on BSE.

[8] The search string was developed, repeatedly controlled and validated by native speakers in Chinese, German, English, French, Dutch, Russian, and Spanish. In English it reads as follows: "(climat* W/5 (chang* OR catastroph* OR disaster* OR transform* OR adjust* OR trend* OR world* OR earth* OR warm* OR heat* OR cool* OR variab*)) OR ((greenhouse* W/3 effect*) OR ((global* OR earth* OR world* OR international* OR hemisphere*) W/5 (warm* OR heat* OR cool* OR chill*)) OR ((temperature* W/5 (global* OR earth* OR world* OR international* OR hemisphere*) W/8 (increas* OR rising* OR rise* OR decreas*))". This complex search string allows us a better coverage of the targeted basic population than many other publications which work with fewer and less-detailed search terms such as "climate change" and/or "global warming" (M. T. Boykoff & Boykoff, 2007: 1194; Grundmann, 2006: 86; Krosnick, Holbrook, & Visser, 2000: 258; Olausson, 2009: 434).

Table 2: Overview of analyzed countries and newspapers

Country	*Newspaper*	*LMI*	*Time period*	*N articles*	*Climate Risk Index 2012*	*Responsibility: Per capita CO2 emissions (t); status in Kyoto Protocol*
Algeria	El Watan	4	07/04 - 06/10	549	94	5.5
Australia	The Australian Sydney Morning Herald	4 4	01/96 - 05/10 01/96 - 06/10	13,906 9,534	44	16.2 Annex B
Brazil	Folha de São Paulo	4	09/97 - 06/10	3,617	96	1.8
Brunei	Borneo Bulletin	3	07/97 - 06/10	590	174	24.0
Canada	Toronto Star The Globe and Mail	4 4	01/96 - 06/10 01/96 - 06/10	7,773 8,350	110	20.0 Annex B
China	People's Daily	4	01/96 - 08/09	2,575	21	3.8
France	Le Figaro	4	01/97 - 06/10	4,218	26	6.0 Annex B
Germany	Süddeutsche Zeitung Frankfurter Allgemeine	4 4	01/96 - 06/10 01/96 - 06/10	6,894 6,404	32	9.8 Annex B
Great Britain	The Times The Guardian	4 4	01/96 - 06/10 01/96 - 06/10	9,946 12,484	66	9.8 Annex B
India	The Hindu Times of India	4 4	01/96 - 06/10 04/97 - 06/10	5,710 3,137	20	1.2
Indonesia	Jakarta Post	4	01/96 - 06/10	2,492	47	1.7
Ireland	Irish Times	4	01/96 - 06/10	6,151	143	10.5 Annex B
Israel	Jerusalem Post	4	01/97 - 05/10	742	113	10.4
Jordan	The Star	2	09/03 - 06/10	101	151	2.9
Malaysia	New Straits Times	4	01/96 - 06/10	1,757	87	7.5
Mexico	Reforma	4	01/96 - 06/10	4,061	49	4.2
Namibia	The Namibian Allgemeine Zeitung	4 4	01/04 - 06/10 06/01 - 06/10	801 134	79	1.2
Netherlands	De Volkskrant	4	01/96 - 06/10	2,652	72	8.7 Annex B
New Zealand	New Zealand Herald The Press	4 4	01/96 - 06/10 06/96 - 06/10	4,961 1,955	78	7.7 Annex B
Papua NG	PNG Post Courier	4	11/01 - 06/10	838	45	0.4
Russia	Izvestija	4	01/96 - 06/10	496	18	10.6 Annex B
Singapore	Straits Times	4	01/96 - 06/10	2,497	177	12.3
South Africa	Sunday Times The Star	3 4	06/01 - 06/10 01/07 - 06/10	383 1,066	83	9.8
Spain	El Pais	4	04/96 - 06/10	6,787	27	7.6 Annex B
Thailand	Bangkok Post The Nation	4 4	01/97 - 06/10 06/98 - 06/10	1,542 1,275	55	4.2
USA	New York Times The Washington Post	4 4	01/96 - 05/10 01/96 - 06/10	8,676 8,095	34	20.6 Annex B, not ratified
Yemen	Yemen Times	3	04/03 - 10/09	112	59	1.0
Total				**153,261**		

The Leading Media Index (LMI) was constructed from the sum of four dichotomous variables. A score of 4 refers to a *national quality daily* newspaper with *high-circulation*. One point is deducted if a publication fails to meet any of the four criteria (Brunei: circulation; South Africa and Yemen: daily publication; Jordan: both). The Climate Risk Index (CRI) was compiled by the non-governmental organization Germanwatch, together with Munich RE (Harmeling, 2011). The index ranks countries according to their long-term average value of direct damage from historical extreme weather events (1991-2010) and refers to relative and absolute personal injury and property damage (the higher the rank, the lower the damage). Due to this methodology the predictive power of the index is limited but for the purpose of our study risks that have already manifested themselves are anyway more relevant. Comparison with an alternative measurement by the Climate Vulnerability Monitor (CVM), however, shows an acceptable correlation (DARA & Climate Vulnerable Forum, 2010). The CVM evaluates the influence of climate change in specific countries in various dimensions for the recent past as well as the near future (the year 2030). Countries listed in Annex B of the Kyoto Protocol made a commitment to reduce or stabilize their greenhouse gas emissions (United Nations, 1998). Per-capita CO_2 emissions levels (from fossil fuel use and cement production) were taken from the 2007/2008 Human Development Report (Watkins, 2007: 310f).

In doing so, we had to restrict our search to coverage from 1996 onwards, i.e. from the year in which most newspapers in question were made available electronically. All articles containing positive search hits were downloaded. Non-relevant articles were later eliminated by employing corpus linguistic techniques, an automated check for duplicates, and extensive manual checks. The final sample contains 153,261 articles.

To ensure cross-country and longitudinal comparability, we also counted the total number of articles that appeared per month in each newspaper. The number of articles referring to climate change was then related to the absolute number in order to calculate coverage of climate change as a proportion of the absolute number of articles by month in percent. By this means we aim at "functional equivalence" (e.g. Esser, 2010: 9) of our measurements, something other comparative studies often miss. Absolute numbers of newspaper articles on climate change (as used in Eskjaer, 2010), for example, do not only indicate different national attention levels to the issue, but are also influenced by the sheer size of a given newspaper and other factors. This is problematic in that newspapers around the world differ measurably in their scope, due to differences in journalistic culture or financial limitations, to name a few.

3.2 Explanatory Part of the Study

In the explanatory part of the study, we focus on only three countries: Australia, Germany and India. We selected these countries on the basis of formal and theoretical criteria. First of all, we restricted our potential selection to countries for which we have two newspapers for (nearly) the whole time period under investigation - in order to ensure more robust results. Secondly, as we wanted to test the potential influence of activities of non-state actors (i.e. ENGOs and business organizations) on media attention, we included only democratic countries where the freedom of press was guaranteed through the entire period of investigation (this was determined on the basis of Freedom House, 2012). Finally, we wanted to include both countries facing high climate risks (as documented in the Climate Risk Index) *and* countries obliged to greenhouse gas emission limitations under the Kyoto Protocol (Annex B countries). India is the only country among the group of highly susceptible (according to CRI) which fulfilled the before mentioned criteria. Concerning Annex B states we decided to include two rather different cases – Australia shows, on average, the greatest media attention to climate

change, whereas the attention level in Germany is comparatively low (see 4.1).[9] This means that we test our hypotheses against a diverse country sample – besides ensuring applicability of the model by restricting the analysis to the subset of democratic countries.

For these three countries, we aimed to explain media attention to climate change over time. Media attention was generally measured as described above. For each country, the monthly average issue attention was then calculated from the two included newspapers (which were strongly correlated in each country anyway: .962 [AUS], .954 [GER] and .831 [IND]), which will serve as the dependent variable in time series analyses.

We operationalized our explanatory model discussed above by a number of variables:

1. Firstly, we include extreme weather events and temperature development as *factual indicators* of climate change. We obtained data on the death toll, number of people affected and estimated damage (US$ Million) for heat waves, wildfires, droughts, storms, storm surges and floods from the International Disaster Database EM-DAT. One international variable was constructed summarizing the severeness of extreme events in all countries in one month. An additional variable takes only events in the respective country into account. Additionally, we include a variable on temperature development at the place of publication of the analyzed newspapers in order to account for mean temperature as one important indicator of global warming.

[9] Moreover, the explanatory evidence produced by existing studies is already broader for some alternative countries, especially the USA (e.g. Brossard, et al., 2004; Liu, et al., 2011; McCright & Dunlap, 2003)

Table 3: Overview over variables and measurements used in our analysis

Variable	*Transformation / Coding*
DEPENDENT VARIABLE	
Issue Attention Monthly share of climate change related articles amongst all newspaper articles, average of two sampled newspapers per country	Square root; differentiation (I=1); ARIMA: (0,1,1) (0,0,0)
INDEPENDENT VARIABLES	
FACTUAL INDICATORS	
International Extreme Weather Events *Heat waves, wildfires, droughts, storms, storm surges and floods with the indicators death toll, number of people affected, estimated damage (US$ Million)* Each indicator of all event types was standardized separately; afterwards a monthly index summarizing the three indicators for events of all types and in all countries was constructed. Source: EM-DAT, The International Disaster Database (http://www.emdat.be/).	Event variable / Strength of the deviation; 0 = no anomaly
Domestic Extreme Weather Events Same variable as above, but restricted to domestic disasters	Event variable / Strength of the deviation; 0 = no anomaly
Domestic Temperature Mean value of the monthly average temperature at the two places of publication Source: NCEP/NCAR Reanalysis (cf. Kalnay, et al.)	
FOCUSSING EVENTS	
International political events: UNFCCC Conferences of the Parties	Event variable / Share of conference days in a month
International political events: United Nations Conferences on Environment and Development	Event variable / 1 = event; 0 = no event
International political events: EU summits (for GER only)	Event variable / 1 = event; 0 = no event
International political events: Asia Pacific Partnership on Clean Development and Climate summits (for AUS and IND only)	Event variable / 1 = event; 0 = no event
International political events: G8 summits	Event variable / 1 = event; 0 = no event
International political events: Ministerial meetings of the Gleneagles dialogue	Event variable / 1 = event; 0 = no event
International scientific/political events: Publication of IPCC assessment reports	Event variable / 1 = event; 0 = no event
International scientific/political events: Publication of Stern Review (Publication date: 30/10/2006; event coded for both October and November)	Event variable / 1 = event; 0 = no event
Cultural events: International and national premiere of selected movies (An Inconvenient Truth, The Day after Tomorrow, The Great Climate Swindle) on climate change and the Live Earth concert	Event variable / 1 = event; 0 = no event
SOCIAL FEEDBACK	
Domestic Political activity Composite index of number of parliamentary papers and parliamentary debates on climate change (India: only parliamentary debates; Germany: parliamentary debates only from 11/2005 onwards)	Square root; differentiation (I=1)
International ENGO activity Mean value index of number of press releases issued by Greenpeace International and WWF International	Square root; differentiation (I=1)
Domestic ENGO activity Mean value index of number of press releases issued by national Greenpeace branch and a second ENGO (Australia: Australian Conservation Fund; Germany: BUND; India: Center for Science and Environment)	Square root; differentiation (I=1)
International scientific publication activity Mean value index of number of research articles on climate change in Science and Nature	Square root; differentiation (I=1)
Domestic scientific publication activity Number of research articles published by domestic scientists and refereed in ISI Web of Knowledge (search terms: „global warming“, „climate change“)	Square root; differentiation (I=1)
Domestic business activity Mean value index of number of press releases issued by big national companies from the energy and resources sector (Australia: AGL Energy, Origin Energy, True Energy; BHP Billiton ; Germany: e.on Energie, RWE, EnBW, Vattenfall, BEE, VDA; India: Tata Power, Reliance Infrastructure, Hindalco, Indian Oil)	Square root; differentiation (I=1)

2. Secondly, we consider several *focussing events* on the international level. As for political events, we include the meetings of several important transnational climate governance structures. Within the UN system, the yearly Conferences of the Parties (COPs) of the United Nations Framework Convention on Climate Change (UNFCCC) are especially important fora for the discussion of climate policies (cf. Keohane & Victor, 2011). But also the United Nations Conferences on Environment and Development, the so called Rio (+x) summits, deal with climate change – although in the larger context of sustainable development (Andonova, Betsill, & Bulkeley, 2009: 62). Other transnational events focusing on climate change include some European Union summits (cf. Jordan, Huitema, & Asselt, 2010), the meetings of the Asia Pacific Partnership on Clean Development and Climate (created as an alternative to the UNFCCC process, cf. McGee & Taplin, 2008), a few summits of the Group of Eight (G8) and the ministerial meetings of the Gleneagles dialogue as a forum originating from the G8+5 consultations at the summit at the eponymous Scottish resort (cf. Zelli, 2011: 261). Concerning international hybrid scientific-political events, we take the publication dates of IPCC assessment reports and of the Stern Review on the Economics of Climate Change into account. As cultural events we included the international and national premiere of selected movies dealing with climate change (An Inconvenient Truth, The Day after Tomorrow, The Great Climate Swindle) and the Live Earth concert (M. T. Boykoff, 2011: 20f).

3. Thirdly, we operationalize *feedback* with several variables measuring activities of actors from different societal spheres. To account for domestic political activities, we consider the number of parliamentary papers and parliamentary debates on climate change. The activity of environmental NGOs (ENGOs) on the international level we measure by the number of press releases issued by Greenpeace International and WWF International, two of the most prominent organizations active in the field of climate change (Harris, 2011: 115). For domestic ENGO activities we take the number of press releases issued by the national Greenpeace branch and a second important organization. Scientific activities are included by the number of research articles on climate change published in the two top international journals *Science* and *Nature* and for the domestic level by the number of research articles published by scientists from the respective country in journals refereed in the ISI Web of Knowledge. And finally

we consider the activities of the business sector (number of press releases issued by big national companies from the energy and resources sector).

We tested the explanatory power of these variables for climate change related media attention with the help of a time series regression analysis, a method especially suitable to explain longitudinal issue attention (Box-Jenkins-ARIMA-Method, cf. Box, Jenkins, & Reinsel, 2008; this has been shown, e.g., for the influence of political campaigns on media attention, cf. Brandenburg, 2002).[10] This analysis proceeded in several steps:

1. *Univariate ARIMA*: First of all, we analyzed the data structure of the dependent variables and made some transformations. All three dependent variables show an ARIMA (0,1,1) structure – this means that they are characterized by a linear trend (l=1) and a first order moving average component (MA=1).[11] All continuous variables, dependent as well as independent, showed a trend. Hence, to achieve weak stationarity - which is a precondition for time-series regression analysis – all of them were squared and differentiated (cf. Thome, 2005: 50f and 78f).[12] In addition, all event variables were differentiated in order to estimate the correct transfer function on the also differentiated dependent variable (cf. Thome 2005: 187f).

2. *Specification of relationship*: In a second step we examined in how far the relations between dependent and independent variables show time lags or dynamical characteristics. Theoretically, this so called transfer function might be characterized by longer lasting effects, e.g. a permanent change of attention levels triggered by events or activities, or delayed impacts.[13] To evaluate this issue empirically, we analyzed the development of the cross-correlations between the transformed independent variables and the prewhitened dependent variable (cf. McCleary & Hay, 1980: 63). In result, we did not find any dynamical relations but in some cases a delayed effect in the next month (indicated by t-1 in table 5).

3. *Model estimation and diagnosis*: Finally, the explanatory power of the different independent variables is assessed. Moreover, the overall model is evaluated with

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[10] The ARIMA (autoregressive integrated moving average) method was used because most of the variables are based on time series data. A normal OLS estimation would lead to biased results (cf. Thome, 2005: 69f, 205f).

[11] This is, according to McCleary (1980: 63) a typical structure for social processes and means that random shocks have a systematic effect on the next month.

[12] Only for the variable domestic temperature this transformation was not necessary, as its data already showed a steady and stationary structure.

[13] As we use data on a monthly basis we considered only time lags of one month as plausible.

regard to auto-correlation of residuals (not existent) and goodness parameters (satisfactory).

4 Findings

4.1 Descriptive Findings

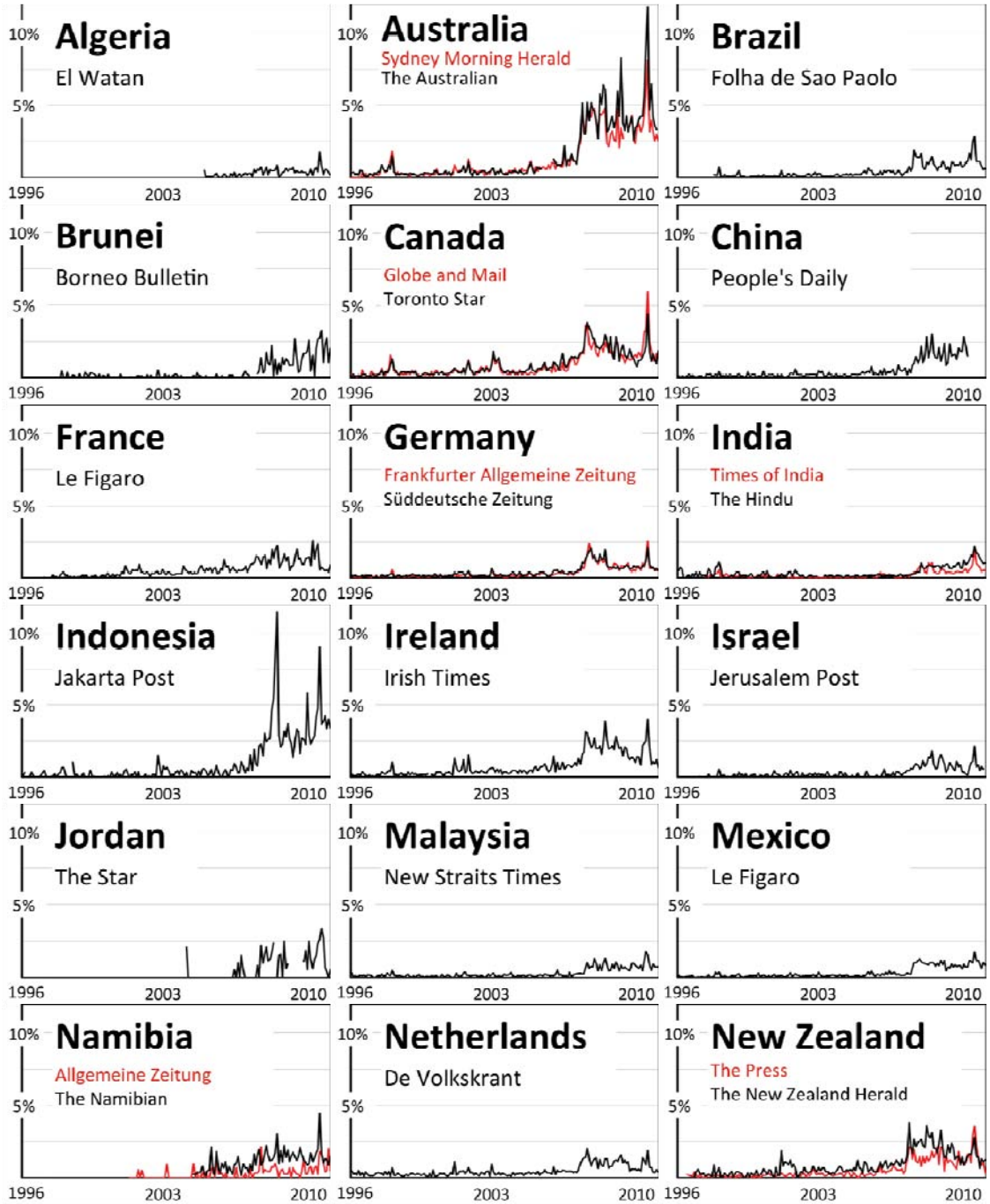
The descriptive results show that climate change is a relevant media topic in all countries. On average, climate change coverage accounts for 0.62% of all articles published between 1997 and 2009 in the 37 newspapers under study. This amount may appear to be small at first, but is still considerable. Other much discussed scientific themes in the media, such as stem cell or human genome research, which were even deemed to be receiving "hype" coverage in the media (Racine, et al., 2006), received significantly less media coverage in Germany, France, and the USA.[14]

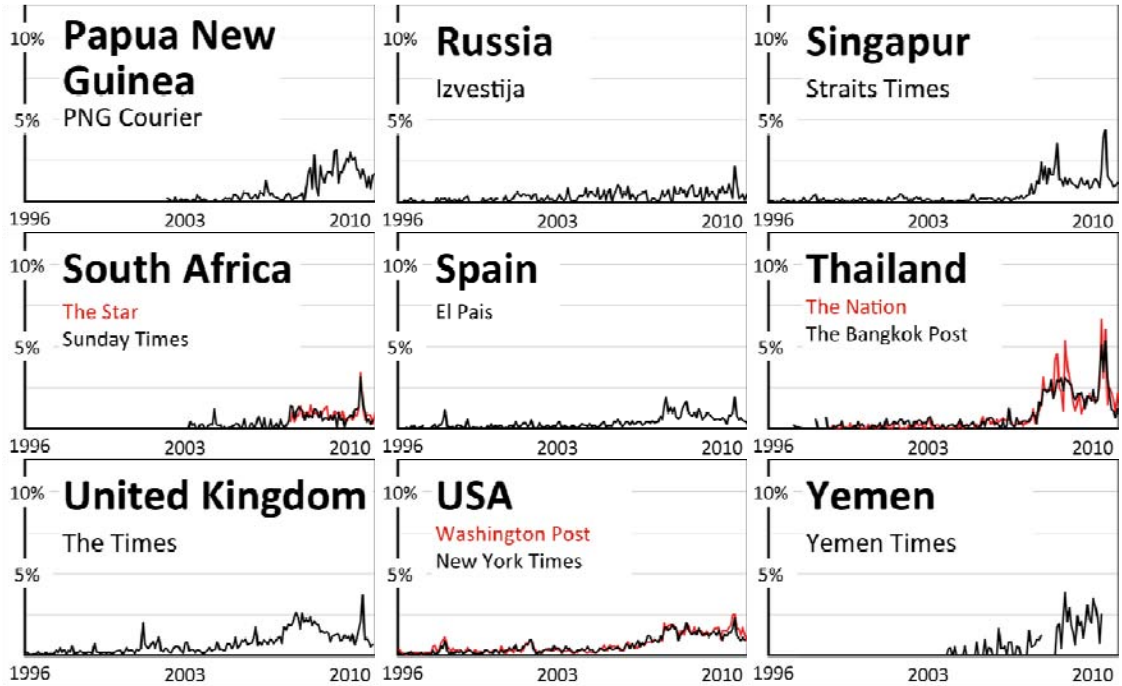
But how did media attention develop between 1996 and 2010? We hypothesized that issue attention has increased in all countries. Indeed, we can see that media coverage on climate change has risen over time. Issue attention in the 1990s was on a relatively low level (in most countries around or below 0.2% of total coverage) – but it expanded, sometimes drastically, in all countries in the course of the following years (for similar results cf. M. T. Boykoff, 2010: 22; Carvalho & Burgess, 2005: 1462; Liu, Vedlitz, & Alston, 2008: 383; Sampei & Aoyagi-Usui, 2009: 205). Comparing the 1997-2000 with the 2006-2009 period highlights this: The level of attention in most countries rose in late 2006/early 2007 and remained at a clearly higher level through the end of 2009, when seemingly, that growth has come to a halt. That is, media attention for climate change has not just evolved cyclical with ups and downs – rather, we can see a clear shift in attention levels. This expanding media attention corresponds with increased activities in different societal realms – among others, Al Gore in 2006 launched his movie *An Inconvenient Truth* (for which he was awarded the 2007 Nobel Peace prize together with the IPCC), the IPCC released the Fourth Assessment Report and Sir Nicholas Stern published a study, commissioned by the British government, on the economics of climate change (cf. M. T. Boykoff, 2011: 20f.; Gupta, 2010: 646). Moreover, most of the national climate legislation existing so far has been drafted since 2007/2008 (see the 15-country study by Townshend, et al., 2011: 5f.). Reusswig (2010: 45) argues that the greater amount of

[14] Stem cell research received 0.12% of total media attention in Germany (Süddeutsche Zeitung 1997-2003), and human genome research received only about 0.06% in Germany (Süddeutsche Zeitung 1993-2003), 0.08% in France (Le Figaro 1999-2001) and 0.1% in the USA (New York Times 1999-2001). These calculations are based on data from Gerhards & Schäfer (2006: 93f) and Schäfer (2007: 88).

climate change related activities since 2006 is also due to the "mainstreaming" of climate change to other domains: it has "evolved as a cross-cutting policy issue" which has been taken up, for example, by existing institutions and organizations in the economic policy domain.

Fig. 1: Media attention for climate change across the world (Graphs show percentage of the respective newspapers' coverage that refers to climate change; 1996-2010; gaps in graphs are due to missing data)





The attention, however, did not develop in a linear way – it fluctuates and peaks around specific events in all countries. In particular, we see peaks during COPs - probably because of the high stakes and the prominent political actors involved in the international negotiations. Additionally, actors from civil society concentrate a considerable part of their mobilizing efforts to these periods which might also contribute to high media attention (cf. Benford, 2010: 77f). The clearest example is the 2009 climate summit in Copenhagen (COP 15), which coincides with one of the highest peaks for media attention, if not the highest (cf. country studies in Eide, et al., 2010; also Schäfer, et al., 2011). Other global climate conferences have had similar cross-country effects, such as COP 3 in Kyoto, COP 6 in the Hague and Bonn, and COP 13 in Bali. Moreover, attention peaks occur after the publication of IPCC assessment reports (cf. Hulme, 2009).

There are noticeable country differences despite the aforementioned general trends, however. While all countries exhibit growing media attention, they did so to varying degrees: the growth is very strong in Australia and Indonesia (climate change coverage increased in the second half of the 2000s as compared to the 1997-2000 period in those countries by a factor of 10.5 and 16.4, respectively), whereas in India attention has expanded only by a factor of 2.9. In most other countries media attention to climate change expanded by a factor of 4 to 8. Moreover, the height of coverage peaks around the aforementioned events differs between countries. For example, media attention to climate change in Indonesian newspapers was 3.2 times higher during the climate conference in Bali than in the six months preceding and following the event. Media attention in other countries also went up in this time, on average, however, only by the

factor 1.4. During other climate-related events media attention increased only in specific countries, such as Ireland, and not, or much less so, in other countries. It is mainly this differentiated development that leads to varying overall levels of media attention: in Israel, Mexico, Brunei, and India climate change accounts for only a quarter or a third percent of the total media coverage. In contrast, Australia, Indonesia, and Great Britain have particularly high levels of media attention, with 1.4, 1.0 and 1.0% of total media coverage, respectively (see Table 4).

Table 4: Level of attention to climate change (percentage of the respective newspapers' coverage that refers to climate change)

	1997-2000	2001-2005	2006-2009	Overall
Algeria		0.15%	0.42%	0.34%
Australia	0.34%	0.52%	3.61%	1.42%
Brazil	0.13%	0.21%	0.91%	0.41%
Brunei	0.10%	0.07%	0.92%	0.35%
Canada	0.36%	0.59%	1.90%	0.92%
China	0.17%	0.27%	1.36%	0.55%
France	0.17%	0.47%	1.20%	0.60%
Germany	0.14%	0.23%	0.90%	0.41%
Great Britain	0.41%	0.73%	1.91%	0.99%
India	0.20%	0.12%	0.58%	0.28%
Indonesia	0.17%	0.30%	2.76%	1.02%
Ireland	0.27%	0.51%	1.82%	0.84%
Israel	0.11%	0.15%	0.72%	0.31%
Jordan		0.11%	0.96%	0.65%
Malaysia	0.11%	0.15%	0.65%	0.29%
Mexico	0.11%	0.15%	0.74%	0.32%
Namibia		0.20%	0.93%	0.52%
Netherlands	0.25%	0.33%	0.94%	0.49%
New Zealand	0.22%	0.43%	1.57%	0.72%
Papua-NG		0.19%	1.25%	0.71%
Russia	0.13%	0.39%	0.54%	0.36%
Singapore	0.12%	0.17%	1.27%	0.49%
South Africa		0.22%	0.73%	0.49%
Spain	0.17%	0.23%	0.80%	0.39%
Thailand	0.16%	0.28%	1.91%	0.78%
USA	0.31%	0.42%	1.37%	0.67%
Yemen		0.26%	1.41%	0.89%
Average (all countries)	0.20%	0.29%	1.26%	0.60%
Average Annex B	0.25%	0.44%	1.51%	0.71%
Average CRI rank ≤ 50	0.19%	0.30%	1.37%	0.61%
Average Annex B + CRI rank > 50	0.21%	0.38%	1.40%	0.64%

Attention levels are reported as means of monthly values. Due to missing data for the years 1996 and 2010 for several countries, we only calculated these numbers for the years 1997 through 2009. Compare table 2 for details on data availability. The category Average Annex B includes the United States (although this country did not ratify the Kyoto Protocol). The CRI ranks countries descending according to experienced damages, i.e. rank 1 represents the greatest weather related damages in the period 1991-2010.

Do these different levels and growth rates of media attention parallel responsibility for and/or vulnerability to climate change, as hypothesized? In other words: do media in countries which face emission limitations under the Kyoto Protocol or that experienced great damages due to extreme weather events (as expressed by the Climate Risk Index) devote more attention to climate change than others?

When we compare the mean attention level of Annex B with non-Annex B countries, we indeed see such an expected variation: media attention in non-Annex B countries for the years 2001-2009 (for which data for most countries is available)[15] amounts to, on average, 0.62%, whereas it is about 1.5 times higher (0.91%) in countries with emission targets under the Kyoto Protocol. The increase of the attention levels between the 1997-2000 and 2006-2009 periods, however, is more pronounced in non-Annex B countries. Comparing less and more vulnerable countries, as well as more vulnerable Annex B countries with less vulnerable non-Annex B countries does not bring about any notable differences (see table 4). So while we found some evidence for our hypotheses that a higher pressure to act on climate change goes along with greater media attention, there seems to be no simple correlation between media attention and vulnerability. To further assess the potential influence of these two factors on media attention levels it would be necessary, however, to control for other potential effects, that is, to set up a multivariate explanatory model.

4.2 Explanatory Findings

While we leave the explanation of country differences for further research, we will try to explain media attention cycles in a longitudinal perspective. We are aiming to find out what drives media attention using statistical analysis, something we have done so far for three countries.

These three countries are Germany, Australia and India. As outlined in section 3.3 they were chosen with the aim to vary between responsibility for climate change and vulnerability to its consequences. Moreover, as we have seen in the previous section, media attention levels and growth rates are rather different. For Australia we found the highest level and one of the greatest increases of media attention among our sample. In Germany, media attention levels and its development lie somewhere in the middle range. Finally, attention of Indian media to climate change is comparatively very low

[15] The differences are similar for other time periods, see table 4.

and is also expanded only modestly. Apart from these characteristics, we believe that we have chosen especially interesting cases with very different profiles.

- In *Australia*, climate change has been a hot and controversial topic – both in the media and in public debates in general. For example, the scientific certainty of climate change has long been questioned by influential political and economic actors (cf. Gelbspan, 2005; Speck, 2010). Moreover, the climate change debate seems to be extremely politicized with two camps fiercely competing (Bulkeley, 2000: 740; Chubb & Bacon, 2010: 51f): actors from the raw material and energy industry, some conservative and neoliberal think tanks as well as liberal political actors form one coalition which first focused on the uncertainties in climate change science, later pointed to the unreasonably high costs of greenhouse gas regulations for the Australian economy (Kurz, Augoustinos, & Crabb, 2010: 611; Stevenson, 2008: 8f). In contrast, environmental groups, the Greens and parts of the Labour party as well as several expertise based organisations highlight the expected dramatic social and environmental consequences of climate change for Australia and push for ambitious climate policies (Hall & Taplin, 2007; Kurz, et al., 2010: 615f.). In both the 2007 and 2010 preelection debates climate change has been a major topic (Rootes, 2011; Rowe, 2011: 76f). Overall, this obviously has led to extensive media coverage on climate change (see sec. 4.1) and – as it is an important topic of domestic politics – a rather strong effect of national factors on attention cycles can be expected.
- The situation in *Germany* is quite different. It seems that climate change has been early established in the media and in politics as certain, serious problem about which science agrees by and large (Grundmann, 2007: 419; Weingart, et al., 2000: 274f): Peters and Heinrichs (2008: 14) e.g. find that the analyzed national and North German media coverage "closely mirrors the position of the scientific community as documented in the IPCC reports". Grundmann (2007: 426f) explains this problem construction with the "broader political climate" including unequivocal conclusions of a parliamentary Enquete Commission in 1987 and a strong green movement. Climate change has, at least since the mid-2000s, become a central topic for organizations of this environmental movement (Roose, 2012: 92). Business and industry organizations, in contrast, seem to have retained from massive intervention into the debate – unlike the situation in Australia or the United States (Müller, 2011: 1). On this basis there is little controversy that Germany should play a leading role in international climate negotiations, and that national measures, such as subsidies for technological innovations, are necessary (cf. Peters & Heinrichs, 2008: 28; Weingart, et al., 2000: 279). Accordingly, public debates since the mid-2000s focus on concrete political options which have been, for example, drafted in the framework of German climate legislation like the Integrated Climate and Energy Program (Reusswig, 2010: 47f). Thus, we suppose that both international and national political factors strongly affect issue attention cycles in Germany.
- The *Indian* media coverage of climate change seems also to be quite straightforward regarding the seriousness of climate change – the existing studies suggest that there are few doubts about the scientific basis (Aram, 2011; Billett, 2010: 5f; Jogesh, 2012: 274f). In turn, the (expected) negative impacts of climate change are an important topic, and often they are discussed as a threat to India and other developing countries (Billett, 2010: 7f; Jogesh, 2012: 272f). Concerning the responsibility for the causes and for action, the existing literature suggests that media coverage presents a divide between the North and the South including India. This 'postcolonial' perspective attributes causal responsibility on the basis of cumulative greenhouse gas emissions to the industrialized countries and demands action only from their side (Billett, 2010: 9). Domestic action, however, is, according to newer research (Jogesh, 2012: 275f), in recent times increasingly also considered. Moreover, this study points to an broadened debate involving actors from different societal realms, especially actors from official politics, experts from research institutes, business and environmental organizations (Betz, 2012: 19; cf. Dubash, 2009; Jogesh, 2012: 278f; Never, 2011: 22). In general, however, the public climate debate seems to be rather elitist, i.e.

restricted to a small group of actors, focusing on international politics and not characterized by major political controversies (Billett, 2010: 13; Jogesh, 2012: 275). Consequently, we assume that international factors are most important for the explanation of attention cycles.

For these countries, we have used time series analysis to explain the issue attention cycles for climate change over time. We use the abovementioned independent variables, which include factual indicators for climate change, focusing events as well as social feedbacks, both on the international and domestic scale.

Table 5: Results of time series regression analysis

	AUS	*GER*	*IND*
Constant	-	-	-
Moving Average Component	.475**	.245**	.429**
Factual Indicators			
International Extreme Weather Events (t-1)	-	-	
International Extreme Weather Events (t-2)			-
Domestic Extreme Weather Events		.310**	-
Domestic Extreme Weather Events (t-1)	-	.221*	
Domestic Temperature	-		-
Domestic Temperature (t-1)		.128*	
Focussing Events			
UNFCCC Conferences of Parties	.283**	.321**	.215**
UNCED Rio (+x) Summits	.181*	-	-
EU / APP Summits	-	-	-
G8 Summits	-	-	.167*
Gleneagles Dialogue Meetings		-	
Gleneagles Dialogue Meetings (t-1)	-		-
IPCC Assessment Reports (t-1)	-	.178*	-
Stern Review	.155*	-	-
Cultural Events	.184*		-
Cultural Events (t-1)	.	-	
Social Feedback			
Domestic Political Activity			-
Domestic Political Activity (t-1)	.259**	.185*	
International ENGO Activity	.265**	.257*	.211**
International ENGO Activity (t-1)			.230**
Domestic ENGO Activity	-	-	-
Internat. Scientific Publication Activity		-	
Internat. Scientific Publication Activity (t-1)	-		-
Domestic Scientific Publication Activity	-	-	-
Domestic Business Activity	-	-	-
R-square for stationary part (adj.^{2})	**.39**	**.44**	**.27**
Ljung-Box-Q statistic (17 dF, p-values in brackets)	24.969 (.095)	12,669 (.758)	13.080 (.731)

We used PASW Statistics 18. n=150 months (Germany), 158 months (Australia), 157 months (India). For the purpose of comparability we report standardized omega weights. These indicate, similar to OLS estimations, by how many standard deviations the stationary part of the dependent variable is changing when the stationary part of the independent variable is changed by one standard deviation and the other factors are kept constant. Omega weights are calculated by multiplying the estimated coefficient with the standard deviation of the respective independent variable and subsequent division by the standard deviation of the dependent variable (in each case after establishing stationarity).
The adjusted R^2 was calculated as follows: R^2-(1-R^2)*p/(n-1-p) with p = number of predictors and n = number of cases.
Only significant coefficients are shown (** p < 0,01; * p < 0,05); - indicates that a variable with the respective time lag is included in the regression but not significant; empty cells indicate that the transfer function did not show a relation for the given specification and that the variable with the respective time lag was therefore omitted in the regression.

With these variables, we can explain issue attention in all countries reasonably well (R^2 between .27 and .44), although best in Germany. Several of the independent variables have significant effects on media attention – and apart from some specifics, the results are similar for all countries.

Regarding the influence of "factual indicators", we assumed that extreme weather events strongly affect issue attention (H3). Our analysis, however, shows no such effects in Australia and India, and only some effects for domestic events in Germany. A more detailed time-series analysis for the German case, in which we distinguished different extreme events, revealed that only floods have had a significant effect in the country, which is most likely due to one single event: the "flood of the century" on the river Elbe in August 2002. When we compare the three countries' disaster profiles, showing the frequency and severity of extreme weather events over time, it is clear that this one event stood out much stronger in Germany than any event in the other countries, where weather extremes are more frequent and single events less outstanding (see figures 2-4 in Appendix).

Stronger predictors of media attention than weather extremes are social factors, above all, political events and activities – this corresponds with our fourth hypothesis. Particularly relevant are the UN climate conferences (COPs), which have the strongest effect on Australian and German media attention and the second strongest (after international ENGO activity) on Indian media attention (cf. Eide & Kunelius, 2010: 13f). Apart from COPs, two other political focussing events show significant effects – the United Nations Conferences on Environment and Development (Rio summits) in Australia and the G8 summits in India.[16] The importance of the political realm is underlined further when looking at the feedback variables: domestic parliamentary activity has a strong effect on media attention in Australia and still considerable influence in Germany (although not on Indian media attention).[17] Moreover, "peripheral" political actors, i.e. international environmental organisations, are influential – especially in India, where their activities increase media attention not only in the same but also in the following month to a quite substantial extent. The relevance of environmental organizations might surprise given these organizations' usual difficulties

[16] We are not entirely certain that the effect of G8 summits on Indian media attention is not an artefact. Some Indian political and weather extreme events obviously overlap with the G8 summits and we will try to account for them in a more comprehensive way in future analyses.

[17] This might be due to the, compared to the other two countries, lower importance of national climate policies in India as the country is not obliged to reduce greenhouse gas emissions under the Kyoto Protocol. Accordingly, climate change is mainly a foreign affairs issue in Indian politics (Betz, 2012).

in achieving media attention (cf. Lester & Hutchins, 2009). But climate change seems to be a special case in this regard – several authors argue that environmental organizations are quite important both in the political and public debate – for at least two reasons. Firstly, several organisations over the years have attained considerable expertise by participating in the (scientific) problem construction and the drafting of policy solutions (Gough & Shackley, 2001) – something that makes them also attractive for the media as they can help explaining and interpreting what is going on, for example, during climate conferences (cf. Adolphsen & Lück, 2012; Brunnengräber, 1997: 19). Secondly, they produce pictures for a topic which is, in general, difficult to visualize. For example, they stage symbolic protest activities providing photo opportunities (Doyle, 2007). It is maybe for a similar reason that cultural events have an impact on media attention in Australia – but they do not show significant effects in Germany and India.

In turn, we can see that scientific activity does not influence media attention strongly – at least not "regular" scientific publications, neither on the national nor international level. Only the two event variables on the release of scientific (synthesis) reports – commissioned by political actors and mainly produced for the purpose of scientific policy advice – show some, rather weak, effects: the IPCC reports on German and the Stern Review on Australian media attention. This resembles the finding of Rick et al. (2011) who investigated US and UK media coverage of sea level rise projections. They found out that the analyzed newspapers rather reported on this topic after the release of IPCC reports or during major international negotiations than subsequent to the publication of new research. So while scientists are, according to several studies (e.g. Besio & Pronzini, 2010: 290; Weingart, et al., 2000: 275f.), important sources for journalists, they seem not strongly to set the occasions for reporting on climate change themselves.

5 Discussion

Comparative studies on climate change communication are paramount to further our understanding of how societies take up, and subsequently react to, transnational problems such as climate change. We provided such an analysis, focussing on media attention for the issue of climate change. Because most previous studies on issue attention have focussed on single, mostly Western countries, we compared issue attention in 27 countries across the globe over 15 years.

Our analyses have shown that climate change coverage has increased in all countries between 1996 and 2010 and that peaks in issue attention tend to coincide with major international events, particularly UN climate change conferences. This general upward trend in media attention confirms our first hypotheses about a global growth of issue attention to climate change – although we have to add that the increase mostly occurred in the mid-2000s and has not further expanded since (cf. M. T. Boykoff, 2011: 20f; M. T. Boykoff & Mansfield, 2012).

Apart from this general trend, however, the development of issue attention varies considerably between countries – as suggested by our second hypotheses. On average, media in countries with obligations to reduce greenhouse gases under the Kyoto Protocol report more about climate change. Particularly vulnerable countries, though, do not show above-average attention levels, nor does the growth rate in both country groups comply with our expectation. Consequently, on the basis of the analyses presented we cannot fully confirm this hypothesis. Nevertheless, we think that this might be a fruitful field for future research addressing country differences with multivariate explanatory analysis.

Apart from describing issue attention in 27 countries, we aimed to explain the longitudinal development of media attention in three selected countries – Australia, Germany and India. For these cases, we found that several types of events and activities are able to explain attention cycles. Contrary to our third hypotheses, extreme weather phenomena play a subordinate role in this regard – only for Germany we found significant effects of such "factual indicators", which can likely be explained, however, by the occurrence of an outstanding singular flooding event in 2002.

More important factors to explain issue attention in these three countries are societal events and activities – especially such on the transnational level: in all three countries political summits dealing with climate change had a strong effect on media attention (Eide & Kunelius, 2010; Schäfer, Ivanova, & Schmidt, 2012). Additionally, the activity of international environmental NGOs had a rather great influence in all countries.

Besides, we also observed some country specifics: In Australia and Germany, the uptake of the climate change issue by domestic political activity is visible in that parliamentary activity is a particularly strong predictor of media attention. In addition, Australia is the only country in which the publication of the Stern Review – dealing with the economics of climate change – results in a significant amount of media attention, which fits well with the result reported elsewhere that the Australian climate debate strongly focuses on

the costs of domestic mitigation policies for the economy (McGaurr & Lester, 2009; Speck, 2010). In India, in contrast, no domestic factors showed significant effects; media attention for climate change in the country seems to be exclusively driven by international political events and the activities of international NGOs. This corresponds with the observation of other studies that responsibility for action on climate change is predominantly perceived to lie outside the country and that there are few subnational conflicts on the topic (cf. Billett, 2010).

Our analysis has a number of restrictions which need to be pointed out and which, in turn, make for interesting research questions for future studies. Because we wanted to sample many countries in our analysis, we did not go beyond issue attention in our description of the media coverage. In other words: Our analyses do not reveal anything about how the issue is framed and evaluated in the respective coverage, what policy options are presented as being preferable, and what institutions or countries as responsible. Future comparative studies, maybe large-n approaches using text-mining and corpus-linguistic tools (cf. Koteyko, 2010), can be imagined here which would undoubtedly enrich the status quo of current scholarship.

Such methods might also enable scholars to reconstruct processes of international media agenda setting that might exist, in which globally leading media such as the New York Times not only influence the US public, but also leading media worldwide (cf. Noelle-Neumann & Mathes, 1987; Reese & Danielian, 1989). Also, the role of news agencies in such processes should be focused on (cf. Takahashi & Meisner, 2012: 4).

In addition, the explanatory analysis should be expanded in the future. Following Liu et al. (2011), we did not take characteristics of the analyzed media into account. Such factors may be influential, however, as differing financial resources of certain newspapers can lead to relatively low levels of media attention, as it seemed to happen in the Middle East (Eskjaer, 2010). More generally, the media's interest in and infrastructure for international reporting may also be relevant factors when explaining media attention for transnational problems (for an Indian example see Billett, 2010).

Bibliography

Adolphsen, M., & Lück, J. (2012). Non-Routine Interactions Behind the Scenes of a Global Media Event. How Journalists and Political PR Professionals Coproduced the 2010 UN Climate Conference in Cancún. *Medien & Kommunikationswissenschaft, Sonderheft 2 „Grenzüberschreitende Medienkommunikation"*, 141-158.

Ahchong, K., & Dodds, R. (2012). Anthropogenic climate change coverage in two Canadian newspapers, the Toronto Star and the Globe and Mail, from 1988 to 2007. *Environmental Science & Policy, 15*(1), 48–59.

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

Anderson, A. (2011). Sources, media, and modes of climate change communication: the role of celebrities. *WIREs Climate Change, 2*(4), 535-546.

Andonova, L. B., Betsill, M. M., & Bulkeley, H. (2009). Transnational Climate Governance. *Global Environmental Politics, 9*(2), 52–73.

Aram, I. A. (2011). Indian media coverage of climate change. *Current Science, 100*(10), 1477–1478.

Arlt, D., Hoppe, I., & Wolling, J. (2011). Climate change and media usage: Effects on problem awareness and behavioural intentions. *International Communication Gazette, 73*(1-2), 45-63.

Aykut, S. C., Comby, J.-B., & Guillemot, H. (2012). Climate Change Controversies in French Mass Media 1990–2010. *Journalism Studies, 13*(2), 157–174.

Baerns, B. (1987). Macht der Öffentlichkeitsarbeit und Macht der Medien. In U. Sarcinelli (Ed.), *Politikvermittlung.* (pp. 147-160). Bonn: Bundeszentrale für politische Bildung.

Benford, R. D. (2010). Framing global governance from below: Discursive opportunities and challenges in the transnational social movement arena. In C. Bjola & M. Kornprobst (Eds.), *Arguing Global Governance* (pp. 67–84). London & New York: Routledge.

Besio, C., & Pronzini, A. (2010). Unruhe und Stabilität als Form der massenmedialen Kommunikation über Klimawandel. In M. Voss (Ed.), *Der Klimawandel* (pp. 283–299). Wiesbaden: VS Verlag für Sozialwissenschaften.

Betz, J. (2012). India's Turn in Climate Policy: Assessing the Interplay of Domestic and International Policy Change.

Billett, S. (2010). Dividing climate change: global warming in the Indian mass media. *Climatic Change, 99*(1), 1-16.

Box, G. E. P., Jenkins, G. M., & Reinsel, G. C. (2008). *Time series analysis. Forecasting and control* (4 ed.). New Jersey: Wiley.

Boykoff, J. (2012). US Media Coverage of the Cancún Climate Change Conference. *PS: Political Science & Politics, 45*(02), 251–258.

Boykoff, M. T. (2007). Flogging a dead norm? Newspaper coverage of anthropogenic climate change in the United States and United Kingdom from 2003 to 2006. *Area, 39*(4), 470-481.

Boykoff, M. T. (2008). Lost in translation? United States television news coverage of anthropogenic climate change, 1995-2004. *Climatic Change, 86*, 1-11.

Boykoff, M. T. (2010). Indian media representations of climate change in a threatened journalistic ecosystem. *Climatic Change, 99*(1), 17-25.

Boykoff, M. T. (2011). *Who Speaks for the Climate? Making Sense of Media Reporting on Climate Change*. Cambridge: Cambridge University Press.

Boykoff, M. T., & Boykoff, J. M. (2007). Climate change and journalistic norms: A case-study of US mass-media coverage *Geoforum, 38*(6), 1190-1204.

Boykoff, M. T., & Mansfield, M. (2008). 'Ye Olde Hot Aire': reporting on human contributions to climate change in the UK tabloid press. [Article]. *Environmental Research Letters, 3*(2), 8.

Boykoff, M. T., & Mansfield, M. (2012). Media Coverage of Climate Change/Global Warming. Retrieved 13.8.2012, from http://sciencepolicy.colorado.edu/media_coverage/

Boykoff, M. T., & Rajan, S. R. (2007). Signals and noise. Mass media coverage of climate change in the USA and the UK. *EMBO Reports, 8*(3), 207–211.

Brandenburg, H. (2002). Who Follows Whom? *The Harvard International Journal of Press/Politics, 7*(3), 34-54.

Brossard, D., Shanahan, J., & McComas, K. (2004). Are issue-cycles culturally constructed? A Comparison of French and American coverage of global climate change. *Mass Communication and Society, 7*(3), 359–377.

Brunnengräber, A. (1997). Advokaten, Helden und Experten: Die NGO´s in den Medien. *Forschungsjournal Neue Soziale Bewegungen, 4*, 13–26.

Bulkeley, H. (2000). Discourse coalitions and the Australian climate change policy network. *Environment and Planning C: Government and Policy, 18*(6), 727–748.

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. (2010). Media(ted)discourses and climate change: a focus on political subjectivity and (dis)engagement. *WIREs Climate Change, 1*(2), 172-179.

Carvalho, A., & Burgess, J. (2005). Cultural circuits of climate change in UK broadsheet newspapers, 1985-2003. [Article]. *Risk Analysis, 25*(6), 1457-1469.

Chubb, P., & Bacon, W. (2010). Australia: Fiery Politics and Extreme Events. In E. Eide, R. Kunelius & V. Kumpu (Eds.), *Global Climate – Local Journalisms* (pp. 51–65). Bochum: projektverlag.

Cobb, R. W., & Elder, C. D. (1983). *Participation in American Politics. The Dynamics of Agenda Building*. Baltimore & London: John Hopkins University Press.

Corfee-Morlot, J., Maslin, M., & Burgess, J. (2006, Apr 03). *Global warming in the public sphere.* Paper presented at the Climate Change and Urban Areas Conference, London, ENGLAND.

DARA & Climate Vulnerable Forum. (2010). *Climate Vulnerability Monitor 2010: The State of the Climate Crisis*. Madrid: DARA.

Dearing, J. W., & Rogers, E. M. (1996). *Agenda Setting*. Thousand Oaks, CA: Sage.

DeLuca, K. M. (2009). Greenpeace International Media Analyst Reflects on Communicating Climate Change. [Editorial Material]. *Environmental Communication-a Journal of Nature and Culture, 3*(2), 263-269.

Doulton, H., & Brown, K. (2009). Ten years to prevent catastrophe? Discourses of climate change and international development in the UK press. [Article]. *Global Environmental Change-Human and Policy Dimensions, 19*(2), 191-202.

Downs, A. (1972). Up and Down With Ecology - The "Issue-Attention Cycle". *Public Interest, 28*, 38-50.

Doyle, J. (2007). Picturing the clima(c)tic: Greenpeace and the representational politics of climate change communication. *Science as Culture, 16*(2), 129–150.

Doyle, J. (2009). Climate Action and Environmental Activism: The Role of Environmental NGOs and Grassroots Movements in the Global Politics of Climate Change. In T. Boyce & J. Lewis (Eds.), *Climate change and the media* (pp. 103–116). New York: Lang.

Dryzek, J. S., Norgaard, R. B., & Schlosberg, D. (Eds.). (2011). *The Oxford Handbook of Climate Change and Society*. London: Oxford University Press.

Dubash, N. K. (2009). Environmentalism in the age of climate change. *Seminar*(601), 63–66.

Duffey, R., & Dincer, I. (2010). Global Warming – Where Is the Cure? In I. Dincer, A. Hepbasli, A. Midilli & T. H. Karakoc (Eds.), *Global Warming* (pp. 1-45): Springer US.

Eide, E., & Kunelius, R. (2010). Domesticating Global Moments.A transnational study on the coverage of the Bali and Copenhagen Climate Summits. In E. Eide, R. Kunelius & V. Kumpu (Eds.), *Global Climate - local journalisms* (pp. 11-50). Bochum: projektverlag.

Eide, E., Kunelius, R., & Kumpu, V. (Eds.). (2010). *Global Climate – local journalisms*. Bochum: projektverlag.

Eskjaer, M. (2010). *The regional dimension: How regional media systems condition global climate change communication.* Paper presented at the ECREA pre-conference "Communicating Climate Change", Hamburg.

Esser, F. (2010). *Komparative Kommunikationswissenschaft. Working Paper No. 41*. Zürich: National Centre of Competence in Research (NCCR).

Evans, M., & Pearson-Merkowitz, S. (2012). Perpetuating the Myth of the Culture War Court? Issue Attention in Newspaper Coverage of U.S Supreme Court Nominations. *American Politics Research*.

Farbotko, C. (2005). Tuvalu and Climate Change: Constructions of Environmental Displacement in The Sydney Morning Herald. *Geografiska Annaler: Series B, Human Geography, 87*(4), 279–293.

Freedom House. (2012). Freedom of the Press: 2012 Freedom of the Press Data. from http://www.freedomhouse.org/report-types/freedom-press

Füssel, H.-M. (2010). How inequitable is the global distribution of responsibility, capability, and vulnerability to climate change: A comprehensive indicator-based assessment. *Global Environmental Change, 20*(4), 597–611.

Gavin, N. T. (2010). Pressure Group Direct Action on Climate Change: The Role of the Media and the Web in Britain—A Case Study. *The British Journal of Politics & International Relations, 12*(3), 459-475.

Gavin, N. T., Leonard-Milsom, L., & Montgomery, J. (2011). Climate change, flooding and the media in Britain. *Public Understanding of Science, 20*(3), 422–438.

Gelbspan, R. (2005). *Boiling Point: How Politicians, Big Oil and Coal, Journalists, and Activists are Fueling the Climate Crisis and What We Can Do to Avert Disaster*. New York: Basic Books.

Gerhards, J., & Schäfer, M. S. (2006). *Die Herstellung einer öffentlichen Hegemonie. Humangenomforschung in der deutschen und der US-amerikanischen Presse*. Wiesbaden: Verlag für Sozialwissenschaften.

Gordon, J. C., Deines, T., & Havice, J. (2010). Global Warming Coverage in the Media: Trends in a Mexico City Newspaper. *Science Communication, 32*(2), 143-170.

Gough, C., & Shackley, S. (2001). The respectable politics of climate change: the epistemic communities and NGOs. *International Affairs, 77*(2), 329–345.

Grundmann, R. (2006). Ozone and Climate: Scientific Consensus and Leadership. *Science Technology Human Values, 31*(1), 73–101.

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

Grundmann, R., & Krishnamurthy, R. (2010). The Discourse of Climate Change: A Corpus-based Approach. *Critical Approaches to Discourse Analysis across Disciplines, 4* (2), 113 – 133.

Gupta, J. (2010). A History of International Climate Change Policy. *Wiley Interdisciplinary Reviews: Climate Change, 1*(5), 636–653.

Hall, N. L., & Taplin, R. (2007). Revolution or Inch-by-Inch? Campaign Approaches on Climate Change by Environmental Groups. *The Environmentalist, 27*(1), 95–107.

Hans-Bredow-Institut (Ed.). (2009). *Internationales Handbuch Medien*. Baden-Baden: Nomos.

Hansen, A. (2011). Communication, media and environment: Towards reconnecting research on the production, content and social implications of environmental communication. *International Communication Gazette, 73*(1-2), 7-25.

Harmeling, S. (2011). Germanwatch Global Climate Risk Index 2012: Who Suffers Most From Extreme Weather Events? Weather-Related Loss Events in 2010 and 1991 to 2010.

Harris, P. G. (2011). Climate change. In G. Kutting (Ed.), *Global environmental politics* (pp. 107–118). London: Routledge.

Hart, P. S., & Leiserowitz, A. A. (2009). Finding the Teachable Moment: An Analysis of Information-Seeking Behavior on Global Warming Related Websites during the of The Day After Tomorrow. [Article]. *Environmental Communication-a Journal of Nature and Culture, 3*(3), 355-366.

Henry, G. T., & Gordon, C. S. (2001). Tracking Issue Attention: Specifying the Dynamics of the Public Agenda. *Public Opinion Quarterly, 65*(2), 157-177.

Hilgartner, S., & Bosk, C. L. (1988). The rise and fall of social problems: A public arenas model. *American Journal of Sociology, 94*, 53-78.

Hopf, M. (2012). „Greenpeace will ein Problem und eine Lösung auf die Agenda setzen". *Forschungsjournal Soziale Bewegungen, 25*(2), 39-42.

Hulme, M. (2009). Mediated Messages about Climate Change: Reporting the IPCC Fourth Assessment in the UK Print Media. In T. Boyce & J. Lewis (Eds.), *Climate change and the media* (pp. 117–128). New York: Lang.

Ihlen, Ø. (2009). Business and Climate Change: The Climate Response of the World's 30 Largest Corporations. *Environmental Communication: A Journal of Nature and Culture, 3*(2), 244–262.

IPCC. (2007). *IPCC Fourth Assessment Report: Climate Change 2007*. Geneva: IPCC - Intergovernmental Panel on Climate Change.

Jogesh, A. (2012). A change in climate?: Trends in climate change reportage in the Indian print media. In N. K. Dubash (Ed.), *Handbook of Climate Change and India* (pp. 266–286). London: earthscan.

Jordan, A., Huitema, D., & Asselt, H. (2010). Climate change policy in the European Union: an introduction. In A. Jordan, D. Huitema, H. Asselt, R. Rayner & F. Berkhout (Eds.), *Climate change policy in the European Union* (pp. 3–25). Cambridge: Cambridge Univ. Press.

Kalnay, E., Kanamitsu, M., Kistler, R., Collins, W., Deaven, D., Gandin, L., et al. (1996). The NCEP/NCAR 40-Year Reanalysis Project. *Bulletin of the American Meteorological Society, 77*(3), 437–471.

Keohane, R. O., & Victor, D. G. (2011). The Regime Complex for Climate Change. *Perspectives on Politics, 9*(1), 7–23.

Koteyko, N. (2010). Mining the internet for linguistic and social data: An analysis of 'carbon compounds' in Web feeds. *Discourse & Society, 21*(6), 655-674.

Krosnick, J. A., Holbrook, A. L., & Visser, P. S. (2000). The impact of the fall 1997 debate about global warming on American public opinion. *Public Understanding of Science, 9*(3), 239–260.

Kurz, T., Augoustinos, M., & Crabb, S. (2010). Contesting the 'national interest' and maintaining 'our lifestyle': A discursive analysis of political rhetoric around climate change. *British Journal of Social Psychology, 49*(3), 601–625.

Ladle, R., Jepson, P., & Whittaker, R. (2005). Scientists and the media: the struggle for legitimacy in climate change and conservation science *Interdisciplinary Science Reviews, 30*(3), 231-240.

Lester, L., & Hutchins, B. (2009). Power Games: Environmental Protest, News Media and the Internet. *Media, Culture & Society, 31*(4), 579–595.

Liu, X., Lindquist, E., & Vedlitz, A. (2011). Explaining Media and Congressional Attention to Global Climate Change, 1969-2005: An Empirical Test of Agenda-Setting Theory. *Political Research Quarterly, 64*(2), 405–419.

Liu, X., Vedlitz, A., & Alston, L. (2008). Regional news portrayals of global warming and climate change. [Article]. *Environmental Science & Policy, 11*(5), 379-393.

Lockwood, A. (2008). *Seeding doubt: how sceptics use new media to delay action on climate change*. Paper presented at the Association for Journalism Education (AJE) annual conference "New Media, New Democracy?".

Lofgren, A., & Nordblom, K. (2010). Attitudes towards CO2 taxation - is there an Al Gore effect? [Article]. *Applied Economics Letters, 17*(9), 845-848.

Luhmann, N. (1971). Öffentliche Meinung. In N. Luhmann (Ed.), *Politische Planung. Aufsätze zur Soziologie von Politik und Verwaltung* (pp. 9-34). Opladen: Westdeutscher Verlag.

Lyytimäki, J. (2011). Mainstreaming climate policy: the role of media coverage in Finland. *Mitigation and Adaptation Strategies for Global Change, 16*(6), 649–661.

Lyytimäki, J., & Tapio, P. (2009). Climate change as reported in the press of Finland: From screaming headlines to penetrating background noise. *International Journal of Environmental Studies, 66*(6), 723–735.

Mazur, A. (2009). American Generation of Environmental Warnings: Avian Influenza and Global Warming. [Article]. *Human Ecology Review, 16*(1), 17-26.

McCleary, R., & Hay, R. A. (1980). *Applied Time Series Analysis for the Social Sciences*. Beverly Hills, London: Sage.

McComas, K. A., & Shanahan, J. (1999). Telling Stories About Global Climate Change. *Communication Research, 26*(1), 30–57.

McCright, A. M., & Dunlap, R. E. (2000). Challenging Global Warming as a Social Problem: An analysis of the Conservative Movement Counter-Claims. *Social Problems, 47*(4), 499-522.

McCright, A. M., & Dunlap, R. E. (2003). Defeating Kyoto: The Conservative Movement's Impact on US Climate Change Policy. *Social Problems, 50*(3), 348-373.

McGaurr, L., & Lester, L. (2009). Complementary Problems, Competing Risks: Climate Change, Nuclear Energy, and the Australian. In T. Boyce & J. Lewis (Eds.), *Climate change and the media* (pp. 174–185). New York: Lang.

McGee, J., & Taplin, R. (2008). Asia-Pacific Partnership and the United States' International Climate Change Policy, The. *Colorado Journal of International Environmental Law and Policy, 19*(2), 179–218.

Miah, M., Kabir, M., Koike, M., & Akther, S. (2011). Major climate-change issues covered by the daily newspapers of Bangladesh. *The Environmentalist, 31*(1), 67–73.

Moellendorf, D. (2009). Treaty Norms and Climate Change Mitigation. *Ethics & International Affairs, 23*(3), 247–265.

Müller, E. (2011). Klimalobbying: Was unterscheidet Europa von den USA? *GAIA - Ecological Perspectives for Science and Society, 20*(1), 1.

Never, B. (2011). Who Drives Change?: Comparing the Evolution of Domestic Climate Governance in India and South Africa.

Neverla, I., & Schäfer, M. S. (2010). Das Medienklima. Relevanz und Spezifika der Medienberichterstattung über den anthropogenen Klimawandel. *Mitteilungen der Deutschen Meteorologischen Gesellschaft, 2010*(3), 9-12.

Newig, J. (2004). Public Attention, Political Action - the Example of Environmental Regulation. *Rationality and Society, 16*(2), 149-190.

Nisbet, M. C., & Huge, M. (2006). Attention Cycles and Frames in the Plant Biotechnology Debate: Managing Power and Participation through the Press/Policy Connection. *The Harvard International Journal of Press/Politics, 11*(2), 3-40.

Noelle-Neumann, E., & Mathes, R. (1987). The "Event as Event" and the "Event as News": The Significance of "Consonance" for Media Effects Research. *European Journal of Communication, 2*, 391-414.

Olausson, U. (2009). Global warming—global responsibility?: Media frames of collective action and scientific certainty. *Public Understanding of Science, 18*(4), 421–436.

Oreskes, N. (2004). The Scientific Consensus on Climate Change. *Science, 306*(5702), 1686.

Peters, H. P., & Heinrichs, H. (2008). Legitimizing Climate Policy: The "Risk Construct" of Global Climate Change in the German Mass Media. *International Journal of Sustainability Communication*(3), 14–36.

Petrocik, J. R. (1996). Issue Ownership in Presidential Elections, with a 1980 Case Study. *American Journal of Political Science, 40*(3), 825-850.

Racine, E., Gareau, I., Doucet, H., Laudy, D., Jobin, G., & Schraedley-Desmond, P. (2006). Hyped biomedical science or uncritical reporting? Press coverage of genomics (1992-2001) in Québec. *Social Science & Medicine, 62*(5), 1278-1290.

Reese, S. D., & Danielian, L. H. (1989). Intermedia Influence and the Drug Issue: Converging on Cocaine. In P. J. Shoemaker (Ed.), *Communication Campaigns about Drugs* (pp. 29-45).

Reusswig, F. (2010). The New Climate Change Discourse: A Challenge for Environmental Sociology. In M. Gross & H. Heinrichs (Eds.), *Environmental Sociology* (pp. 39–57). Dordrecht: Springer Netherlands.

Rick, U. K., Boykoff, M. T., & Pielke Jr, R. A. (2011). Effective media reporting of sea level rise projections: 1989–2009. *Environmental Research Letters, 6*(1), 1–5.

Rödder, S., & Schäfer, M. S. (2010). Repercussion and resistance: An empirical study in the interrelation between science and mass media. *Communications, 35*(3), 249-267.

Roose, J. (2012). Wollen die Deutschen das Klima retten?: Mobilisierung, Einstellungen und Handlungen zum Klimaschutz. In J. Roose & M. S. Schäfer (Eds.), *Kampf um die Köpfe* (pp. 89–100): Lucius&Lucius.

Rootes, C. (2011). Denied, deferred, triumphant? Climate change, carbon trading and the Greens in the Australian federal election of 21 August 2010: Environmental Politics. *Environmental Politics, 20*(3), 410–417.

Rowe, D. (2011). Comparing Newspaper Coverage of Climate Change During Election Campaigns in the United States, Canada and Australia.

Ryghaug, M., Holtan Sørensen, K., & Næss, R. (2011). Making sense of global warming: Norwegians appropriating knowledge of anthropogenic climate change. *Public Understanding of Science, 20*(6), 778-795.

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*(2), 203–212.

Schäfer, M. S. (2007). *Wissenschaft in den Medien. Die Medialisierung naturwissenschaftlicher Themen*. Wiesbaden: Verlag für Sozialwissenschaften.

Schäfer, M. S. (2012a). Hacktivism? Online-Medien und Social Media als Instrumente der Klimakommunikation zivilgesellschaftlicher Akteure. *Forschungsjournal Soziale Bewegungen, 2012*(2), 68-77.

Schäfer, M. S. (2012b). Taking Stock: a Meta-Analysis of Studies on the Media's Coverage of Science. *Public Understanding of Science, 21*(6), 650-663.

Schäfer, M. S., Ivanova, A., & Schmidt, A. (2011). Globaler Klimawandel, globale Öffentlichkeit?: Medienaufmerksamkeit für den Klimawandel in 23 Ländern. *Studies in Communication | Media*(1), 131–148.

Schäfer, M. S., Ivanova, A., & Schmidt, A. (2012). Issue-Attention: Mediale Aufmerksamkeit für den Klimawandel in 26 Ländern. In I. Neverla & M. S. Schäfer (Eds.), *Das Medien-Klima* (pp. 149-174). Wiesbaden: Springer VS.

Schlichting, I. (2012, in press). Strategic Framing of Climate Change by Industry Actors: A Literature Review. *Environmental Communication: A Journal of Nature and Culture*.

Schmidt, A. (2012). Bewegungen, Gegenbewegungen, NGOs: Klimakommunikation zivilgesellschaftlicher Akteure. In I. Neverla & M. S. Schäfer (Eds.), *Das Medien-Klima* (pp. 69–94). Wiesbaden: Springer VS.

Schützenmeister, F. (2008). Zwischen Problemorientierung und Disziplin. Ein koevolutionäres Modell der Wissenschaftsentwicklung. Bielefeld: transcript.

Shah, D. V., McLeod, D. M., Gotlieb, M. R., & Lee, N. (2009). Framing and agenda setting. In R. Nabi & M. B. Oliver (Eds.), *The SAGE handbook of media processes and effects* (pp. 83-98). Thousand Oaks: Sage.

Shanahan, J., & Good, J. (2000). Heat and hot air: influence of local temperature on journalists' coverage of global warming. *Public Understanding of Science, 9*(3), 285-295.

Shanahan, M. (2009). Time to Adapt? Media Coverage of Climate Change in Nonidustrialised Countries. In T. Boyce & J. Lewis (Eds.), *Climate Change and the Media* (pp. 145-157). New York: Peter Lang.

Shehata, A., & Hopmann, D. N. (2012). Framing Climate Change: A study of US and Swedish press coverage of global warming. *Journalism Studies, 13*(2), 175–192.

Smith, J. (2005). Dangerous News: Media Decision Making about Climate Change Risk. *Risk Analysis, 25*(6), 1471-1482.

Speck, D. L. (2010). A hot topic?: Climate change mitigation policies, politics, and the media in Australia. *Research in Human Ecology, 17*(2), 125–134.

Stamm, K. R., Clark, F., & Eblacas, P. R. (2000). Mass communication and public understanding of environmental problems: The case of global warming. *Public Understanding of Science, 9*(3), 219-237.

Stehr, N., & von Storch, H. (1999). *Klima, Wetter, Mensch*. München: C.H. Beck.

Stern, N. (2007). *The Economics of Climate Change. The Stern Review*. Cambridge: Cambridge University Press.

Stevenson, H. (2008). Creating a Climate of Convenience: Australia's Response to Global Climate Change (1996-2007). *Energy & Environment, 19*(1), 3–20.

Synovate. (2010, 21.6.2010). *Climate Change Global Study 2010.* Paper presented at the Deutsche Welle Global Media Forum, Bonn.

Takahashi, B., & Meisner, M. (2012). Climate change in Peruvian newspapers: The role of foreign voices in a context of vulnerability. *Public Understanding of Science*(OnlineFirst), 1–16.

Thome, H. (2005). *Zeitreihenanalyse: Eine Einführung für Sozialwissenschaftler und Historiker*. München: Oldenbourg.

Townshend, T., Fankhauser, S., Matthews, A., Feger, C., Liu, J., & Thais, N. (2011). GLOBE Climate Legislation Study.

Trumbo, C. (1996). Constructing climate change: claims and frames in US news coverage of an environmental issue

Public Understanding of Science, 5(3), 269-283.

Ungar, S. (1992). The Rise and (Relative) Decline of Global Warming as a Social Problem. *The Sociological Quarterly, 33*, 483-501.

Kyoto Protocoll to the United Nations Framework Convention on Climate Change(1998).

Vliegenthart, R., & Boomgaarden, H. G. (2007). Real-World Indicators and the Coverage of Immigration and the Integration of Minorities in Dutch Newspapers. *European Journal of Communication, 22*(3), 293–314.

Watkins, K. (2007). *Human Development Report 2007/2008. Figthing climate change: Human solidarity in a divided world*. Houndmills: United Nations Development Programme.

WBGU - Wissenschaftlicher Beirat der Bundesregierung für Globale Umweltveränderungen. (2008). *Climate Change as a Security Risk*. London & Sterling: earthscan.

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*(3), 261-283.

Wilke, J. (1999). Leitmedien und Zielgruppenorgane. In J. Wilke (Ed.), *Mediengeschichte der Bundesrepublik Deutschland* (pp. 302-329). Bonn: Bundeszentrale für politische Bildung.

Williams, B. A., & Carpini, M. X. D. (2012). *After Broadcast News: Media Regimes, Democracy, and the New Information Environment*: Cambridge University Press.

Young, N., & Dugas, E. (2011). Representations of Climate Change in Canadian National Print Media: The Banalization of Global Warming. *Canadian Review of Sociology/Revue canadienne de sociologie, 48*(1), 1–22.

Zelli, F. (2011). The fragmentation of the global climate governance architecture. *Wiley Interdisciplinary Reviews: Climate Change, 2*(2), 255–270.

Zhao, X. (2009). Media Use and Global Warming Perceptions. *Communication Research, 36*(5), 698-723.

Appendix

Fig. 2: Extreme weather events in Australia

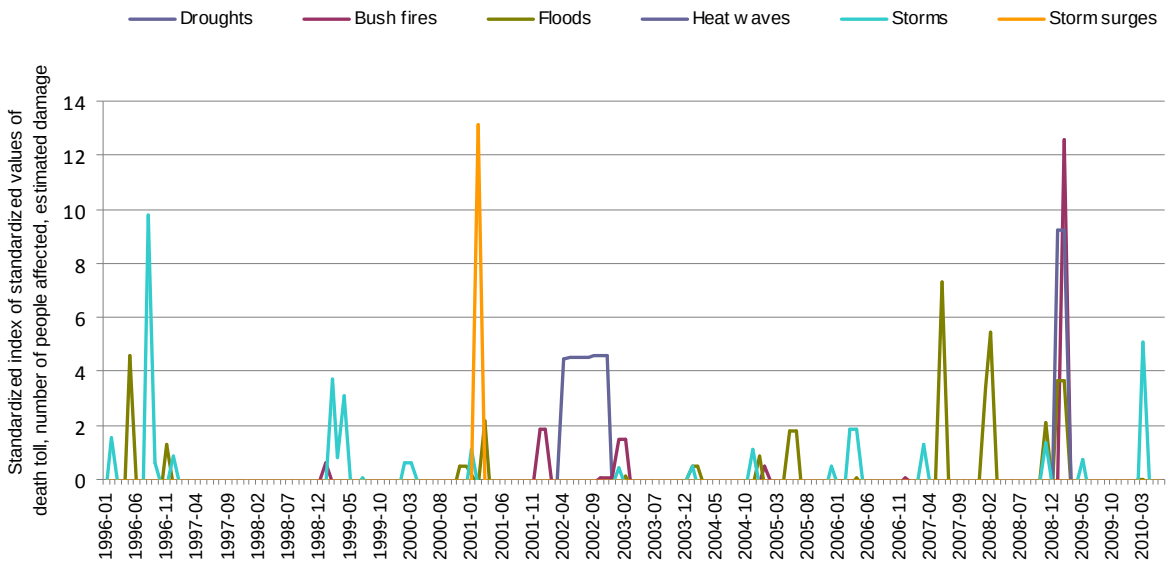


Fig. 3: Extreme weather events in Germany

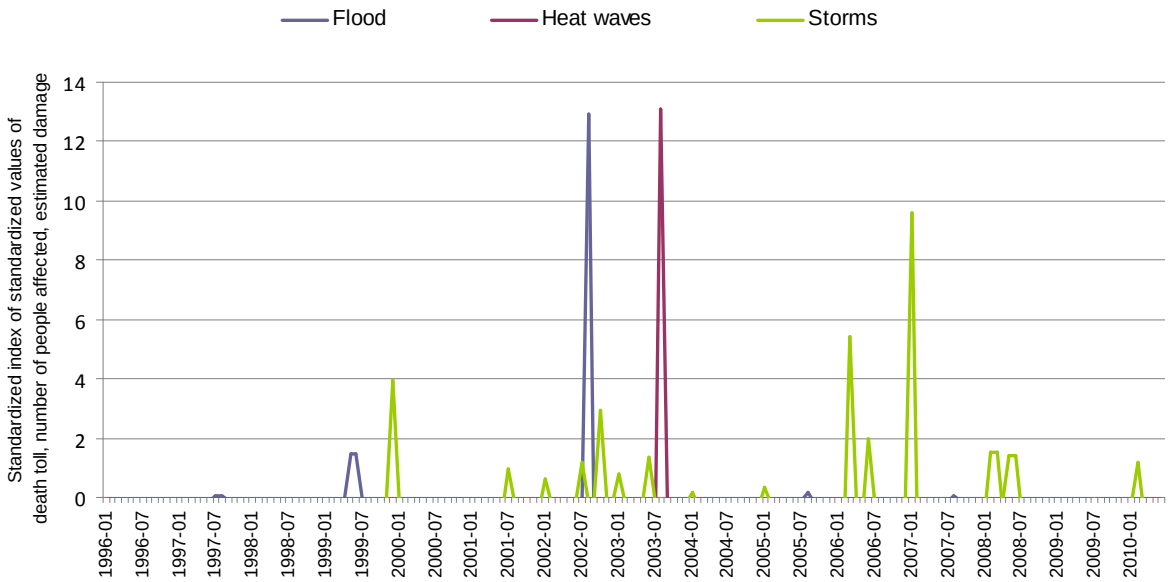


Fig. 4: Extreme weather events in India