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Reviewing the climate change reviewers: Exploring controversy through report references and citations

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ABSTRACT

There is a growing need to analyse the knowledge controversies about climate change. Human geography has a role in understanding of the motivations and sources of the participants in the debate. In this study, we explore the scientific background of the contrarian arguments, using *Climate Change Reconsidered* published by the conservative think tank Heartland Institute, in comparison with the Fourth Assessment Report of the Intergovernmental Panel on Climate Change *The Physical Science Basis*. Firstly, we surveyed the reference lists, which showed that in general the contrarian report used the same journals, as their most important sources. However, the differences are in the details: journals dealing with paleo-issues are more important for the contrarian report. Further, it is noteworthy that we found only 262 identical references (4.4% of all references) in the reports and their contextual analyses revealed that the rhetoric can be remarkably different, as can the way in which an article is used. These results indicate that we cannot state that the opponents use completely different sources, but the complementarity of their reference list raised some questions which are discussed in the last section of the paper. Should we take the 'contrarians' and their arguments seriously or not?

Introduction

The Intergovernmental Panel on Climate Change (IPCC) accepted the Fifth Assessment Report *The Physical Science Basis* at the end of September 2013, but only the draft version was accessible on its webpage for several months. At the same time well-informed insiders might have noticed that a US policy think tank, the Heartland Institute, had already published the final version of its own counter-report (Climate Change Reconsidered II, CCR2) demonstrating the position of the 'climate sceptics' on anthropogenic global warming.

When climate change became a relevant question in the 1970s, reviewing and assessing the current state of climate science was an obvious consequence. One of the first assessments was published by the Massachusetts Institute of Technology (SMIC, 1971) before the UN Conference on the Human Environment in Stockholm (Weart, 2010). After the IPCC was established in 1988, it became more influential through its scientific reports on climate change both in scientific and public discourses and in shaping climate policy. Hence, its work at the science-policy interface became highly reviewed after the year 2000 (e.g. Edwards and Schneider, 2001; Dahan-Dalmedico, 2008; Hulme and Mahony, 2010; Bjurström and Polk, 2011a, 2011b; Beck, 2012). Interest in the IPCC grew, particularly after the UN Climate Change Conference in Copenhagen and the Climatic Research Unit (CRU) email incident at the University of East Anglia ('Climategate') at the end of 2009, when hackers released thousands of emails, many of which were written by leading climate scientists. These events put climate science and climate policy generally under scrutiny (e.g., Berkhout, 2010; Prins et al., 2010; IAC, 2010; Grundmann, 2012; Maibach et al., 2012; Lahsen, 2013a).

There are several calls in the literature to analyse climate change from the various viewpoints of social sciences and particularly geography and science studies. Perhaps Hulme first noted that here is an important and timely research task for geography:

> "The [. . .] geographical project I propose as urgent is to scrutinize the knowledge claims made by science about climate change, most notably the various assessments of the IPCC" (Hulme, 2008, p. 8).

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"Revealing the local and situated characteristics of climate change knowledge thus becomes central for understanding both the acceptance and resistance that is shown towards the knowledge claims of the IPCC. It is a task for physical and human geographers to take seriously, and a task for them to do together" (Hulme and Mahony, 2010, p. 714).

Whatmore (2009, p. 596) argued that, in relation to environmental issues, "an interest in knowledge controversies as generative events in the socialization of scientific knowledge claims and technologies" is a common feature of geography and science and technology studies. Thus, geography has a potential role not only in interpretating the events at the interface between science and policy, but in understanding and mapping environmental controversies.

Lahsen (2013a) made a similar call in the wider context of social sciences. "[S]ocial scientists and scholars often explicitly posit ACC [anthropogenic climate change] as uncontested, objective reality" and "analysts tend to lump climate scientists into two polarized camps, and to subsequently dismiss the non-IPCC side". While social science research has focused overwhelmingly on backlash actors "[t]here is a reticence to shed similar, critical light on the extra-scientific dynamics shaping IPCC science" (Lahsen, 2013a, p. 551).

Despite the carefully built and widely argued consensus of the IPCC reports (see also e.g. Oreskes, 2004; Anderegg et al., 2010; Rosenberg et al., 2010; but cf. Bray, 2010), the counter-movement to the ACC idea emerged in parallel with the publication of the first IPCC reports in the 1990s, and its participants intensified their activity particularly after the global climate policy negotiations in Kyoto in 1997 about the reduction of carbon dioxide emissions (Oreskes and Conway, 2010; Dunlap and McCright, 2011). Hence, climate change became highly contested in society and politics (Hulme, 2009). However, the climate debate has different effects in different places (Grundmann and Scott, 2012). Due to the distance in minds and kilometres there was hardly a single report about Climategate in the mass media of the authors' country.

In the US, where the controversy continues to be most intense, a great amount of research has addressed the so called 'climate sceptics.' (There are several different, sometimes misleading terms, like climate change 'deniers', 'dismissers', 'contrarians' or 'mainstream sceptics' – Kemp et al., 2010; O'Neill and Boykoff, 2010; Lahsen, 2013b.) Accordingly, several studies aimed to unveil the 'denial machine', pointing out the various methods used by the sceptics to discredit the mainstream science (e.g., Edwards and Schneider 2001; McCright and Dunlap, 2010; Nerlich, 2010; Oreskes and Conway, 2010; Ceccarelli, 2011; Dunlap and McCright, 2011). Further, the backgrounds and the motivations of the contrarian scientists are explored (Jaques et al., 2008; Lahsen, 2008, 2013b), and the linkages and attitudes of the oil economy are identified (Kolk and Levy, 2001; van de Hove et al., 2002).

However, the scientific sources of the contrarian arguments, according to our present knowledge, are barely known. For this reason, we analysed a 'sceptic' report on climate change to get a deeper insight into how contrarian views are constructed and legitimized using scientific material. Because the opposing assessment criticises the main findings of the IPCC, it was logical to review it by contrasting it with the IPCC Fourth Assessment Report, *The Physical Science Basis*, by the Working Group I (IPCC AR4 WGI). Thus, our study has two parallel goals: to understand the ideas of the contrarians of the ACC idea by revealing the nature of their report and also to show the scientific basis of the IPCC (similarly as Bjurström and Polk, 2011a, 2011b did in terms of the IPCC Third Assessment Report, TAR).

"Climate Change Reconsidered" (CCR), the previous version of the CCR II, was published in 2009 under the umbrella of the Nongovernmental International Panel on Climate Change (NIPCC), by the Heartland Institute, an influential conservative think tank (Idso and Singer, 2009). Although this report was widely publicised in the US and abroad, it is barely reviewed in the scientific literature (but see Van der Sluijs et al., 2010a: 44–45; or Hamilton, 2012: 38–39).

The NIPCC, a group of international scientists, was founded by the Science and Environmental Policy Project (SEPP) in Milan in 2003 and got active after the publication of IPCC AR4. The Heartland Institute was founded in 1984 and turned its attention to global warming particularly after 2000. Using different resources, from newsletters to media campaigns, it became the most active participant in the debate. It organises climate conferences and mobilises hundreds of scientists with its branches (e.g. Centre for the Study of Carbon Dioxide and Global Change, SEPP) in the world. The failure and the consequences of the recent billboard campaign in Heartland's hometown of Chicago showed that local incidents may have a global effect on the rearrangement of the network of climate change deniers. When Heartland portrayed the Unabomber as saying "I still believe in global warming. Do you?" there was a strong protest against comparing global warming advocates to the terrorist. The campaign was stopped after one day and many supporters and employees left the Institute following the incident. Another recent example, the Peter Gleick case ('Fakegate'), when the scientist used fraudulent means to reveal the financial background of the Institute, showed that the opponents sometimes use similar efforts (cf. the hackers' attack in case of Climategate).

Scientific background and theoretical considerations

To analyse the reports we used the simple but laborious method of bibliometrics, and also applied contextual analysis in contrasting identical references, suggested by the field of rhetoric of science in science and technology studies (Gross, 2006; Sismondo, 2010). In this section we give an overview about the overlapping research interest of geography and science studies in climate change to show the trends in scholarly work and to make our theoretical and methodological background clearer. After placing our research in a scientific context, we present our detailed research questions.

Science studies, geography and climate change

Philosophy and sociology of science offer some simple starting points to explore and understand the debate over climate change. The 'scientific field' concept of Bourdieu (2001) presents the controversy as mainstream science protecting the field of climate change from the attacks of the contrarians. According to the concept it may be suggested that the 'field' of climate change is not homogeneous; it has a changing structure, its agents have different amounts of scientific capital, and the boundaries of the field are continually being re-demarcated (cf. Hoffman, 2011). Relatedly, several papers have focused on the demarcation problem between mainstream science and climate-sceptic or non-science (Demeritt, 2001, 2006; Berkhout, 2010), although this polarised view of the debate could be criticised (Bray, 2010; Lahsen, 2013a, 2013b).

There is a similar but overly simplified perspective, when we see mainstream climate science as normal science in the Kuhnian sense, working within the anthropogenic paradigm of climate change (cf. Hulme, 2009; Goeminne, 2011), while its opponents are trying to debunk it. The post-normal theory of science, where facts are uncertain, values in dispute, stakes are high and decisions are urgent, offers an alternative view for climate science; it was applied to and tested on climate science by many scholars (Bray and von Storch, 1999; Saloranta, 2001; Glover, 2006; Hulme, 2009, 2010a; Hulme and Mahony, 2010; Friedrichs, 2011; Krauss et al., 2012; Turnpenny, 2012) and this controversial concept also fuelled the post-Climategate debate itself (Ravetz, 2011).

However, the recognition that the social sciences can play a major role in understanding the climate change controversy is quite recent; social science research previously largely ignored the debate or dismissed the distinct opinions (Hoffman, 2011; Lahsen, 2013a). Indeed, for social scientists ‘scepticism’ is mostly a phenomenon to understand in the public engagement process or in the media (e.g., Krosnick et al., 2006; Boykoff, 2007; Boykoff and Boykoff, 2007; Carvalho, 2007; Van der Sluijs et al., 2010a; Gavin and Marshall, 2011; Corner et al., 2012). In the US in particular, public attitudes embedded in political ideologies and environmental values are under investigation (e.g., Lorenzoni and Pidgeon, 2006; McCright and Dunlap, 2010, 2011; Poortinga et al., 2011; Whitmarsh, 2011), and the controversy is usually explained as the struggle of the environmental (leftist, democratic or reflexive-modernist) and the anti-environmental (conservative, modernist or anti-reflexive) social movement (Glover, 2006; McCright, 2011).

Studying climate change controversies therefore was not in the research focus of either science studies, or geography. Considering the debates in principle, it is difficult to bring climate change and science studies together, as Demeritt (2006) warns. Paradoxically, science studies are traditionally identified with the ‘Academic Left’, while climate sceptics are usually connected to conservative ideology and politics. “Though there are no substantive connections” between them, the arguments of climate sceptics “exemplify many of the wider claims made in academic science studies about the construction of scientific knowledge” (Demeritt, 2006, pp. 464–465). This situation is quite inconvenient for scholars of science studies (Grundmann, 2012). “Was I wrong to participate in the invention of this field known as science studies? Is it enough to say that we did not really mean what we said? Why does it burn my tongue to say that global warming is a fact whether you like it or not? Why can’t I simply say that the argument is closed for good?” pondered Latour (2004, p. 227).

The common approaches of science studies and geography, urged by Whatmore (2009), became major issues only after Climategate (Grundmann, 2012; Lahsen, 2013a), when Ryghaug and Skjølsvold (2010) demonstrated the research possibilities on a particular material, analysing the scholarly practices manifested in the hacked emails. Mainstream research usually focused on the knowledge-making process, especially on the role of climate modelling (van der Sluijs et al., 1998; Edwards, 1999, 2001; Shackley 2001; Lahsen, 2005; Sundberg, 2007; Guillemot, 2010) and the science–policy interface (e.g., Hulme and Dessai, 2008; Pielke, 2007; van der Sluijs et al., 2010a, 2010b).

As a connected research interest, geographical work is flourishing on knowledge production (Hulme, 2010b, 2010c; Hulme and Mahony, 2010; Vasileiadou et al., 2011) and on situated environmental knowledge (Daniels and Endfield, 2009; Jasanoff, 2010; Brace and Geoghegan, 2011; Krauss and von Storch, 2012), while the geopolitical aspect of the debate over mitigation policy is an ongoing question (Dahan-Dalmedico, 2008; Reddy and Assenza, 2009). The dispute around anthropogenic climate change is also an emergent field for geography and related thought (Hulme, 2009) as well as the history of climate change science (Hamblyn, 2009; Sörlin, 2009; Galam, 2010; Eastin et al., 2011).

Scientometrics and rhetoric of science

For the methodological background of the paper we overview first some examples in the climate change literature applying the scientometric approach. Scientometrics (or narrowly bibliometrics), a well-known approach for studying science itself, was used initially to demonstrate the developments (Weingart et al., 2000; Stanhill, 2001; Russil and Nyssa, 2009), or the consensus of climate change science (Oreskes, 2004). In these cases scientometrics was meant to be only a simple content analysis with computational support. With a more detailed citation analysis, Vasileiadou et al. (2011) were among the first who assessed the distribution of the impact of the IPCC based on the geographical origins of the authors and their disciplines.

Similarly to our investigation, Nordlund (2008) used the references of the IPCC (AR4 WGII and WGIII) to explore the contribution of ‘futures research’ to the reports. Despite the date, the IPCC TAR was the subject of the studies by Bjurström and Polk (2011a, 2011b). Classifying 14,000 references of the full report by type and subject, they tried to explore the disciplinary differences (Bjurström and Polk, 2011a).

Science and technology studies and particularly their subfield, rhetoric of science, provides the methodological background for the second part of our analysis. There is a dispute whether rhetoric creates or only shapes scientific knowledge, but Gross (2006) argues that rhetoric is constitutive of science, and that citations can be viewed as rhetorical features. There are three genres of speech in the rhetoric of science: forensic, epideictic and deliberative:

> “A report is forensic because it reconstructs past science in a way most likely to support its claims; it is deliberative because it intends to direct future research; it is epideictic because it is a celebration of appropriate methods.” (Gross, 2006, p. 25)

In another landmark study, *Science in Action*, Bruno Latour (1987) provocatively demonstrated literature processing techniques and showed that scientists often modify a given statement that originates from others with ‘modalities’. Positive modalities are “those sentences that lead a statement away from its conditions of production, making solid enough to render some other consequences necessary” and negative modalities are those “that lead a statement in the other direction towards its conditions of production and that explain in detail why it is solid or weak instead of using it to render some other consequences more necessary” (Latour, 1987, p. 23). As Latour argues, “by itself a given sentence is neither a fact nor a fiction; it is made so by others, later on’ and ‘the status of a statement depends on later statements” (Latour, 1987, p. 25 and 27). Latour sums up his analysis of literature as follows, and these ideas form a good starting point for our analysis:

> “Whatever the tactics, the general strategy is easy to grasp: do whatever you need to the former literature to render it as helpful as possible for the claims you are going to make. The rules are simple enough: weaken your enemies, paralyse those you cannot weaken [...], help your allies if they are attacked, ensure safe communications with those who supply you with indisputable instruments [...], oblige your enemies to fight one another [...]; if you are not sure of winning, be humble and understated” (Latour, 1987, pp. 37–38).

These quotations also indicate that both rhetoric and language are very important (see a related approach by Fahnestock, 1986, or recently Fløttum and Dahl, 2012). Moreover, Livingstone (2005) turns our attention in another interesting direction. He argues about the geographies of reading and interpretation, or the cultural ecology of science, and states that reading is crucial in terms of assessments and report making. He says scientific knowledge” is also about the encounter with scientific texts” (Livingstone, 2005, p. 391), where “the horizons of reader and writer come together to make meaning” (p. 393). Obviously, readers might have different reading strategies, textual practices and interpretative tactics. Livingston cites Stanley Fish’s concept of 'interpretive communities', and underlines that "the inescapably collective character of interpretation and the way in which any individual reading is located in the reader's membership of a community sharing some foundational assumptions and interpretive strategies" (Livingstone, 2005, p. 395). These thoughts also open another way to see the process of reviewing and assessing scientific literature.

As we saw with Gross, Latour and Livingstone, authors, readings and use of references might be all in dispute, particularly in case of the scientific assessments. In fact, the conflict of references is already palpable on the websites of the IPCC and the NIPCC, where the former claims that "[r]eview is an essential part of the IPCC process, to ensure an objective and *complete* assessment of current information" (emphasis added, see: www.ipcc.ch/organization Accessed: 26 January, 2012), while the latter notes that they aim "to look at evidence the [IPCC] ignores" (www.nipccreport.org/about/about.htm Accessed: 26 January, 2012).

Goals of the paper

We now have discussed a growing body of scientific literature on the interface of climate change, geography and science studies. We have shown the different trends in approaches and methods of research: in our paper the results of scientometrics provide the context for the further analysis of the rhetorical differences of the reports. Setting the references and in-text citations at the focus of our study, our research questions were the following:

- Analysing the reference lists, what difference is there in the scientific basis of CCR compared to the IPCC?
- Considering the identical references, what is the difference in how they are used (e.g. interpretation and context)?
- How does the rhetoric of the sceptical report differ from that of the IPCC report?

Methods

The reports of the IPCC AR4 WGI and CCR are of similar total length, but have different structures. The CCR reflects directly on the three reports made by the IPCC working groups. For this reason, in the analysis we used only the first six chapters which are related to the WGI Report of the IPCC.

Starting our work in scientometrics, we processed the reference lists of the reports, computed statistics and identified the identical references that provided a context to begin further analysis. In studying the context of the in-text citations and rhetoric, we decided to focus on extreme weather and paleoclimate, because of their relevance in wider public debates about climate change.

First, we analysed nearly all the journal articles and all the separate in-text citations which are associated with extreme weather. Thus, Chapter 6 of the NIPCC report, "Observations: Extreme Weather," and the related parts of the IPCC report were chosen for investigation (see Appendix A).

Second, we analysed all the 46 identical references which occurred in Chapter 6 of CCR and also appear in the IPCC report. Nevertheless, we did not aim to systematically control whether the references and citations are used relevantly or not. For the rhetorical analysis, we defined the mode in which the results of a given article were interpreted in both reports (Appendix B). The aim here was to determine how the reviewers used the references associated with the ACC theory. Specifically, we examined whether or not the cited reference is used to support the view that the climate/weather will be more extreme due to climate change. We defined four options for interpretation:

- The cited fact or finding or its interpretation *supports* the ACC idea (e.g. "Emanuel (2005a) and Webster et al. (2005, 2006) indicated that the typhoons have become more intense in this region" IPCC, 2007, p. 306);
- or *does not* (e.g. "Pielke et al. (2005) began their discussion by noting that 'globally there has been no increase in tropical cyclone frequency over at least the past several decades'" IPCC, 2007, p. 309).
- The citation of a reference indicates *uncertainty* by alluding either to the limits of the knowledge or methods, or to the discrepancy of the present knowledge (e.g. "During an El Niño event, the incidence of hurricanes typically decreases in the Atlantic (Gray, 1984; Bove et al., 1998) [...], while it increases in the central North and South Pacific and especially in the western North Pacific typhoon region (Gray, 1984 [...])" IPCC, 2007, p. 305).
- The method of citation is *neutral* by alluding either to a method or data source, or to irrelevant information (e.g., a weather event; "[t]he power dissipation of a storm is proportional to the wind speed cubed (Emanuel, 2005a)" IPCC, 2007, p. 305).

In the first case of this analysis, we computed a further statistic based on the dominant use of a given article. For this purpose, each reference that was used more than once in different contexts in the same report was classified into a dominant category by the following logic: 'not supporting' (the strongest) – 'supporting' – 'uncertainty' – 'neutral' (the weakest). In analysing the identical references, we tried also to identify the literature processing techniques of the scientists, as described by Gross (2006) and Latour (1987).

Results

Reference statistics of the reports

We summarised the reference statistics of the scientometric analysis in Table 1. The scientific basis of the IPCC AR4 WGI is almost four times larger than the same field of review of CCR. The peer-reviewed material was 90.5% of the IPCC report (and 84% of the IPCC TAR WGI Report – Bjurström and Polk, 2011a) and 90.79% of the material used by the NIPCC.

Considering the contrarian views that there might be a publication bias, because the gatekeepers of the mainstream journals do not allow contrarian articles to be published (McKitrick, 2011), and because the CRU affair suggested that the peer review process of the IPCC and some journals were affected by malpractice (Grundmann, 2012, 2013), we assumed that the reference list of the NIPCC report would differ markedly, and that some well-known key scientists or some journals (cf. Ackerman, 2008) would be overrepresented on the contrarian side. In fact, considering the most cited journals (*Journal of Geophysical Research*, *Geophysical Research Letters*, *Journal of Climate*, *Nature*, *Science*), it seems that the scientific background of the NIPCC report is quite similar to the IPCC report.

There are, however, differences, each report preferring references from specific journals (Tables 1 and 2: column D), such as *Climate Dynamics* (in 5th place with 5.82% by the IPCC versus 14th place with 1.35% by the NIPCC), *Global Biogeochemical Cycles* (2.28% versus 0.68%), *Journal of the Atmospheric Sciences* (2.11% versus 0.53%) and *Tellus* (1.48% versus 0.23%). On the contrary, *The Holocene* is 6th in the NIPCC-report and 35th in the IPCC (with 4.66% versus 0.38%) and several other journals are similarly referred to disproportionately by the NIPCC e.g. *Quaternary Research* (3.16% versus 0.32%), *Geology* (1.43% versus 0.19%) and *Palaeogeography*, *Palaeoclimatology*, *Palaeoecology* (1.43% versus

Table 1
The scientific background of the reports; the most important forty journals by reference numbers without recurrence. *Source:* Computed by the authors from IPCC 2007 and Idso and Singer, 2009.

Rank		IPCC	%	Cumm. %	Rank		NIPCC Chap. 1–6	%	Cumm. %
	References altogether	5242	–			References altogether	1466	–	
	Journal references	4742	100.00			Journal references	1331	100.00	
1	Journal of Geophysical Research	694	14.64	14.64	1	Geophysical Research Letters	129	9.69	9.69
2	Geophysical Research Letters	673	14.19	28.83	2	Science	112	8.41	18.11
3	Journal of Climate	658	13.88	42.70	3	Journal of Geophysical Research	91	6.84	24.94
4	Science	284	5.99	48.69	4	Nature	90	6.76	31.71
5	Climate Dynamics	276	5.82	54.51	5	Journal of Climate	83	6.24	37.94
6	Nature	257	5.42	59.93	6	The Holocene	62	4.66	42.60
7	Global Biogeochemical Cycles	108	2.28	62.21	7	Quaternary Research	42	3.16	45.76
8	Journal of the Atmospheric Sciences	100	2.11	64.32	8	Climatic Change	35	2.63	48.38
9	Climatic Change	85	1.79	66.11	9	Quaternary Science Reviews	33	2.48	50.86
10	International Journal of Climatology	83	1.75	67.86	10	International Journal of Climatology	31	2.33	53.19
11	Bulletin of the American Meteorological Society	79	1.67	69.53	11	Bulletin of the American Meteorological Society	25	1.88	55.07
12	Tellus	70	1.48	71.00	12	Geology	19	1.43	56.50
13	Atmospheric Chemistry and Physics	66	1.39	72.40	13	Palaeogeography, Palaeoclimatology, Palaeoecology	19	1.43	57.93
14	Quaternary Science Reviews	59	1.24	73.64	14	Climate Dynamics	18	1.35	59.28
15	Monthly Weather Review	53	1.12	74.76	15	Global and Planetary Change	18	1.35	60.63
16	Journal of Hydrometeorology	50	1.05	75.81	16	Climate Research	17	1.28	61.91
17	Quarterly Journal of the Royal Meteorological Society	50	1.05	76.87	17	EOS: Transactions of the American Geophysical Union	17	1.28	63.19
18	Proceedings of the National Academy of Sciences	43	0.91	77.77	18	Earth and Planetary Science Letters	13	0.98	64.16
19	Journal of Physical Oceanography	42	0.89	78.66	19	Proceedings of the National Academy of Sciences	13	0.98	65.14
20	Paleoceanography	41	0.86	79.52	20	Quaternary International	13	0.98	66.12
21	Global and Planetary Change	38	0.80	80.32	21	Annals of Glaciology	12	0.90	67.02
22	Climate Research	37	0.78	81.11	22	Paleoceanography	11	0.83	67.84
23	Journal of the Meteorological Society of Japan	27	0.57	81.67	23	Atmospheric Environment	10	0.75	68.60
24	Atmospheric Environment	26	0.55	82.22	24	Journal of Hydrology	10	0.75	69.35
25	Global Change Biology	26	0.55	82.77	25	Journal of Paleolimnology	10	0.75	70.10
26	Theoretical and Applied Climatology	26	0.55	83.32	26	Global Biogeochemical Cycles	9	0.68	70.77
27	Deep Sea Research	22	0.46	83.78	27	Natural Hazards	8	0.60	71.37
28	Annals of Glaciology	21	0.44	84.23	28	Arctic Antarctic and Alpine Research	8	0.60	71.98
29	Journal of Glaciology	21	0.44	84.67	29	Soil Biology and Biochemistry	8	0.60	72.58
30	Review of Geophysics	21	0.44	85.11	30	Global Change Biology	7	0.53	73.10
31	Earth and Planetary Science Letters	19	0.40	85.51	31	Journal of the Atmospheric Sciences	7	0.53	73.63
32	Philosophical Transactions of the Royal Society A	19	0.40	85.91	32	Journal of the American Water Resources Association	7	0.53	74.15
33	Scientific Online Letters on the Atmosphere	19	0.40	86.31	33	Journal of Glaciology	7	0.53	74.68
34	Journal of Applied Meteorology	18	0.38	86.69	34	Physical Review Letters	7	0.53	75.21
35	The Holocene	18	0.38	87.07	35	Theoretical and Applied Climatology	7	0.53	75.73
36	EOS: Transactions of the American Geophysical Union	16	0.34	87.41	36	Ambio	6	0.45	76.18
37	Journal of Hydrology	15	0.32	87.73	37	Advances in Space Research	6	0.45	76.63
38	Quaternary Research	15	0.32	88.04	38	Canadian Journal of Forest Research	6	0.45	77.08
39	Advances in Atmospheric Sciences	14	0.30	88.34	39	Ecology	6	0.45	77.54
40	Ocean Modelling	13	0.27	88.61	40	Journal of Quaternary Science	6	0.45	77.99

0.15%) representing mainly the 'paleo-sciences' are cited in the NIPCC report. Considering these results, in Section 'Different constructions of the past' we address the paleoclimate chapters of the reports to investigate the different rhetorical constructions of the past.

Of course, there are also journals that are cited in only one of the reports. The IPCC used 258 journals, the NIPCC 218 and there were 126 common journals from a total of 350.

It is notable that the reference list of the IPCC report is a little more concentrated. Each of the three most cited journals make up over 10% of the total, while the five most cited journals together account for 50% in the IPCC report. In CCR, only the nine most cited journals reach this level after aggregation, and there are no journals providing over 10% of its content.

In the reference lists of the reports we found 262 identical journal references (from 46 common journals) and nine overlapping 'grey' literature references, so the proportion of identical journal references is very low (4.35% – Table 2).

Using the literature on extreme weather

Classifying the context of the citations associated with extreme weather was difficult. The category 'uncertainty' in particular required careful consideration. As anticipated, the main rhetoric of the IPCC supports the ACC theory, and similarly, the main type of citation by the NIPCC is 'not supporting' the idea. According to our data, the main sources of 'not supporting' and 'uncertain' findings are the following journals: *The Holocene*, *Quaternary Science Reviews*, *Quaternary Research*, *Climate Research*, *Bulletin of the American Meteorological Society*, *Geophysical Research Letters*, *Journal of Hydrometeorology*, *Nature*, and *Science* (Table 3).

Table 2
Common journals with identical references, by journals with at least ten references in any report. Sorted by the ratio of identical references. *Source:* Computed by the authors from IPCC 2007 and Idso and Singer, 2009.

	IPCC A	NIPCC Chap. 1–6 without 2008–2009 B	Identical references C	Ratio of the reports [B/A × 100] D	Ratio of identical references [C/(A + B) × 100] E
References altogether	5242	1407	271	26.88	4.07
Journal references	4742	1283	262	27.06	4.35
Science	284	110	39	38.73	9.90
Climate Research	37	17	5	45.95	9.26
Proceedings of the National Academy of Sciences	43	13	5	30.23	8.93
Bulletin of the American Meteorological Society	79	23	9	29.11	8.82
Nature	257	89	30	34.63	8.67
Journal of Paleolimnology	2	10	1	500.00	8.33
Journal of Hydrology	15	10	2	66.67	8.00
Quaternary Science Reviews	59	33	7	55.93	7.61
Journal of Atmospheric and Oceanic Technology	12	2	1	16.67	7.14
Journal of Glaciology	21	7	2	33.33	7.14
Natural Hazards	3	13	1	433.33	6.25
International Journal of Climatology	83	30	7	36.14	6.19
Paleoceanography	41	11	3	26.83	5.77
Global and Planetary Change	38	15	3	39.47	5.66
Journal of Climate	657	78	39	11.87	5.31
Geophysical Research Letters	673	123	40	18.28	5.03
Climatic Change	85	35	6	41.18	5.00
Review of Geophysics	21	1	1	4.76	4.55
Philosophical Transactions of the Royal Society A	19	4	1	21.05	4.35
Palaeogeography, Palaeoclimatology, Palaeoecology	7	19	1	271.43	3.85
The Holocene	18	62	3	344.44	3.75
Journal of the Meteorological Society of Japan	27	2	1	7.41	3.45
Monthly Weather Review	53	6	2	11.32	3.39
EOS: Transactions of the American Geophysical Union	16	17	1	106.25	3.03
Atmospheric Chemistry and Physics	66	3	2	4.55	2.90
Journal of Geophysical Research	694	81	22	11.67	2.84
Journal of the Atmospheric Sciences	100	7	3	7.00	2.80
Climate Dynamics	276	18	6	6.52	2.04
Journal of Hydrometeorology	50	3	1	6.00	1.89
Quaternary Research	15	42	1	280.00	1.75
Global Biogeochemical Cycles	108	9	2	8.33	1.71
Tellus	70	3	1	4.29	1.37

Second, it has become clear that ‘citation in quotation’ (citations appearing inside a verbatim quotation which also appear in the reference list) is a widely used technique in the NIPCC report. Our investigation revealed that 25.67% of the analysed references were used in this way, which opens the possibility of a stronger critique of the sceptic report and to a degree distorts the results presented in Table 1. However, from another perspective, this technique – in Latour’s terms – can be regarded as a particular way of ‘bringing the friends in’.

The context of the identical references

We present here some examples of the variant use of identical references. The results of this investigation are summarised in Appendix A. One important difference is that the IPCC usually uses overall statements with grouped citations, in many cases with comments (or as Latour says: modalities), meaning that forensic language is the dominant rhetoric. The NIPCC generally applies a narrative form of citation, explaining the details of the work of the scientists. This language is rather epideictic in a rhetorical sense; they celebrate the scientist who performs measurements and observations in the field: “Hodell et al. (2005a) returned to Lake Chichancanab in March 2004 and retrieved a number of additional sediment cores in some of the deeper parts in the lake” (Idso and Singer, 2009, p. 290). This technique is usually supplemented with verbatim quotations (without page numbers), where the abovementioned ‘citations in quotations’ occur.

Both ways of reviewing aim to be credible, but strive for this aim in different rhetorical ways. The narrative context and the verbatim quotations make the text *itself* more believable; the authors of CCR usually arrange and narrate the quotations drawing conclusions only at the end of the sections. Thus the authors remain in the background. The IPCC report always synthesises the literature using grouped citations, and this technique makes the reviewer *himself* or *herself* more believable; they are in the foreground. But the text is important as well because it demonstrates the skills of the reviewer.

The battle of ‘key references’

Tropical cyclones are among the most controversial topics in the climate change debate, particularly in the US. Beyond the hundreds of media reports, several debates were going on in journals around the very active hurricane season in 2004–2005 (see a summary by Shepherd and Knutson, 2007). There was a short dispute in *Journal of Climate* (Knutson and Tuleya, 2004 versus Michaels et al., 2005, for and against the ACC theory respectively), in *Nature* (Emanuel, 2005 versus Landsea, 2005 and Pielke, 2005) and in *Science* (Webster, 2005 versus Chan, 2006), while later Klotzbach, 2006 and Michaels et al., 2006 joined the debate from *Geophysical Research Letters* among others. Obviously, their ‘calculation centres’ (Latour, 1987) are in similar apparent opposition: Massachusetts Institute of Technology (Emanuel), Georgia Institute of Technology (Webster), National Oceanic and Atmospheric Administration (NOAA) Geophysical Fluid Dynamics Laboratory (Knutsen) versus the NOAA National Hurricane Centre (Landsea) and Colorado State University (Klotzbach, W. Gray, earlier Chan). Going through the reports we can see that these 'key authors' and papers are mostly referenced in both documents as they line up for a predetermined battle again: the source of data and the methodology are the basis for criticism.

In the IPCC report, the key references of CCR are usually cited to demonstrate uncertainties, but in the hurricane debate they referred briefly only to the controversy between Emanuel and Landsea in *Nature*. One explanation for the reduced representation of the debate in the IPCC AR4 might be that Christopher Landsea withdrew from participating in AR4 due to personal conflicts in 2005. Nevertheless, the IPCC's conclusion reflects the results of their key authors:

> "In the western North Pacific, long-term trends are masked by strong inter-decadal variability for 1960 to 2004 (Chan and Liu, 2004; Chan, 2006), but results also depend on the statistics used and there are uncertainties in the data prior to the mid-1980s (Klotzbach, 2006). Further increases in activity have occurred in the last few years after Chan and Liu (2004) was completed (Figure 3.40). Tropical cyclones making landfall in China are a small fraction of the total storms, and no obvious long-term trend can be discerned (He et al., 2003; Liu and Chan, 2003; Chan and Liu, 2004). However, Emanuel (2005a) and Webster et al. (2005, 2006) indicated that the typhoons have become more intense in this region, with almost a doubling of PDI [Power Dissipation Index] values since the 1950s and an increase of about 30% in the number of category 4 and 5 storms from 1990 to 2004 compared with 1975 to 1989. The post-1985 record analysed by Klotzbach (2006) is too short to provide reliable trends" (IPCC, 2007, p. 306).

In the 9th chapter of the IPCC, the 'key authors' line up for a predetermined battle for the second time. The authors of this section tried to present the opposing facts and statements ("There continues to be little evidence [...] However, there is some evidence [...]" IPCC, 2007, p. 711) and concluded as follows: "[The] deficiencies preclude a stronger conclusion than an assessment that anthropogenic factors more likely than not have contributed to an increase in tropical cyclone intensity." (IPCC, 2007, p. 712)

The NIPCC contrasts the references similarly. It criticises the results or methods of the IPCC's key authors using many of the findings of the review by Pielke Jr. et al. (2005), or Klotzbach (2006):

> "Emanuel (2005) claimed to have found that a hurricane power dissipation index had increased by approximately 50 percent for both the Atlantic basin and the Northwest Pacific basin since the mid 1970s, and Webster et al. (2005) contended the numbers of Category 4 and 5 hurricanes for all tropical cyclone basins had nearly doubled between an earlier (1975–1989) and a more recent (1990–2004) 15-year period. However, in a challenge to both of these claims, Klotzbach (2006) wrote that "many questions have been raised regarding the data quality in the earlier part of their analysis periods" [...] With respect to Category 4 and 5 hurricanes, however, he found there had been a "small increase" in their numbers from the first half of the study period (1986–1995) to the last half (1996–2005); but he noted that "most of this increase is likely due to improved observational technology"" (Idso and Singer, 2009, pp. 328–329).

The vocabulary of the reports is quite similar. When citing a friendly author, the reports use the verbs 'find', 'indicate', 'report', 'show', 'conclude', but while citing an opposing author 'claim', 'contend' and, for presenting the counter-opinions, 'challenge' are used. It should also be noted that clauses starting with 'however/although/nevertheless' are very important for reviews on both sides, either diminishing the main sentence with a negative modality or dissolving the uncertainty. Thus, results from key authors always modify or qualify the claims of the opponents returning to the original context of the statement's production.

Facts from papers presented in different ways

There are also cases where a particular finding of a study is interpreted in different ways by the reports, e.g., Knutson and Tuleya (2004), which is an important reference in the IPCC report. The report states that an increase in mean and peak wind intensities and in peak precipitation intensities will occur over most of the tropical cyclone areas (IPCC, 2007, p. 864). Earlier, it reports the conclusions of this study briefly as follows:

> "They use mean tropical conditions from nine global climate models with increased CO_2 to simulate tropical cyclones with 14% more intense central pressure falls, 6% higher maximum surface wind speeds and about 20% greater near-storm rainfall after an idealised 80-year buildup of CO_2 at 1% yr – 1 compounded" (IPCC, 2007, p. 788).

In contrast, using the phrases of Pielke Jr. et al. (2005), the NIPCC puts some of the findings of this reference in the context of uncertainty; moreover, the potential conclusion of the cited finding is weakened with a negative modality, citing the opposing article from the *Journal of Climate*.

> "[M]ore recent work by Knutson and Tuleya (2004) points to only a 5 percent increase in hurricane windspeeds by 2080, and [...] Michaels et al. (2005) conclude that even this projection is likely twice as great as it should be" (Idso and Singer, 2009, p. 310).

Another interesting example occurs where the reports obtain two different facts from Gulev et al. (2001). The IPCC cites the article in the context of uncertainty the first time, but uses Gulev et al. to demonstrate the evidence for the ACC paradigm the second time: "General features include a poleward shift in storm track location, increased storm intensity, but a decrease in total storm numbers" and "increase in the number of deep cyclones is apparent over the North Pacific and North Atlantic" (IPCC 2007, p. 282 and 311). However, the NIPCC reports only that Gulev et al. (2001) "found a statistically significant decline of 1.2 cyclones per year" (Idso and Singer, 2009, p. 343).

The example of Zhang et al. (2000) shows that a given sentence taken out of its original context can read quite different. The IPCC reports briefly on the rise in extreme and mean sea levels (IPCC, 2007, p. 414), while the NIPCC writes the following:

> "Their analysis did not reveal any trends in storm activity during the twentieth century, which they say is suggestive of "a lack of response of storminess to minor global warming along the U.S. Atlantic coast during the last 100 yr"" (Idso and Singer, 2009, p. 344).

The contrarian interpretation sounds quite different, particularly taking the original conclusion of the authors into account, where they contextualize their findings referring to abrupt climate change (positive modality) and use a negative modality returning back to the original method and data to turn the final message in the right direction:

> "Analysis of the hourly tide gauge records from 10 tide gauges along the East Coast does not show any discernible long-term secular trend in storm activity during the twentieth century. This suggests a lack of response of storminess to minor global warming along the U.S. Atlantic coast during the last 100 yr. However,

Table 3
Contextual types of references associated with extreme weather: the most important fifteen journals in the reports. *Source:* Computed by the authors from IPCC 2007 and Idso and Singer, 2009.

		Literature items after dominant category									Every separate in-text citation							
	Altogether	Supporting		Uncertainty		Not supporting		Neutral/		Altogether	Supporting		Uncertainty		Not supporting		Neutral/	
	N	*n*	%	*n*	%	*n*	%	*n*	%	*n*	*n*	%	*n*	%	*n*	%	*n*	%
IPCC-report																		
References altogether	504	316	*62.70*	97	*19.25*	15	*2.98*	76	*15.08*	783	456	*58.24*	153	*19.54*	18	*2.30*	156	*19.92*
Journal references	465	288	*61.94*	93	*20.00*	15	*3.23*	69	*14.84*	727	417	*57.36*	149	*20.50*	15	*2.06*	146	*20.08*
Journal of Climate	106	60	*56.60*	27	*25.47*	5	*4.72*	14	*13.21*	164	89	*54.27*	42	*25.61*	7	*4.27*	26	*15.85*
Geophysical Research Letters	47	33	*70.21*	6	*12.77*	4	*8.51*	4	*8.51*	70	46	*65.71*	12	*17.14*	4	*5.71*	8	*11.43*
Climate Dynamics	43	30	*69.77*	8	*18.60*	0	*0.00*	5	*11.63*	69	46	*66.67*	14	*20.29*	0	*0.00*	9	*13.04*
International Journal of Climatology	30	22	*73.33*	7	*23.33*	0	*0.00*	1	*3.33*	39	26	*66.67*	11	*28.21*	0	*0.00*	2	*5.13*
Journal of Geophysical Research	25	19	*76.00*	3	*12.00*	0	*0.00*	3	*12.00*	39	23	*58.97*	5	*12.82*	0	*0.00*	11	*28.21*
Nature	24	17	*70.83*	3	*12.50*	2	*8.33*	2	*8.33*	46	30	*65.22*	8	*17.39*	2	*4.35*	6	*13.04*
Science	22	13	*59.09*	8	*36.36*	0	*0.00*	1	*4.55*	35	21	*60.00*	11	*31.43*	0	*0.00*	3	*8.57*
Climate Research	17	7	*41.18*	6	*35.29*	2	*11.76*	2	*11.76*	32	11	*34.38*	11	*34.38*	2	*6.25*	8	*25.00*
Bull. of the American Meteorological Soc.	17	7	*41.18*	1	*5.88*	1	*5.88*	8	*47.06*	30	9	*30.00*	1	*3.33*	1	*3.33*	19	*63.33*
Climatic Change	15	12	*80.00*	2	*13.33*	0	*0.00*	1	*6.67*	28	23	*82.14*	3	*10.71*	0	*0.00*	2	*7.14*
Sci. Online Letters on the Atmosphere	11	10	*90.91*	0	*0.00*	0	*0.00*	1	*9.09*	14	12	*85.71*	0	*0.00*	0	*0.00*	2	*14.29*
Global and Planetary Change	10	8	*80.00*	1	*10.00*	0	*0.00*	1	*10.00*	12	8	*66.67*	1	*8.33*	0	*0.00*	3	*25.00*
Journal of Hydrometeorology	9	5	*55.56*	1	*11.11*	0	*0.00*	3	*33.33*	23	12	*52.17*	1	*4.35*	1	*4.35*	9	*39.13*
Journal of the Meteorological Soc. of Japan	8	2	*25.00*	4	*50.00*	0	*0.00*	2	*25.00*	14	2	*14.29*	8	*57.14*	0	*0.00*	4	*28.57*
Journal of Hydrology	6	2	*33.33*	1	*16.67*	0	*0.00*	3	*50.00*	6	2	*33.33*	1	*16.67*	0	*0.00*	3	*50.00*
NIPCC-report																		
References altogether	374	36	*9.63*	27	*7.22*	264	*70.59*	47	*12.57*	448	47	*10.49*	32	*7.14*	303	*67.63*	66	*14.73*
Journal references	347	30	*8.65*	25	*7.20*	249	*71.76*	43	*12.39*	422	41	*9.72*	30	*7.11*	289	*68.48*	62	*14.69*
Geophysical Research Letters	32	1	*3.13*	3	*9.38*	24	*75.00*	4	*12.50*	36	1	*2.78*	4	*11.11*	26	*72.22*	5	*13.89*
Journal of Climate	29	3	*10.34*	4	*13.79*	18	*62.07*	4	*13.79*	36	4	*11.11*	4	*11.11*	23	*63.89*	5	*13.89*
Nature	22	6	*27.27*	0	*0.00*	15	*68.18*	1	*4.55*	30	9	*30.00*	0	*0.00*	20	*66.67*	1	*3.33*
Science	18	2	*11.11*	1	*5.56*	12	*66.67*	3	*16.67*	28	6	*21.43*	1	*3.57*	16	*57.14*	5	*17.86*
The Holocene	18	0	*0.00*	0	*0.00*	17	*94.44*	1	*5.56*	19	0	*0.00*	0	*0.00*	17	*89.47*	2	*10.53*
Bull. of the American Meteorological Soc.	15	1	*6.67*	1	*6.67*	10	*66.67*	3	*20.00*	24	3	*12.50*	2	*8.33*	15	*62.50*	4	*16.67*
Quaternary Research	14	0	*0.00*	0	*0.00*	12	*85.71*	2	*14.29*	18	0	*0.00*	0	*0.00*	15	*83.33*	3	*16.67*
International Journal of Climatology	13	1	*7.69*	1	*7.69*	10	*76.92*	1	*7.69*	16	1	*6.25*	1	*6.25*	13	*81.25*	1	*6.25*
Climatic Change	12	1	*8.33*	1	*8.33*	9	*75.00*	1	*8.33*	13	1	*7.69*	2	*15.38*	9	*69.23*	1	*7.69*
Journal of Geophysical Research	10	2	*20.00*	1	*10.00*	4	*40.00*	3	*30.00*	11	2	*18.18*	1	*9.09*	4	*36.36*	4	*36.36*
Quaternary Science Reviews	8	0	*0.00*	0	*0.00*	7	*87.50*	1	*12.50*	8	0	*0.00*	0	*0.00*	7	*87.50*	1	*12.50*
Climate Research	7	0	*0.00*	1	*14.29*	6	*85.71*	0	*0.00*	9	0	*0.00*	2	*22.22*	7	*77.78*	0	*0.00*
Natural Hazards	6	0	*0.00*	1	*16.67*	4	*66.67*	1	*16.67*	6	0	*0.00*	1	*16.67*	4	*66.67*	1	*16.67*
Canadian Journal of Forest Research	5	1	*20.00*	0	*0.00*	3	*60.00*	1	*20.00*	6	1	*16.67*	0	*0.00*	3	*50.00*	2	*33.33*
Climate Dynamics	5	0	*0.00*	1	*20.00*	3	*60.00*	1	*20..00*	6	0	*0.00*	1	*16..67*	4	*66.67*	1	*16.67*

climate can change abruptly. Relatively large global warming is predicted in the next century, which may cause a major change in coastal storm activity. If future hourly tide gauge records are evaluated using methods employed in this paper, it will be possible to detect the response of tropical and extratropical storms to global warming" (Zhang et al. 2000, p. 1760).

Analysis of identical references has shown that the manner of citation and the context are often different. It was in fact a rare situation when a particular reference was used in nearly the same way, and this occurred mainly in methodological citations.

Different constructions of the past

The 6th chapter of the IPCC report deals with the paleoclimate issue. Sections of similar length (20–20 pages) are devoted to the last 2000 years and to the earlier periods up to the Pre-Quaternary times. On the other hand CCR devotes about 20 pages to the last 1000 years focusing on the 'hockey stick controversy', but only 3–4 pages to the earlier epochs. The 'hockey stick controversy' is well documented from different approaches (Demeritt, 2006; Frank et al., 2010; Ryghaug and Skjølsvold, 2010; Røyrvik, 2013); we focused on exploring the role and meaning of the past in the reports.

In these chapters it seems clear that climate modelling is not a reliable method for the authors of the NIPCC report, while the IPCC states that "[c]limate models are used to simulate episodes of past climate [...] to help understand the mechanisms of past climate changes. [...] At the same time, palaeoclimate reconstructions offer the possibility of testing climate models" (IPCC, 2007, p. 439). While the reports generally agree on the fact that variations in carbon dioxide were followed by variations in air temperature only after thousands of years, the message that the ice cores may tell us about the past, is totally different. The CCR draws groundbreaking conclusions from the references (e.g. Petit et al. 1999; Mudelsee, 2001), while the IPCC uses the same references to highlight mainly the paleoclimatic method and its achievements, and did not make far-reaching conclusions even afterwards.

> "Ice cores provide key information about past climates, including surface temperatures and atmospheric chemical composition. The bubbles sealed in the ice are the only available samples of these past atmospheres. The first deep ice cores from Vostok in Antarctica [...] also revealed a highly correlated evolution of temperature changes and atmospheric composition, which was subsequently confirmed over the past 400 kyr (Petit et al., 1999) and now extends to almost 1 Myr. This discovery drove research to understand the causal links between greenhouse gases and climate change." (IPCC, 2007, p. 106)

> "Figure 3.1 [i.e. temperature record of 420 kyr by Petit et al., 1999] tells us three things about the current warm period. First, temperatures of the last decades of the twentieth century were "unprecedented" or "unusual" only because they were cooler than during past interglacial peaks. Second, the current temperature of the globe cannot be taken as evidence of an anthropogenic effect since it was warmer during parts of all preceding interglacials for which we have good proxy temperature data. And third, the higher temperatures of the past four interglacials cannot be attributed to higher CO_2 concentrations caused by some non-human influence because atmospheric CO_2 concentrations during all four prior interglacials never rose above approximately 290 ppm" (Idso and Singer, 2009, p. 64)

The view of the past is uncertainly articulated by the IPCC, but their emphasis is on the future, in contrast with CCR, which uses the past unambiguously for explaining the present. The IPCC remarks that "WGI FAR [First Assessment Report] noted that past climates could provide analogues. [...] These past climates do not appear to be analogues of the immediate future, yet they do reveal a wide range of climate processes that need to be understood when projecting 21st century climate change" (IPCC, 2007, p. 107). However, later the 6th chapter says that the Mid-Pliocene climatic event was very similar to the present warming period "providing an accessible example of a world that is similar in many respects to what models estimate could be the Earth of the late 21st century." (IPCC, 2007, p. 440). Later, Palaeocene–Eocene Thermal Maximum is discussed briefly, which "is a striking example of massive carbon release and related extreme climatic warming." (IPCC, 2007, p. 442). Summing up, the IPCC looks for paleoclimatic examples to understand our future, while the NIPCC applies past climatic data to demonstrate that present climatic changes are not unprecedented.

Conclusions

"The debate has only just begun" concluded Grundmann (2012, p. 287) in his recent paper about the legacy of Climategate. Indeed, our results raise some further questions about the knowledge controversy escalating after the email incident. Analysing the difference between the reference lists, we concluded that scientific arguments were constructed from the similar material; references came mainly from the same journals and the same journals were among those most cited by both sides. Should we take the contrarian statements seriously? Should we consider them as well-established statements, legitimated with the same or similar peer reviewed journals? If we say 'no' and take the CCR as a partisan report, produced by cherry-picking the literature (a mutual charge in the controversy; Pielke, 2007), there is no end to the debate.

Our results show that some of the difference lies in the details; journals dealing with paleo-issues are more important for the NIPCC report. This raises a cautious question: is there an opposition in climate science palpable between paleoclimatology and the mainstream methods, similarly to the difference between observation and modelling (cf. Edwards, 1999; Lahsen, 2005; Guillemot, 2010)? In other words, are there specific sub-fields in climate science, which provide some more evidence against the anthropogenic climate change idea? Another question is who are the authors of the references used by the contrarian report? We checked the original references only in some cases but we did not analyse these scholars. Only further research can give the answer to both questions (cf. Lahsen, 2013b).

Based on the above findings and because grey literature had only a small significance in both reports, we cannot state that climate sceptics use completely different sources to demolish the architecture of mainstream climate science. Thus, we should reject the assumption that the reference list of CCR would differ markedly from that of the IPCC report. On the contrary, the contextual and rhetorical analysis of the extreme weather and paleoclimate chapters and sub-chapters revealed that not only do the contrarians have their key-authors, but so does 'mainstream' science and it was very instructive to see the pre-organised battle of these references with the pre-assigned winners, who were supporting the knowledge claims of the reviewers and 'weakening the enemies' (see Latour, 1987 as quoted above). Further, not only the facts, but the readings of the same facts differ, which makes the assessment process flexible.

What are the implications for science? There is a real concern that the controversy has so far had a negative effect on the reputation of science. From the perspective of an idealised public view of science (Lahsen, 2013a), such a polarised debate about 'truths' may be confusing. Thus, social science with science studies in the forefront has a mission to change this obsolete view of science. Saying 'yes' to our first question we might have a somewhat 'naive' implication for the IPCC; improving and widening the reviewing process may be a possible answer to the contrarian criticisms. But when we take the contrarian arguments seriously, there is a chance to bring together the differing views and knowledge claims of the disputing 'interpretive communities' (Lahsen, 2013b).

More broadly, we should consider that both reports purport to be based on the ideal of pure, value-free science, where the prevailing scientific practices may not lead to the end of the debate because citations are not solid bricks on which to build statements, conclusions and political decisions later on (cf. Sarewitz, 2004). Scientific reports should be viewed not only as a second level of peer review and canonization of scientific facts but also as a means of politicization of science. Our paper's final conclusion, claiming a more constructive and iterative science-policy relation, is well echoed in the literature (e.g. Demeritt, 2006; Pielke, 2007; Hulme, 2009; van der Sluijs et al., 2010b; Latour, 2011). However, there will be hope for better science for the public and for policy, for better constructions of the problem only when we fully understand the knowledge controversy around climate change.

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Appendix A. Subchapters of the IPCC report related to the extreme weather topic

3.3.4 + FAQ 3.2.	9.5.4.2.2.	11.3.3.5.	11.7.3.5.
3.5.3.	9.5.4.3.	11.3.3.6.	11.7.3.6.
3.8.	10.3.6. + FAQ 10.1.	11.3.3.7.	11.7.3.7.
8.5.	11.1.3.	11.4.3.1	11.8.1.3. p. 906
9.4.3	11.2.3.3.	11.4.3.2.	11.8.2.2. p. 909
9.5.3.6.	11.3.3.3.	11.5.3.3.	11.9.5.
9.5.3.7.	11.3.3.4.	11.6.4.	Box 11.5.

Appendix B. Identical references in the reports on the basis of Chapter 6 of the NIPCC report

Reference	IPCC		NIPCC	
	Place of in-text citation	Mode and context of citation associated with the ACC theory	Place of in-text citation	Mode and context of citation associated with the ACC theory
Gupta, A.K., Anderson, D.M., Overpeck, J.T., 2003. Abrupt changes in the Asian southwest monsoon during the Holocene and their links to the North Atlantic Ocean. Nature 421, 354–356	6.5. The Current Interglacial p. 463	Neutral/Irrelevant	6.1. Drought p. 285	Citation in quotation Neutral, indirectly supportive
Hodell, D.A., Brenner, M., Curtis, J.H., 2005. Terminal Classic drought in the northern Maya lowlands inferred from multiple sediment cores in Lake Chichancanab (Mexico). Quaternary Science Reviews 24, 1413–1427	6.6. The Last 2.000 Years p. 483	Not supporting	6.1. Drought p. 290–91	Not supporting
Manabe, S., Wetherald, R.T., 1987. Large-scale changes of soil wetness induced by an increase in atmospheric carbon dioxide. Journal of the Atmospheric Sciences 44, 1211–1235	11.1. Some Unifying Themes p. 861	Uncertainty	6.1. Drought p. 293	Citation in quotation Supporting but with critique
Wells, N., Goddard, S., Hayes, M.J., 2004. A selfcalibrating Palmer drought severity index. Journal of Climate 17, 2335–2351	3.3. Changes in Surface Climate: Precipitation, Drought and Surface Hydrology p. 261	Neutral/Irrelevant	6.1. Drought p. 300	Neutral/ Irrelevant
Hyvarinen, V., 2003. Trends and characteristics of hydrological time series in Finland. Nordic Hydrology 34, 71–90	4.2. Changes in Snow Cover p. 345	Supporting	6.2. Floods p. 305	Citation in quotation Not supporting
Mudelsee, M., Borngen, M., Tetzlaff, G., Grunewald, U., 2003. No upward trends in the occurrence of extreme floods in central Europe. Nature 425, 166–169	3.8. Changes in Extreme Events p. 311	Not supporting	6.2. Floods p. 304–5	Not supporting

Appendix B (*continued*)

Reference	IPCC		NIPCC	
	Place of in-text citation	Mode and context of citation associated with the ACC theory	Place of in-text citation	Mode and context of citation associated with the ACC theory
Zhang, X., Harvey, K.D., Hogg, W.D., Yuzyk, T.R., 2001. Trends in Canadian streamflow. Water Resources Research 37, 987–998	3.3. Changes in Surface Climate: Precipitation, Drought and Surface Hydrology p. 264	Uncertainty	6.2. Floods p. 305	Citation in quotation Uncertainty
	3.3. Changes in Surface Climate: Precipitation, Drought and Surface Hydrology p. 264	Supporting		
	4.2. Changes in River and Lake Ice p. 348	Not supporting + Figure		
	4.7. Changes in Permafrost p. 369	Neutral/Irrelevant, presumably a false citation instead of Zhang et al. 1999		
Knox, J.C., 2000. Sensitivity of modern and Holocene floods to climate change. Quaternary Science Reviews 19, 439–457	6.6. The Last 2.000 Years p. 483	Neutral/Irrelevant	6.2. Floods p. 308	Citation in quotation Neutral
Free, M., Bister, M., Emanuel, K., 2004. Potential intensity of tropical cyclones: Comparison of results from radiosonde and reanalysis data. Journal of Climate 17, 1722–1727	3.8. Changes in Extreme Events p. 304	Not supporting but with critique	6.3. Tropical Cyclones p. 309	Not supporting
			6.3. Tropical Cyclones p. 325	Not supporting
			6.3. Tropical Cyclones p. 328	Supporting
			6.3. Tropical Cyclones p. 328	Not supporting
Klotzbach, P.J., 2006. Trends in global tropical cyclone activity over the past 20 years (1986–2005). Geophysical Research Letters 33, doi: 10.1029/2006GL025881	3.8. Changes in Extreme Events p. 306	Uncertainty but with critique	6.3. Tropical Cyclones p. 311	Not supporting
	3.8. Changes in Extreme Events p. 306	Uncertainty but with critique	6.3. Tropical Cyclones p. 328–9	Not supporting
Knutson, T.R., Tuleya, R.E., 2004. Impact of CO_2-induced warming on simulated hurricane intensity and precipitation: Sensitivity to the choice of climate model and convective parameterization. Journal of Climate 17, 3477–3495	8.5. Model Simulations of Extremes p. 628	Uncertainty	6.3. Tropical Cyclones p. 310	Citation in quotation Supporting but with critique
	10.3. Projected Changes in the Physical Climate System p. 788	Supporting		
	11.1. Some Unifying Themes p. 864	Supporting		
	11.4. Asia p. 887	Supporting		
	11.6. Central and South America p. 895	Supporting		
Landsea, C.W., 2005. Hurricanes and global warming. Nature 438, E11–13, doi: 10.1038/nature04477	3.8. Changes in Extreme Events p. 305	Uncertainty	6.3. Tropical Cyclones p. 311	Citation in quotation Not supporting
	3.8. Changes in Extreme Events p. 306	Neutral/Irrelevant		
	9.5. Understanding of Change in Other Variables during the Industrial Era p. 711–2.	Uncertainty		

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Appendix B (*continued*)

Reference	IPCC		NIPCC	
	Place of in-text citation	Mode and context of citation associated with the ACC theory	Place of in-text citation	Mode and context of citation associated with the ACC theory
Pielke Jr., R.A., Landsea, C., Mayfield, M., Laver, J., Pasch, R., 2005. Hurricanes and global warming. Bulletin of the American Meteorological Society 86, 1571–1575	9.5. Understanding of Change in Other Variables during the Industrial Era p. 711	Not supporting	6.3. Tropical Cyclones p. 309–10	Not supporting
Solow, A.R., Moore, L.J. 2002. Testing for trend in North Atlantic hurricane activity, 1900-98. Journal of Climate 15: 3111-3114	9.5. Understanding of Change in Other Variables during the Industrial Era p. 711	Not supporting	6.3. Tropical Cyclones p. 309–10	Citation in quotation Not supporting
Bove, M.C., Elsner, J.B., Landsea, C.W., Niu, X.F., O'Brien, J.J., 1998. Effect of El Niño on US landfalling hurricanes, revisited. Bulletin of the American Meteorological Society 79, 2477–2482	3.8. Changes in Extreme Events p. 305	Neutral/Irrelevant	6.3. Tropical Cyclones p. 315	Citation in quotation Neutral/ Irrelevant
Gray, S.T., Graumlich, L.J., Betancourt, J.L., Pederson, G.T., 2004. A tree-ring-based reconstruction of the Atlantic Multidecadal Oscillation since 1567 A.D. Geophysical Research Letters 31, 1–4	3.6. Patterns of Atmospheric Circulation Variability p. 293	Neutral/Irrelevant	6.3. Tropical Cyclones p. 315	Citation in quotation Neutral/ Irrelevant
Gray, W.M., 1984. Atlantic seasonal hurricane frequency. Part I: El Niño and 30 mb quasi-biennial oscillation influences. Monthly Weather Review 112, 1649–1668	3.8. Changes in Extreme Events p. 305	Neutral/Irrelevant	6.3. Tropical Cyclones p. 315	Citation in quotation Neutral/ Irrelevant
	3.8. Changes in Extreme Events p. 305	Uncertainty		
	3.8. Changes in Extreme Events p. 307	Neutral/Irrelevant		
	11.9. Small Islands p. 916	Neutral/Irrelevant		
Smith, T.M., Reynolds, R.W., 2004. Improved extended reconstruction of SST (1854–1997). Journal of Climate 17, 2466–2477	3.2. Changes in Surface Climate: Temperature p. 245	Neutral/Irrelevant	6.3. Tropical Cyclones p. 317	Neutral/ Irrelevant
Easterling, D.R., Evans, J.L., Groisman, P. Ya., Karl, T.R., Kunkel, K.E., Ambenje, P., 2000. Observed variability and trends in extreme climate events: A brief review. Bulletin of the American Meteorological Society 81, 417–425	3.8. Changes in Extreme Events p. 302	Supporting	6.3. Tropical Cyclones p. 319	Not supporting
Elsner, J.B., Niu, X., Jagger, T.H., 2004. Detecting shifts in hurricane rates using a Markov Chain Monte Carlo approach. Journal of Climate 17, 2652–2666	9.5. Understanding of Change in Other Variables during the Industrial Era p. 711	Not supporting	6.3. Tropical Cyclones p. 320	Not supporting
			6.3. Tropical Cyclones p. 322	Neutral/ Irrelevant

Appendix B (*continued*)

Reference	IPCC		NIPCC	
	Place of in-text citation	Mode and context of citation associated with the ACC theory	Place of in-text citation	Mode and context of citation associated with the ACC theory
Landsea, C.W., Bell, G.D., Gray, W.M., Goldenberg, S.B., 1998. The extremely active 1995 Atlantic hurricane season: environmental conditions and verification of seasonal forecasts. Monthly Weather Review 126, 1174–1193	3.8. Changes in Extreme Events p. 307	Neutral/Irrelevant	6.3. Tropical Cyclones p. 318	Not supporting
			6.3. Tropical Cyclones p. 322	Neutral/ Irrelevant
Mann, M., Emanuel, K., 2006. Atlantic hurricane trends linked to climate change. EOS: Transactions, American Geophysical Union 87, 233, 238, 241	9.5. Understanding of Change in Other Variables during the Industrial Era p. 712	Supporting	6.3. Tropical Cyclones p. 320	Supporting but with critique
Chan, J.C.L., Liu, K.S., 2004. Global warming and western North Pacific typhoon activity from an observational perspective. Journal of Climate 17, 4590–4602	3.8. Changes in Extreme Events p. 306	Uncertainty	6.3. Tropical Cyclones p. 310	Citation in quotation Not supporting
	3.8. Changes in Extreme Events p. 306	Neutral/Irrelevant and uncertainty	6.3. Tropical Cyclones p. 325	Not supporting
	9.5. Understanding of Change in Other Variables during the Industrial Era p. 712	Uncertainty		
Emanuel, K., 2005. Increasing destructiveness of tropical cyclones over the past 30 years. Nature 436, 686–688	3.8. Changes in Extreme Events p. 304–5	Supporting and uncertainty	6.3. Tropical Cyclones p. 309–11	Supporting but with critique
	3.8. Changes in Extreme Events Box 3.5 p. 305	Neutral/Irrelevant	6.3. Tropical Cyclones p. 315	Supporting but with critique
	3.8. Changes in Extreme Events p. 306	Supporting	6.3. Tropical Cyclones p. 326	Supporting but with critique
	9.5. Understanding of Change in Other Variables during the Industrial Era p. 711–2	Supporting and uncertainty	6.3. Tropical Cyclones p. 328–9	Supporting but with critique
Walsh, K.J.E., Ryan, B.F., 2000. Tropical cyclone intensity increase near Australia as a result of climate change. Journal of Climate 13, 3029–3036	11.7. Australia – New Zealand p. 902	Neutral/Irrelevant	6.3. Tropical Cyclones p. 326	Citation in quotation Neutral/ Irrelevant
	11.9. Small Islands p. 916	Neutral/Irrelevant		
Webster, P.J., Holland, G.J, Curry, J.A., Chang, H.-R., 2005. Changes in tropical cyclone number, duration, and intensity in a warming environment. Science 309, 1844–1846	3.8. Changes in Extreme Events p. 305–6	Supporting	6.3. Tropical Cyclones p. 315	Supporting but with critique
	3.8. Changes in Extreme Events p. 306	Supporting	6.3. Tropical Cyclones p. 309–11	Supporting but with critique
	3.8. Changes in Extreme Events p. 307	Supporting	6.3. Tropical Cyclones p. 326	Supporting but with critique
	3.8. Changes in Extreme Events p. 307	Supporting	6.3. Tropical Cyclones p. 328–9	Supporting but with critique
	9.5. Understanding of Change in Other Variables during the Industrial Era p. 711	Supporting and uncertainty		

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Appendix B (*continued*)

Reference	IPCC		NIPCC	
	Place of in-text citation	Mode and context of citation associated with the ACC theory	Place of in-text citation	Mode and context of citation associated with the ACC theory
Sugi, M., Noda, A., Sato, N., 2002. Influence of the global warming on tropical cyclone climatology: an experiment with the JMA global model. Journal of the Meteorological Society of Japan 80: 249–272	8.5. Model Simulations of Extremes p. 628	Neutral/Irrelevant	6.3. Tropical Cyclones p. 328	Not supporting
	10.3. Projected Changes in the Physical Climate System p. 779	Neutral/Irrelevant		
	10.3. Projected Changes in the Physical Climate System p. 786	Uncertainty		
	10.3. Projected Changes in the Physical Climate System p. 788	Neutral/Irrelevant		
	11.1. Some Unifying Themes p. 864	Supporting		
Walsh, K., 2004. Tropical cyclones and climate change: unresolved issues. Climate Research 27, 77–83	10.3. Projected Changes in the Physical Climate System p. 788	Supporting and uncertainty	6.3. Tropical Cyclones p. 328	Supporting and uncertainty but with critique
	11.4. Asia p. 886	Uncertainty		
	11.7. Australia – New Zealand p. 902	Supporting, uncertainty and neutral/irrelevant		
	11.9. Small Islands p. 915	Supporting and uncertainty		
Latif, M., Sperber, K., Arblaster, J., Braconnot, P., Chen, D., Colman, A., Cubasch, U., Cooper, C., Delecluse, P., DeWitt, D., Fairhead, L., Flato, G., Hogan, T., Ji, M., Kimoto, M., Kitoh, A., Knutson, T., Le Treut, H., Li, T., Manabe, S., Marti, O., Mechoso, C., Meehl, G., Power, S., Roeckner, E., Sirven, J., Terray, L., Vintzileos, A., Voss, R., Wang, B., Washington, W., Yoshikawa, I., Yu, J., Zebiak, S., 2001. ENSIP: the El Niño simulation intercomparison project. Climate Dynamics 18, 255–276	8.4. Evaluation of Large-Scale Climate Variability as Simulated by Coupled Global Models p. 623	Neutral/Irrelevant	6.4. ENSO p. 330	Uncertainty
	11.10. Assessment of Regional Climate Projection Methods p. 919	Uncertainty		
Cobb, K.M., Charles, C.D., Cheng, H., Edwards, R.L., 2003. El Niño/Southern Oscillation and tropical Pacific climate during the last millennium. Nature 424, 271–276	6.6. The Last 2.000 Years p. 481	Neutral/Irrelevant	6.4. ENSO p. 333	Not supporting
	6.6. The Last 2.000 Years p. 482	Neutral/Irrelevant		
	9.3. Understanding Pre-Industrial Climate Change p. 682	Uncertainty		
Evans, M.N., Kaplan, A., Cane, M.A., 2002. Pacific sea surface temperature field reconstruction from coral δ18O data using reduced space objective analysis. Paleoceanography 17, U71–U83	6.6. The Last 2.000 Years p. 481–2	Neutral/Irrelevant	6.4. ENSO p. 333	Not supporting
McGregor, H.V., Gagan, M.K., 2004. Western Pacific coral δ18O records of anomalous Holocene variability in the El Niño-Southern Oscillation. Geophysical Research Letters 31, doi: 10.1029/2004GL019972	6.5. The Current Interglacial p. 464	Neutral/Irrelevant	6.4. ENSO p. 334	Not supporting

Appendix B (*continued*)

Reference	IPCC		NIPCC	
	Place of in-text citation	Mode and context of citation associated with the ACC theory	Place of in-text citation	Mode and context of citation associated with the ACC theory
Moy, C.M., Seltzer, G.O., Rodbell, D.T., Anderson, D.M., 2002. Variability of El Niño/Southern Oscillation activity at millennial timescales during the Holocene epoch. Nature 420, 162–165	6.5. The Current Interglacial p. 464 9.3. Understanding Pre-Industrial Climate Change p. 680	Neutral/Irrelevant Supporting	6.4. ENSO p. 334	Not supporting
Rodbell, D.T., Seltzer, G.O., Abbott, M.B., Enfield, D.B., Newman, J.H., 1999. A 15,000-year record of El Niño driven alluviation in southwestern Ecuador. Science 283, 515–520	6.5. The Current Interglacial p. 464	Neutral/Irrelevant	6.4. ENSO p. 334	Citation in quotation Neutral/ Irrelevant
Timmermann, A., Oberhuber, J., Bacher, A., Esch, M., Latif, M., Roeckner, E. 1999. Increased El Niño frequency in a climate model forced by future greenhouse warming. Nature 398, 694–696	9.5. Understanding of Change in Other Variables during the Industrial Era p. 709	Supporting	6.4. ENSO p. 334	Supporting but with critique
Tudhope, A.W., Chilcott, C.P., McCuloch, M.T., Cook, E.R., Chappell, J., Ellam, R.M., Lea, D.W., Lough, J.M., Shimmield, G.B., 2001. Variability in the El Niño-Southern Oscillation through a glacial-interglacial cycle. Science 291, 1511–1517	6.5. The Current Interglacial p. 464	Neutral/Irrelevant	6.4. ENSO p. 334 6.4. ENSO p. 334	Citation in quotation Neutral/ Irrelevant Citation in quotation Not supporting
Barring, L., von Storch, H., 2004. Scandinavian storminess since about 1800. Geophysical Research Letters 31, doi: 10.1029/ 2004GL020441	3.5. Changes in Atmospheric Circulation p. 282 3.8. Changes in Extreme Events p. 313	Uncertainty Uncertainty	6.6. Storms p. 343	Not supporting
Gulev, S.K., Zolina, O., Grigoriev, S., 2001. Extratropical cyclone variability in the Northern Hemisphere winter from the NCEP/ NCAR reanalysis data. Climate Dynamics 17, 795–809	3.5. Changes in Atmospheric Circulation p. 282 3.8. Changes in Extreme Events p. 311	Supporting Supporting	6.6. Storms p. 343	Not supporting
Jones, P.D., Jonsson, T., Wheeler, D., 1997. Extension to the North Atlantic Oscillation using early instrumental pressure observations from Gibraltar and South-West Iceland. International Journal of Climatology 17, 1433–1450	3.6. Patterns of Atmospheric Circulation Variability p. 286	Neutral/Irrelevant	6.6. Storms p. 341	Supporting but with critique
Smits, A., Klein Tank, A.M.G., Konnen, G.P., 2005. Trends in storminess over the Netherlands, 1962-2002. International Journal of Climatology 25: 1331-1344	3.8. Changes in Extreme Events p. 313	Uncertainty	6.6. Storms p. 342	Not supporting and uncertainty

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Appendix B (*continued*)

Reference	IPCC		NIPCC	
	Place of in-text citation	Mode and context of citation associated with the ACC theory	Place of in-text citation	Mode and context of citation associated with the ACC theory
Woodworth, P.L., Blackman, D.L., 2002. Changes in extreme high waters at Liverpool since 1768. International Journal of Climatology 22, 697–714	5.5. Changes in Sea Level p. 414	Not supporting	6.6. Storms p. 342	Not supporting
Zhang, K., Douglas, B.C., Leatherman, S.P., 2000. Twentieth-Century storm activity along the U.S. East Coast. Journal of Climate 13, 1748–1761	5.5. Changes in Sea Level p. 414	Neutral/Irrelevant	6.6. Storms p. 344	Not supporting
Brown, R.D., 2000. Northern hemisphere snow cover variability and change, 1915–97. Journal of Climate 13, 2339–2355	4.2 Changes in Snow Cover p. 343–4	Supporting	6.7. Snow p. 347	Not supporting
Iskenderian, H., Rosen, R.D., 2000. Low-frequency signals in midtropospheric submonthly temperature variance. Journal of Climate 13, 2323–2333	3.5. Changes in Atmospheric Circulation p. 282	Uncertainty	6.9. Temperature Variability p. 354	Uncertainty
Zhai, P., Pan, X., 2003. Trends in temperature extremes during 1951–1999 in China. Geophysical Research Letters 30, doi: 10.1029/2003GL018004	3.8. Changes in Extreme Events p. 300	Supporting	6.9. Temperature Variability p. 354	Not supporting
McCabe, G.J., Palecki, M.A., Betancourt, J.L., 2004. Pacific and Atlantic Ocean influences on multidecadal drought frequency in the United States. Proceedings of the National Academy of Sciences (USA) 101, 4136–4141	3.6. Patterns of Atmospheric Circulation Variability p. 294	Neutral/Irrelevant	6.10. Wildfires p. 357	Citation in quotation Neutral/Irrelevant
	3.8. Changes in Extreme Events p. 311	Uncertainty		

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