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## Global warming estimates, media expectations, and the asymmetry of scientific challenge<sup>☆</sup>

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### ABSTRACT

Mass media in the U.S. continue to suggest that scientific consensus estimates of global climate disruption, such as those from the Intergovernmental Panel on Climate Change (IPCC), are “exaggerated” and overly pessimistic. By contrast, work on the Asymmetry of Scientific Challenge (ASC) suggests that such consensus assessments are likely to *understate* climate disruptions. This paper offers an initial test of the competing expectations, making use of the tendency for science to be self-correcting, over time. Rather than relying in any way on the IPCC process, the paper draws evidence about emerging science from four newspapers that have been found in past work to be biased against reporting IPCC findings, consistently reporting instead that scientific findings are “in dispute.” The analysis considers two time periods — one during the time when the papers were found to be overstating challenges to then-prevailing scientific consensus, and the other focusing on 2008, after the IPCC and former Vice-President Gore shared the Nobel Prize for their work on climate disruption, and before opinion polls showed the U.S. public to be growing more skeptical toward climate science once again. During both periods, new scientific findings were more than twenty times as likely to support the ASC perspective than the usual framing of the issue in the U.S. mass media. The findings indicate that supposed challenges to the scientific consensus on global warming need to be subjected to greater scrutiny, as well as showing that, if reporters wish to discuss “both sides” of the climate issue, the scientifically legitimate “other side” is that, if anything, global climate disruption may prove to be significantly worse than has been suggested in scientific consensus estimates to date.

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### 1. Introduction

The scientific core of international decision-making on global climate disruption is provided by the Intergovernmental Panel on Climate Change (IPCC), which regularly summarizes and re-examines the available body of scientific findings on the topic. Although IPCC assessments are widely respected in the scientific world, they are regularly attacked by critics of climate science, often with the charge that the IPCC is “too pessimistic” and that scientists are more divided on climate disruption than the IPCC assessments indicate. Perhaps in part because these critics’ charges have received extensive attention in the U.S. mass media, independent surveys indicate that the U.S. public increasingly

believes the scientists themselves to be far more deeply divided than the peer-reviewed literature on climate disruption would indicate.

As will be spelled out below, the disjuncture between scientists’ views and those of the U.S. general public has been the focus of a number of analyses. Some assessments have pointed out, accurately, that the IPCC illustrates the ways in which scientific views can be shaped as well as communicated by fallible human beings. Others have noted that mass media norms can cause news articles to be written in ways that distort scientists’ findings. To date, however, little attention has been devoted to the way in which the public debate could shape scientific consensus itself. Precisely because of the ongoing pattern of criticisms toward climate science in general, and the IPCC in particular, work on the Asymmetry of Scientific Challenge (ASC) predicts that the overall effect on science will be precisely the opposite of the usual charges in the U.S. mass media — that is, that scientific consensus estimates such as those from the IPCC should be expected to *underestimate* the severity of climate disruption taking place.

This paper presents an initial analysis of evidence, comparing the usual expectations against those derived from the literature on the Asymmetry of Scientific Challenge, doing so in four additional

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sections. Section 2 offers a brief summary of existing literature on the IPCC process and on potential sources of bias in science more broadly. Section 3 spells out the key challenges of performing a fair test of the competing hypotheses – particularly given that the critics or contrarians have been so outspoken in denouncing the IPCC process, even though it closely follows established scientific norms for assessing the available evidence. As we note, however, it is possible to draw on media norms to identify another sampling process – one that is independent of the IPCC, drawing instead on newspapers that have been found to be biased against the scientific consensus – permitting a more conservative test of the ASC hypothesis. Section 4 presents the quantitative findings, which provide strong if initial support for the ASC hypothesis and a strong rejection of the widespread charges in the U.S. mass media. Section 5, finally, considers implications for future research on global environmental change.

## 2. The IPCC and the U.S. public: findings to date

Established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), the Intergovernmental Panel on Climate Change was mandated by the UN General Assembly to assess scientific knowledge, impacts, and possible mitigation and adaptation options surrounding climate change. Its “First Assessment Report” in 1990 provided the basis for the 1992 UN Conference on Environment and Development, as well as for the [United Nations \(UN\) Framework Convention on Climate Change \(UNFCCC\)](#), aimed at “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system” (United Nations, 1992, Article 2). The IPCC produced its second, third, and fourth reports in 1995, 2001, and 2007, along with numerous Special Reports on more specific topics.

The IPCC itself includes the work of more than 2000 respected climate scientists from more than 100 countries, and the work of the IPCC has been endorsed by most of the world's leading Academies of Science, including that of the U.S. (see e.g. [National Research Council, 2001, 2006](#)). Strictly speaking, however, the IPCC is not so much a scientific organization as a distinctive way of dealing with the interface between science and policy. In the interest of ensuring that the Panel's work is serving the needs of government and policy, it includes governmental as well as scientific representatives, and it is charged with producing assessments that are relevant to policy, without being policy-prescriptive. In short, as noted for example by [Hulme \(2009\)](#), the IPCC is a human process – susceptible to emotions, values, and human fallibilities in general. Still, as pointed out by [Edwards and Schneider \(2001: 244–245\)](#), IPCC assessments “are nonetheless the best representation of the scientific community's current general opinion,” and authors such as [Dunlap and McCright \(2010\)](#) refer to the IPCC as symbolizing “mainstream climate science.” In the words of [Hulme \(2009: 91, 98\)](#), “Such scientific consensus is not ultimate ‘truth’ and, on occasion, may turn out to be wrong. But the alternatives to the IPCC style of consensus-building are even less likely to command widespread authority within the worlds of science and policy. . . [T]he IPCC is – as in Winston Churchill's famous aphorism about democracy as a form of governance – the worst of all possible ways of assessing knowledge about climate change. . . apart from all the others.”

The most recent assessment from the IPCC at the time of this writing is its Fourth Assessment Report ([IPCC, 2007](#)), although that report has been updated by the [UNEP Climate Change Compendium \(2009\)](#), which represents scientists' growing understanding of global climate complexities as well as presenting strong consensus conclusions of possible effects and implications. The expectations

for global climate disruption in the *Compendium* are noticeably more grave than those presented in earlier IPCC assessments. The *Compendium* concludes, for example, that global concentrations of carbon dioxide in the atmosphere have been growing, at an accelerating rate – roughly tripling over just the last decade, from 1.1% per year for 1990–1999, to 3.5% per year for 2000–2007 – meaning that global average sea-level rise may reach 80–200 cm by 2100. It also concludes that past actions have by now committed the earth to a warming by 2100 of 2.4 °C, or potentially as much as 4.3 °C, and that certain areas are likely to experience over 90% species change, meaning future ecosystems may look very different from those of today.

Particularly in the U.S., however, IPCC assessments have been portrayed, repeatedly, as having overstated the scientific evidence on climate disruption. The IPCC reports have been the focus of especially intense criticism from a small group of critics that [Dunlap and McCright](#) have labeled “contrarians,” who are often industry-funded and who work hard to create the impression that science is “divided” (see [Dunlap and McCright, 2010](#); see also [Fisher, 2006](#); [McCright and Dunlap, 2000](#); [Trumbo, 1996](#); for journalistic accounts, see [Gelbspan, 1997](#); [Goodell, 2010](#); [Sample, 2007](#)). Investigative journalists (see e.g. [Harkinson, 2009](#)) have noted the potential for contrarian attacks to be seen in a wider range of countries in the future, due to “a loose network of some 500 organizations in dozens of countries,” bankrolled by organizations such as the Atlas Economic Research Foundation – a “think-tank incubator” that receives financial support from fossil-fuel corporations such as ExxonMobil. To date, however, the most notable media successes of the contrarians have come in the U.S., where the differences between scientific assessments and mass media reports have been striking and persistent.

On the one hand, peer-reviewed literature clearly reflects what [Oreskes \(2004\)](#) has termed a “scientific consensus” position – global warming is occurring, due in significant part to humans. Reviewing 928 abstracts with the keywords “global climate change,” published in key peer-reviewed scientific journals between 1993 and 2003; Oreskes found that three quarters of the articles offered explicit endorsement of that consensus position, and not a single paper disagreed with it. During roughly the same period, on the other hand, over half of the reports on the topic in U.S. “prestige” newspapers, and 70% of the reports in U.S. network television newscasts, were found to convey nearly the opposite message, depicting the state of scientific work as being “in dispute” (see [Boykoff and Boykoff, 2004](#); [Boykoff, 2008](#)). Even after the IPCC's Nobel Peace Prize in 2007, U.S. media reports continued to characterize the IPCC and other scientific consensus reports as “exaggerating” reasons for concern (see e.g. [Revkin, 2008](#)). Recent poll evidence, moreover, suggests that growing fractions of the U.S. public may believe the contrarians, rather than the scientists, with public belief in rising global temperatures having dropped significantly during 2008–2009 ([Pew Research Center, 2009](#); [Leiserowitz et al., 2010](#)).

Still, as pointed out by a number of observers, arguments over global climate disruption are not just “scientific” disputes (see e.g. [Charlesworth and Okereke, 2010](#); [Cox, 2009](#); [Gautier, 2008](#); [Hulme, 2009](#); [Trumbo and Shanahan, 2000](#); [Weingart et al., 2000](#)); instead, they are examples of what [Mazur \(1981\)](#) long ago called technological controversies. As such, they are likely to illustrate that scientists are not immune to human frailties; inevitably, what we know as “scientific facts” will be socially constructed rather than divinely revealed. Once discussions move outside the walls of the laboratory, moreover, the debates can be expected to involve an even more complex mixture of facts, values and blind spots (see e.g. [Latour and Woolgar, 1986](#); [Jasanoff, 1993](#); [Kleinman, 2003](#); [Freudenburg, 1996](#)).

When considering debates over global climate disruption, accordingly, it is important not to assume that scientists are merely

providing clear, definitive, black-and-white answers – or for that matter, to assume that policymakers actually want clear, scientific answers to the questions they ask. Still, given the complexity of societal debates over global climate disruption – to say nothing of the complexity of the underlying science itself (Charlesworth and Okereke, 2010; Fisher, 2006; Hulme, 2009) – it should perhaps not be surprising that this topic has been approached in ways that often differ from, as well as building on, the research that has been done on past technological controversies.

A significant body of research, for example, has dealt with past controversies in which powerful interests have managed to keep an issue from becoming part of the “agenda” for public policy. As pointed out by McCright and Dunlap (2000, 2003), however, the issue of global climate disruption is in many ways more remarkable than the controversies that have been considered in the past: At least in the U.S., a large and respected body of extensively peer-reviewed scientific work was effectively neutralized in public policy debates, despite numerous endorsements from respected scientific organizations such as the British Royal Society (2007) and the U.S. National Academy of Sciences (2001, 2006), even *after* that work had become the focus of significant public discussion (see also Dunlap and McCright, 2010). The patterns in other leading economies of the time, including Japan (Sampei and Aoyagi-Usui, 2009) and Germany (Weingart et al., 2000), were very different.

Other research has focused on the contrarian literature, in particular. The most careful study of this research, to date, found that almost all of the English-language books expressing environmental skepticism have come directly from a small number of what Jaques et al. (2008) characterize as ideological, “conservative think tanks.” Of the 141 books they identified, 130, or 92%, came directly from a handful of “conservative think tanks” such as the Heartland Institute. The criteria of Jaques et al., moreover, were unambiguous – the books’ authors worked at those think tanks, the books were published by those think tanks, or both (see also Dunlap and McCright, 2010).

The findings by Jaques et al. differ from the concerns that have been emphasized in past studies about potential distortions of science. Past work has often emphasized the potential significance of “tainted” sources of funding for scientific laboratories – involving, for example, the ways in which an interest in product commercialization might influence scientists’ reporting of research findings (see e.g. Busch and Lacy, 1983; Kloppenburg, 1988; Kleinman, 1995). Another notable illustration is provided by the Center for Tobacco Research, which was supported by the tobacco industry and which helped to produce many published articles that questioned the health dangers of cigarette smoking (see e.g. Glantz et al., 1996; Michaels, 2009). Similar patterns have been documented in studies of support for research on nuclear energy and its associated risks (see for example Clarke, 1988; Morone and Woodhouse, 1989), and in more recent years, in patterns of support for biomedical research from pharmaceutical companies (Bekelman et al., 2003; Krinsky, 2003).

In addition, the findings of Oreskes (2004), noted above, show that climate contrarians have not had anything like the same level of success as have earlier industry-funded researchers in producing peer-reviewed publications. Instead, almost all contrarian books have been self-published, and much of their other work has consisted of *ad hominem* attacks against leading scientists. For example, when Harvard Professor and former President of the American Association for the Advancement of Science, John Holdren, was named as President-Elect Obama’s chief Science Advisor, a spokesperson from the conservative think tank, the Competitive Enterprise Institute, said Holdren would be one of Obama’s “worst choices...He rants, he’s a ranter” (Borenstein, 2008).

These, clearly, are not the kinds of characterizations one would expect to find in peer-reviewed literature, but they do appear to have had their intended effects. In the 1990s, for example, an international survey of climate scientists found the majority of the climate scientists in the U.S. agreed that climate scientists had little control over the information getting to policymakers, while less than a quarter of the scientists in Germany agreed (von Storch and Bray, 1999: 48). A decade later, a 15-nation survey found that the U.S. public’s views toward global climate disruption were substantially different from those in other parts of the world. Roughly two-thirds of survey respondents in Japan (66%) and India (65%) said they personally worried a great deal about global warming, and around half shared similar worries in Spain (51%) and France (46%), but the comparable figure for the United States was just 19% – the lowest in any of the 15 countries surveyed (Kohut et al., 2006).

When analysts have attempted to explain the sharp differences between the U.S. and other industrialized countries, a number of explanations have focused on the amount of media attention devoted to a relatively small number of critics of mainstream scientific work (see McCright and Dunlap, 2000, 2003; Gelbspan, 1997; Shanahan and Trumbo, 1998; Trumbo, 1996; for assessments that also considers the importance of the U.S. coal industry, see Fisher, 2004, 2006). Other studies have focused on the importance of media norms regarding what Mazur termed “even-handed” reporting – the tradition of reporting the views from both “sides” of a given debate, thus seeming to give them equal weight, regardless of the actual distribution of scientists’ views (Mazur, 1979, 1981). These media norms may be among the reasons why, despite the strong consensus within the scientific community, so many reports in the U.S. mass media have depicted the issue as being “in debate” (Boykoff and Boykoff, 2004; Boykoff, 2008; Trumbo, 1996; see also Sampei and Aoyagi-Usui, 2009).

In at least one respect, however, the findings from research on media coverage of global climate disruption have tended to mirror those in the wider literature: Although observers have emphasized the importance of understanding that science communication is a two-way process, most of the focus has been on one direction of information flow – on the reinterpretation and/or amplification of scientific findings in the worlds of policy and the media (see e.g. Fisher, 2004; McCright and Dunlap, 2003; see also Kasperson et al., 1988; Pidgeon et al., 2003). Only a limited number of peer-reviewed articles have begun to analyze the influences that might run in the other direction, with the worlds of policy and the mass media potentially shaping what is taken to be mainstream science (for exceptions, see Charlesworth and Okereke, 2010; Fisher, 2006; Hulme, 2009; Pulver, 2007; for broader discussions of social influences on science, see e.g. Latour and Woolgar, 1986; Kleinman, 2003; Knorr-Centina, 1981; Pickering, 1995; Freudenburg et al., 1998).

A sharply different pattern is to be found outside of the peer-reviewed literature – that is, in active societal debates over global climate disruption. By far the majority of the attention, to date, has come from U.S.-based contrarians, who generally state their views very strongly. One recent assessment, for example, dismissed the UNEP *Compendium* (2009) as “eyewash, brainwash and hogwash...incomplete at best and, more likely, manipulated for political reasons” (Byrne, 2009). There is also an alternative possibility, however, that has received much less attention. This possibility, initially analyzed by Hirt (1994, 1999), was later characterized by Freudenburg and Youn (1999) as involving the potential for an Asymmetry of Scientific Challenge (ASC).

An informal way to think of the ASC is to see science as involving the same kind of need for balance as does walking a tightrope: Focusing excessively on not falling off the left side of the tightrope may increase the probability of falling to the right. As Hirt spelled

out, however, the balance problem can take a more specific form in scientific contexts. In analyzing quantitative assessments of timber production on U.S. public lands, Hirt identified a pattern that he initially termed a *Conspiracy of Optimism* (Hirt, 1994). Hirt emphasized, however, that this was not a “conspiracy” in the usual sense: The scientists involved may not have realized that they were pursuing anything other than the best possible scientific estimates. Instead, Hirt emphasized that organized industrial interests — often in alliance with relevant governmental agencies of that era, most notably the U.S. Forest Service — tended not just to support the lines of research that indicated higher levels of logging to be “sustainable,” but also to hire the most skillful experts available to challenge or attack any research that might have suggested the need to reduce logging rates. Hirt found that, partly because industry-friendly or “optimistic” estimates were not subjected to comparably vigorous challenges, the accepted scientific estimates of “sustainable” logging levels became far too high — ultimately proving to be more than twice as high as the levels that have been seen in subsequent work as being scientifically credible (Hirt, 1994, 1999).

Hirt’s research builds on and extends the limited but important body of work that highlights selective *challenges* to research. Much of the work in that tradition focuses on organized efforts to keep unfavorable evidence from coming to public attention and/or to undermine its legitimacy (see e.g. Rosner and Markowitz, 1985; Dietz et al., 1989; Martin, 1999; Krinsky, 2000). Perhaps the clearest contribution to this research comes from Martin (1999), who has called attention to what he has termed the “suppression of dissent” — the effort to sustain the impression of expert unanimity. As Martin notes, such “suppression” appears most likely in cases where virtually all funding for scientific research on a given technology comes from agencies or commercial interests that support further expansion of the technology — something that was in fact the case in the U.S. logging industry at the time, as it was in industries that Martin examined more closely, such as nuclear power. In Martin’s terminology, “suppression” differs from concepts such as censorship, discrimination, or whistle-blowing, and it could be expected to be “more common and visible” in cases where “a powerful interest group has a near-monopoly on scientific credibility” (Martin, 1999: 126).

In the case of global climate disruption, of course, a common claim by contrarians is that the IPCC, government agencies and researchers are responsible for “suppression” and/or a “conspiracy,” but in the opposite direction — toward predicting levels of global climate disruption that are unfriendly to industry, too alarmist, and far too pessimistic in general. Those charges, however, have often been leveled at agencies that are well respected for balanced and high-quality research, such as the (U.S.) National Science Foundation or National Aeronautics and Space Administration, so say nothing of the IPCC itself. In addition, as noted by Dietz and Rycroft (1987), environmental groups generally cannot afford to hire nearly as many scientists as can corporate interests. Given the extensive news coverage devoted to the contrarians in the U.S. media, finally, it would be difficult to argue that mainstream climate scientists have enjoyed anything like a “monopoly” on credibility, particularly in the eyes of the press and the public. Instead, more careful assessments have noted that in the case of climate debates, organized industrial interests that parallel those identified by Hirt or Martin — fossil-fuel industries and the ideologically conservative think tanks that are supported in part by such industries — have been active in challenging peer-reviewed publications, while celebrating the work of contrarians whose publications come from conservative think tanks that rely in significant part on industry funding (see e.g. Fisher, 2004; McCright and Dunlap, 2000, 2003; Trumbo, 1996; see also Gelbspan, 1997; Goodell, 2010; Harkinson, 2009).

Overall, the work by Hirt, Martin, and others, has pointed to a pattern having three key characteristics that appear relevant to scientific work on climate disruption. First, organized industrial interests have consistently and vigorously challenged scientific findings that have indicated the seriousness of anthropogenic climate disruptions. Second, contrary or “optimistic” findings have not been subjected to similar levels of criticism; indeed, a number of findings suggesting greater reasons for optimism have been praised and widely publicized by the same industrial interests. These first two asymmetries mirror the two that were first identified by Hirt.

The third is more complex, requiring additional discussion: Mainstream scientists are strongly motivated by norms of “being fair,” even to points of view with which they personally disagree. Ironically, if such *individual* commitments to “fairness” are exercised within a broader context where views on one side of an issue have been subjected to substantially greater challenges than those on the opposing side, the net result may well be a *collective* bias — an excessive readiness to accept the views that have not been examined as carefully.

The bias that is expected by the ASC perspective, accordingly, relates to one typical dictionary definition of the term, but not to another — it involves systematic error, rather than individual prejudice. As the terminology implies, the key theoretical expectation is that an Asymmetry of Scientific Challenge — attacks on new findings or hypotheses that might push scientific consensus in one direction, combined with an absence of comparably vigorous challenges to new findings or hypotheses that might have the opposite effect — can lead to an initially imperceptible but cumulatively significant bias in what comes to be taken as the prevailing scientific consensus. The ASC expectation, more specifically, is that the scientific outcome is likely to be precisely the opposite of the one that is most often feared — in the case of global climate disruptions, a bias toward *underestimating* rather than *overestimating* likely climate disruptions — precisely because so much of the prevailing pattern of scientific challenge has had the opposite focus and concern.

The literature on the use and misuse of scientific evidence in policy debates suggests that this possibility deserves much more attention than it has received to date. As that literature indicates, the scientific evidence available for policy decisions, like scientific evidence in general, is likely to be ambiguous or incomplete (see e.g. Hattis and Anderson, 1999). If most scientific articles end by concluding that “further research is necessary,” and if regulatory action can be delayed until there is no longer any need for further research, then it may well prove possible for an industry to delay effective regulation for years, or even indefinitely, while waiting for research findings to become definitive. One article has even concluded that such a pattern is so widespread that it deserves its own name — “Scientific Certainty” Argumentation Methods, or SCAMs — and it is clear that U.S. policy regarding the regulation of global warming gases has been consistent with the expectation for effective regulations to be delayed (Freudenburg et al., 2008; see also Michaels, 2008; Dietz and Rycroft, 1987; McCright and Dunlap, 2000, 2003).

### 3. Materials and methods

Empirically testing the common assumption in the U.S. mass media against the competing ASC hypothesis requires an appropriate and fair technique for identifying “real” biases in scientific findings — and doing so in light of the criticisms from contrarians, as well as in the more formal literature summarized above, on limits to scientific objectivity. For our tests, accordingly, we avoid any assumption that it might be possible to identify systematic errors, “objectively,” *at a given time*. Instead, we follow

the example of analysts such as Hirt (1994, 1999), as well as the many scientists with whom we have discussed this issue, relying instead on *subsequent* scientific assessments and on the broader tendency for science to be self-correcting, over time: We will focus on new or emerging findings, in this case meaning those that emerge *after* any given assessment report. Such an approach is also more in keeping with an important methodological tradition of favoring what a classic assessment (Webb et al., 1966) called *Unobtrusive Methods* – those that do not influence a phenomenon in the process of attempting to measure it.

Such a process, however, has been employed repeatedly in the Assessment Reports by the IPCC itself, as well as in the most recent UNEP reappraisal at the time of this writing, the *Compendium* from the United Nations Environment Programme (2009). That *Compendium* analyzed more than 400 major studies that were published after the IPCC's most recent *Assessment Report (Intergovernmental Panel on Climate Change, 2007)*, and as noted earlier, it concluded that climate disruption appears more severe than would have been expected on the basis of the earlier appraisals from the IPCC. The emissions growth rate since 2000, for example, was found to be greater than had been expected even in the “highest” or most fossil-fuel intensive of the IPCC's emissions scenarios from the late 1990s, and expectations for sea-level rise were found to be toward the higher end of the ranges that had been described as plausible by the IPCC. This pattern appears to be largely consistent with the ASC hypothesis, rather than with the expectations expressed by contrarians, but like the IPCC's own assessments, the *Compendium* was bitterly attacked by contrarians as lacking credibility. A relatively typical example was provided by the so-called “American Thinker” blog, which saw the reassessment as “blatant lies,” accompanied by “frantic hype” and a “call-to-pointless-action” (Sheppard, 2009).

An additional, potentially complicating factor is that scientific journals prefer to report “findings,” rather than “non-findings,” and that new evidence on any issue may be more likely to receive attention if it indicates that the problem is “worse than previously thought,” or “not as bad as previously thought,” rather than simply concluding that “past estimates were roughly correct.” If new findings are often reported in terms of differences from prevailing consensus views, however, this can increase possibilities for selective sampling. In informal conversations, for example, climate scientists often complain that, even if most new studies underscore the significance of climate disruption, just a few studies reaching contrary conclusions can create the possibility for selective “samples” of findings that suggest scientific consensus estimates to be “exaggerated” or “in dispute.” As noted above, by contrast, contrarians have often charged that the IPCC process is selective in the opposite direction, paying too much attention to findings that indicate climate disruption to be serious, while paying too little attention to contrary evidence.

In most fields, the traditional approach for taking new findings into consideration is the one that has consistently been followed by the IPCC itself – drawing systematically on new peer-reviewed publications. Given, however, that contrarians and ideologically oriented think tanks tend to see any process involving the IPCC or the UN as “biased” – charges that continue to be reported in the U.S. news media – there is clearly a need for new ways of sampling from the emerging scientific findings that is independent from both the think tanks and the IPCC.

Perhaps the most important possibility for doing so is to heed Zehr's advice to “consider popular press representations of science as another arena for *doing science*” (Zehr, 2000: 87). To be more specific, by taking note of media norms for reporting, it is possible to identify a “fair sample” of emerging scientific work – or at least one that is completely independent from the IPCC, although it may not be independent of the think tanks' influence. That approach is

to focus on the subset of new scientific studies that have been identified as newsworthy *in specific mass media outlets that have already been found to be biased against the consensus scientific position.*

This approach is made possible by the fact that the mass media have different ways of reporting “new scientific findings” than “policy issues,” with the latter having become the way in which they commonly report on climate disruption, at least in the U.S. As noted in past studies, the U.S. mass media began to pay increasing attention to ideologically oriented think tanks around the time of the IPCC First Assessment Report in 1990, as the U.S. public was first beginning to learn about climate disruption – a shift that has been tied to “the increasingly complex politicization of the global warming issue... and the coalescence of a small group of influential spokespersons” who emerged in the news coverage (Boykoff and Boykoff, 2004: 130). Trumbo (1996: 281) identified this pattern as the most “alarming” finding in his study, which found scientists receiving “a shrinking proportion of growing media attention during an important part of the public debate.”

Reporters with whom we have discussed this shift have generally interpreted it as being less alarming; instead, they often see it as evidence that climate disruption became a “policy story,” rather than a “science story,” during the 1990s. They base this conclusion in part on their informal observations and in part on the very pattern that is often criticized by scientists, namely that, increasingly, the quotations in the media reports have tended to come from political rather than scientific observers. By January 2000, for example, when the *Los Angeles Times* ran a news article on a National Research Council report – a report concluding that the warming of the Earth's surface was “undoubtedly real” (Hotz, 2000: A3) – the article did not include any quotes from independent climate scientists at universities or government agencies. Instead, it included a supportive comment from an environmental organization, plus a much more negative line of commentary from the president of a contrarian organization, who claimed that the “National Academy board has pretty much been taken over by enviros” (see also Union of Concerned Scientists, N.D.). The next January, similarly, when a headline for the *Washington Post* said that the IPCC Third Assessment Report offered a “dire prediction” on global warming, the newspaper's story on the Report included a quotation from a well-known think-tank contrarian, Fred Singer, who called the report “a political statement,” which he claimed to be based on theoretical models that did not conform to existing scientific data (Pan, 2001: A1)

By contrast, newspaper articles on new scientific findings – even in the same newspapers – still tend to be treated as “science news.” These articles are commonly written by different journalists, many of whom have relatively high levels of science literacy and who regularly cover what they call the “science beat.” In these articles, quotations for context and balance come not from political actors, but from other scientists. At about the time of the IPCC's Third Assessment Report, for example, the *New York Times* ran an article on new research indicating that droughts could activate dormant enzymes in moist, peaty northern soils, potentially triggering decomposition of billions of tons of carbon. Although this article (and the research) had obvious implications for global climate disruption, the article focused on the science, not the policy: Its quotations from people who were not involved in the actual research came from other scientists, including a professor of biological sciences at one university and an ecologist at another, both of whom offered scientific perspectives, rather than political ones (Glanz, 2001: A24).

A particularly promising approach for sampling the emerging science is to build on the findings of Boykoff and Boykoff (2004), who found a pattern of “biased coverage” in the U.S. prestige press (the *New York Times*, *Washington Post*, *Los Angeles Times* and *Wall*

*Street Journal*) between 1988 and 2002. Their study found that, in contrast to the previously noted consensus in the scientific community over the same time period – namely that global temperatures were rising and that humans were contributing significantly to that trend – the majority of the articles on climate disruptions in these four newspapers depicted the scientific findings as being uncertain or in debate, continuing to do so in ways that showed little variation over time. At least during the years covered by the Boykoff and Boykoff study, accordingly, it would be expected that, if anything, these four newspapers would over-report scientific findings that would challenge the scientific consensus position, while under-reporting those that would reinforce the scientific consensus.

The analyses that follow will thus focus on articles about scientific findings on global climate disruption that were carried in the same four newspapers (the *New York Times*, *Los Angeles Times*, *Washington Post* and *Wall Street Journal*). In the interest of providing an initial assessment of whether coverage patterns have changed over time, analyses will consider both the time period analyzed by Boykoff and Boykoff – 1998–2002 – and, for comparison, the year after the IPCC produced its fourth assessment report (IPCC, 2007). As noted by Cox (2009), 2007–2008 may have marked the high point of U.S. media coverage of climate disruption, at least in terms of reporting mainstream scientific views, coming at a time when scientific consensus had become still more pronounced, after Al Gore and the IPCC were awarded the 2007 Nobel Peace Prize, and after the documentary featuring Al Gore, *An Inconvenient Truth*, had not only become one of the highest-grossing documentary films ever released, but had also won the 2007 Academy Award for Documentaries. By 2009, on the other hand, studies found that attacks on climate change science in general, and the IPCC in particular, were once again on the rise in the U.S. and showing signs of having their intended effects (Cox, 2009; see also Glantz, 2010; Harkinson, 2009).

As reviewers of an earlier version of this paper have noted, scientific work tends to be produced and published year-round, but mass media publications such as newspapers pay far more attention to the degree to which stories appear timely or topical (for further discussion, see e.g. Friedman et al., 1986). In particular, journalists with whom we have discussed this topic report that stories about climate and global temperatures are most likely to be seen by editors as being topical or worthy of attention during the hottest and the coldest months of the year. To respond to this point, and to its potential relevance for newspaper articles about global warming being more or less serious than indicated in previous research, the sampling for this initial exploration of the competing hypotheses has focused on the two coldest and two hottest months of the year in North America – January/February and July/August, respectively.

The articles for the analysis were identified by searching the LexisNexis Academic database for the *New York Times* and *Washington Post*, and by searching the archives for the *Los Angeles Times* and *Wall Street Journal* through ProQuest. The search identified all stories that included the term(s) “global warming,”

“climate change,” and/or “climate disruption” within a paragraph of the terms “science,” “scientist,” “scientific,” “research,” “finding” and/or “study.” Given the focus on news coverage of actual scientific studies and their findings, the next step was to exclude all editorials, obituaries, letters to the editor, corrections of errors, “perspective” pieces, etc., as well as news articles that were actually “about” topics other than scientific findings (e.g., reports on government funding for studies being increased or decreased, announcements of policy initiatives such as “voluntary programs” for CO<sub>2</sub> reductions, or the decision by the state of California to limit greenhouse gases, etc.) This approach led to the identification of a total of 137 news articles in the four newspapers over the months of the study.

As the system for coding or classifying the articles was being developed, discussions with colleagues pointed out the potential for differences between studies that were intended to be global in scope versus those that were not. Many if not most scientific studies, in other words, focus on relatively specific questions, such as the melting of sea ice in a specific location, patterns of rainfall in a given region, or the risks of extinction being faced by a given species or set of species. All 137 relevant news stories were thus coded in terms of a six-category classification system regarding the overall thrust of the news coverage. The first three categories for the new scientific findings were that *global warming itself* was proving to be (1) worse than thought, (2) not as bad as previously thought, or (3) roughly in the range that would have been expected by prevailing scientific consensus of the time. The remaining three categories were for indicating that *the implications of global warming* were proving to be (4) worse than thought, (5) not as bad as previously thought, or (6) roughly as expected.

There were few cases where articles proved ambiguous or difficult to code, and most had to do with the intended distinction between “implications of” global climate disruption versus “climate disruption itself.” Few such cases were encountered, however, and all such cases were discussed and examined in detail until a clear consensus judgment could be assigned. In addition, as will be noted below, quantitative analyses revealed in the end that there were no significant differences between “climate disruption itself” versus “implications of climate disruption.” Spot checks of coding reliability revealed no cases where the senior investigator reached different conclusions than did the person doing the initial coding.

#### 4. Results

As can be seen from Table 1, the overall results are unambiguous. Out of the 137 news articles, 117 (85.4%) reported that new scientific findings indicated global climate disruption to be worse than expected by the prevailing scientific consensus of the time. Another 15 news articles (10.9%) indicated climate disruption to be roughly as bad as suggested by prevailing scientific assessments, while only 5 articles, or 3.6% of the total, indicated climate disruptions or its implications to be less bad than previously expected.

**Table 1**  
Overall patterns in news reports on scientific findings regarding global climate disruption, all years (1998–2002 and 2008): number of articles, and percentages.<sup>a</sup>

Focus:	Worse than thought	As expected	Better than thought	Total
Observed effects of climate change	31 77.5%	6 15.0%	3 7.5%	40 articles
Implications of climate change	86 88.7%	9 9.3%	2 2.1%	97 articles
Total	117 85.4%	15 10.9%	5 3.6%	137 articles 100.0%

<sup>a</sup> Differences between coverage of “observed effects” and “implications” not significant.

**Table 2**

Patterns in news reports on scientific findings regarding global climate disruption, by reporting period (years): number of articles, and percentages.

1998–2002 <sup>a</sup>				
Focus	Worse than thought	As expected	Better than thought	Total
Observed effects of climate change	28 75.7%	6 16.2%	3 8.1%	37 articles
Implications of climate change	61 88.4%	7 10.1%	1 1.4%	69 articles
Total	89 84%	13 12.35%	4 3.8%	106 articles 100.0%
2008 <sup>a</sup>				
Focus	Worse than thought	As expected	Better than thought	Total
Observed effects of climate change	3 100.0%	0 0.0%	0 0.0%	3 articles
Implications of climate change	25 89.3%	2 7.1%	1 3.6%	28 articles
Total	28 90.3%	2 6.5%	1 3.2%	31 articles 100.0%

<sup>a</sup> Differences between 1998–2002 and 2008 not statistically significant.

Table 2 shows that these overall results were not significantly affected by either of the variables that were identified on an *a priori* basis as having the potential to affect the findings – the differing time periods and the distinction between “observed effects” versus “implications” of global warming. In terms of time periods, the pattern was roughly as strong during the period when Boykoff and Boykoff found these specific newspapers to be biased against reporting the clear scientific consensus on the reality of global warming (1998–2002) as during the year of 2008 – after the Fourth Assessment Report and the Nobel prizes, and after the reality of the scientific findings had become better-known and more widely accepted, but before the contrarians’ counterattacks began to erode U.S. public confidence in the science and in the IPCC. During the earlier period, 89 of the 106 news stories, or 84%, reported global warming to be worse than expected at the time. The proportion was higher during the year of 2008, with 28 of those 31 news stories, or 90.3%, reporting scientific studies to have found global climate disruption to be even worse than expected at that time, but this difference fell short of statistical significance.

Similarly, the differences between “*observed effects of global climate change*,” versus “*implications of climate change*,” proved to be modest and insignificant. There were only three articles reporting on “observed effects” during the later year of 2008 – too few to permit any confidence about implications – but all three did report the effects to be worse than expected in then-prevailing scientific estimates. From 1988 to 2002, approximately 76% of the articles assessing observed effects (28 of 37) indicated the effects of climate change to be worse than expected while similarly troubling findings made up as much as 10% of the results (the highest level observed was 8.1% – a figure that again represents just three cases – for “observed effects,” during the years of 1998–2002). All of these differences also fell far short of standard levels of statistical significance.

The more telling point has to do with the competing expectations between the ASC perspective versus the common expectation in U.S. mass media coverage of global climate disruption, namely that new scientific findings should have indicated then-prevailing estimates of the seriousness of global climate disruption to have been “too pessimistic.” Given that the overall ratio between “worse than thought” versus “better than thought” findings is well over 20:1 – 117 “worse than thought” findings, versus just 5 in the other direction – it should also not be a surprise that the ASC perspective was found to do a significantly

better job of predicting the actual pattern of findings revealed by the data ( $p < .001$ ).

## 5. Discussion

The U.S. mass media, reflecting in part the insistent arguments from a committed set of conservative think tanks, have tended for many years to report that “real” problems of global climate disruption might be less significant than indicated by consensus assessments such as those from the Intergovernmental Panel on Climate Change. By contrast, literature on the Asymmetry of Scientific Challenge points to precisely the opposite expectation, predicting that – in part because of the outspoken arguments from conservative think tanks, particularly in the United States – the more likely outcome is that scientific consensus will have been affected by the asymmetry of challenges, such that new or emerging scientific research would indicate global climate disruption to be *more* significant than would prevailing scientific consensus assessments.

This study appears to be the first to have compared the two perspectives against one another, and as such, the present findings – while striking in their apparent strength – should be interpreted with caution. In particular, there is a need for further research that assesses the preponderance of scientific findings through other approaches. At the same time, it should be kept in mind that the four specific newspapers providing the raw data for this study are ones that have already been found by Boykoff and Boykoff to have had a systematic bias toward reporting scientific findings as being *less* clear-cut than was actually the case in the open scientific literature. The support for the ASC perspective was found to be as strong during the period that provided the data for the Boykoff and Boykoff findings (1998–2002) as during the later year of 2008.

Overall, it would be premature to consider the present study’s findings to be definitive. It is not too soon, however, to conclude that, based on the best evidence available to date, consensus statements such as those from the Intergovernmental Panel on Climate Change are highly unlikely to represent the kind of “exaggerated fears” often claimed by those who deny the reality or scientific credibility of findings on global climate disruption. There is significantly stronger support for the testable prediction from work on the Asymmetry of Scientific Challenge – namely that, far from *overstating* the degree of change that is likely, scientific consensus statements such as those provided by the IPCC are more

likely to *understate* the actual degree of climate disruption taking place.

These findings need to be considered in conjunction with other recent findings in the peer-reviewed literature. Particularly noteworthy are two sets of findings – those of Oreskes (2004), showing that any supposed “debates” among scientists were remarkable mainly for their absence from leading peer-reviewed scientific journals, and those of Jaques et al. (2008), demonstrating that almost the entire English-language literature expressing climate denialism was produced by a small number of ideologically oriented “think tanks” that in many cases received significant fractions of their funding from fossil-fuel companies.

When considered in conjunction with one another, the accumulated findings in this paper and in the broader peer-reviewed literature have clear implications, as well, for credible reporting on “climate debates.” If the intention is to offer true balance in reporting, the *scientifically credible* “other side” is that, if the consensus estimates such as those from the IPCC are wrong, it is because the physical reality is significantly *more* ominous than has been widely recognized to date.

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