# Atmosfear: Communicating the Effects of Climate Change on Extreme Weather

VLADIMIR JANKOVIĆ

*Centre for the History of Science, Technology and Medicine, University of Manchester, Manchester, United Kingdom*

DAVID M. SCHULTZ

*Centre for Atmospheric Science, School of Earth, Atmospheric and Environmental Sciences, University of Manchester, Manchester, United Kingdom*

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ABSTRACT

The potential and serious effects of anthropogenic climate change are often communicated through the soundbite that anthropogenic climate change will produce more extreme weather. This soundbite has become popular with scientists and the media to get the public and governments to act against further increases in global temperature and their associated effects through the communication of scary scenarios, what the authors term ''atmosfear.'' Underlying atmosfear's appeal, however, are four premises. First, atmosfear reduces the complexity of climate change to an identifiable target in the form of anthropogenically forced weather extremes. Second, anthropogenically driven weather extremes mandate a responsibility to act to protect the planet and society from harmful and increased risk. Third, achieving these ethical goals is predicated on emissions policies. Fourth, the end result of these policies—a nonanthropogenic climate—is assumed to be more benign than an anthropogenically influenced one. Atmosfear oversimplifies and misstates the true state of the science and policy concerns in three ways. First, weather extremes are only one of the predicted effects of climate change and are best addressed by measures other than emission policies. Second, a preindustrial climate may remain a policy goal, but it is unachievable in reality. Third, the damages caused by any anthropogenically driven extremes may be overshadowed by the damages caused by increased exposure and vulnerability to the future risk. In reality, recent increases in damages and losses due to extreme weather events are due to societal factors. Thus, invoking atmosfear through such approaches as attribution science is not an effective means of either stimulating or legitimizing climate policies.

## 1. Introduction

Anthropogenic climate change—in its historical, scientific, political, legal, and socioeconomic contexts—is framed in terms of values, goals, and choices for which climate science and modeling alone cannot provide sufficient guidance in decision-making. Commentators, activists, and policymakers regularly ground their claims and motives in terms of values and choices that they see contributing to a better climatic future, arguing that their proposals are better informed, fairer, or more altruistic than those of their opponents (Lee 2014). But outside the explicit calls to consider moral values in making climate-relevant decisions, there is a level at which values enter into the discussion without being recognized as such. In this article, we look at the assumptions, mostly implicit or unstated, that embody norms and expectations about the relationship between social responsibility and the ontology of climate change. In particular, we look at the representation of climate change as that of a physical entity responsible for increasing the socioeconomic and environmental impacts of future weather events. We argue that this representation helps its champions—scientists, analysts, and politicians—to buttress their political and ethical preferences and enhance the role of extreme weather in climate change policy.

Sociologists and philosophers of science have extensively discussed the value-ladenness of scientific practice, the concept that science cannot be performed in a vacuum without making value judgments based on

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*Corresponding author address*: Dr. Vladimir Janković, Centre for the History of Science, Technology and Medicine, Simon Building, University of Manchester, Manchester M13 9PL, United Kingdom.
E-mail: vladimir.jankovic@manchester.ac.uk

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context (e.g., Laudan 1984; Kitcher 2001; Kincaid et al. 2007; Douglas 2009). This article explores one aspect of value-ladenness related to attributing extreme weather to climate change, so-called attribution science. Thus, the purpose of this article is to examine how a specific set of perceptions associated with the current climate policy gives credence to attribution science—namely, "the science of probabilistic event attribution [that] can provide scientific evidence about the contribution of anthropogenic climate change to changes in risk of extreme events" (Otto et al. 2015). Specifically, we argue that the current scientific and policy interests in high-impact weather events stem from a perceived deficit in the public awareness of climate threat and the associated perceived deficit in the locally demonstrable proofs of its growing environmental impact. The logic goes that if the link between the anthropogenic drivers of climate change and an increasing intensity of individual weather events could be established, then developing a convincing case for robust, effective, and universally agreed upon climate policies would be easier. Making climate change visible—the approach Rudiak-Gould (2013) calls *visibilism*—would elevate the fight against climate change from one depending on future threats to one based on a clear and present danger. Despite this pragmatic appeal, however, visibilism favors dramatization and hype over the more systematic and less fortuitous rationales for stimulating climate policies. Also, visibilism downplays the complexity of the relationship between environmental risk and socioeconomic vulnerability and misstates our understanding of climate science.

## 2. Attribution of extreme weather events to climate change

In 2011, the nonprofit science and outreach organization Climate Communication—whose staff and science advisors include, among others, Richard Sommerville, Jerry Melillo, Ken Kaldeira, Kerry Emanuel, Michael Mann, and Michael Oppenheimer—issued the following statement.

> Recent weather events such as deadly heat waves and devastating floods. . . . are part of a new pattern of more extreme weather across the globe, shaped in part by human-induced climate change.
>
> As the climate has warmed, some types of extreme weather have become more frequent and severe in recent decades, with increases in extreme heat, intense precipitation, and drought. Heat waves are longer and hotter. Heavy rains and flooding are more frequent. In a wide swing between extremes, drought, too, is more intense and more widespread.
>
> All weather events are now influenced by climate change because all weather now develops in a different environment than before. . . . [C]limate change has shifted the odds and changed the natural limits, making certain types of extreme weather more frequent and more intense (Climate Communication 2011).

The statement goes on to note that

> [m]ore frequent and more severe extreme weather events are more likely to destabilize ecosystems and cripple essential components of human livelihood, such as food production, transportation infrastructure, and water management. Death, disease, displacement, and economic hardship may follow, as we have seen with recent hurricanes, floods, heat waves, and droughts (Climate Communication 2011).

Yet, this statement, as well as numerous others in the popular literature and media stories, contradicts the scientific evidence. IPCC (2011, p. 112) claims that "there is evidence that some extremes have changed as a result of anthropogenic influences, including increases in atmospheric concentrations of greenhouse gases." Yet, IPCC (2011, p. 9) adds that "attribution of single extreme events to anthropogenic climate change is challenging." A recent report by the National Academies of Sciences Engineering and Medicine (2016, p. 9) concludes that, although the confidence is highest for attribution of heat- or cold-related weather extremes to an anthropogenic influence, "[t]here is little or no confidence in the attribution of severe convective storms and extratropical cyclones." The assessment of levels of confidence for other phenomena (Bindoff et al. 2013) include the intensification of heavy precipitation (medium confidence), drought (low confidence), and overall midlatitude cyclonic activity (low confidence).

If attribution of such single events to climate change remains difficult, why are scientists (as noted above) implying this attribution in their public statements? What, in other words, are the motivations, assumptions, and implications of attribution claim making, and, in particular, what are their effects on current climate policy?

Starting in 2004, a series of weather events took place around the world that raised public and economic concerns that quickly raised the issue of their potential link with climate change. With the 2004 North Atlantic hurricane season becoming the costliest on record and the 2005 season marked by the record-breaking intensity of Hurricane Wilma, economic and insurance analysts voiced disquiet about the unprecedented levels of damages that seemed to harbinger a future characterized by supercatastrophes and a major rethinking of underwriting principles among governments and risk industries (Johnson 2011). With such events seemingly

outside the expected natural range of possibilities, the media increasingly turned to blaming climate change for the severe weather (e.g., Janković 2006; Hulme 2014). The cover of the 3 October 2005 issue of *Time* (Vol. 166, No. 14) asked, ''Are we making hurricanes worse?'' Some media outlets proclaimed that the strengths of Hurricanes Katrina and Sandy, as well as their impacts, were exacerbated by climate change (e.g., *New York Times* 2012; Gillis 2011; Emanuel 2015). More recently, the extreme cold in North America during winter 2013/14 (associated with the media's use of the overhyped term ''polar vortex'') had been attributed to a slowing down of the jet stream caused by the likely human-driven melting of the Arctic (*Rutgers Today* 2014).

During this period, scientists began developing tools and approaches for studying the probability that certain weather events were enhanced or became more frequent because of anthropogenic climate change. Comparisons between model climates in a preanthropogenic world and a postanthropogenic world became more commonplace. Among indications that attribution has secured a comfortable place among scientists is the four year-end summaries published by the American Meteorological Society in its high-impact *Bulletin of the American Meteorological Society* (Peterson et al. 2012, 2013; Herring et al. 2014, 2015). Each of these reports summarized the previous year's extremes and reported the results of attribution studies made to determine if these extreme weather events could be ''explained from a climate perspective.'' These studies are motivated by the hope that they would ''stimulate the development of attribution science'' (Stott et al. 2012, p. 1042).

These and other similar reports (e.g., Min et al. 2011; Pall et al. 2011; Christidis and Stott 2012; Lewis and Karoly 2013) exude cautious enthusiasm for the possibility of discovering any relationship between anthropogenic climate change and severe weather events. And while the formulation of this relationship has an intrinsic scientific value, it also has an important political role. For example, Thompson and Otto (2015) write that, ''if harmful weather extremes can be attributed to anthropogenic climate change, this could bring a lot of *needed* attention to the severity and danger associated with humanity's unfolding climate crisis'' (emphasis ours). Vanderheidein (2008, p. xii) argued that, ''[a]lthough any single climate-related catastrophe cannot with any certainty be definitively attributed to anthropogenic climate change, . . . what is certain is that as long as such weather events continue to wreak their destructive force upon human settlements and populations, global climate change *will remain on the public's agenda*'' (emphasis ours). As these citations imply, attribution represents welcome evidence for a much needed action on climate change, and any effort to provide a demonstrable proof of the relationship between severe weather events and anthropogenic climate change would be valuable to those in the political and public arenas arguing for greater governmental action.

## 3. What is atmosfear, and why is it invoked?

Hulme (2014) has identified four reasons why the attribution of severe weather events to anthropogenic climate change plays a role in current climate science and policy: scientific curiosity, adaptation guidance, liability for damages, and the visualization of climate change. To these, we add atmosfear as a discursive practice used to accelerate the implementation of greenhouse mitigation policies. Although atmosfear shares common features with other forms of anxiety and fears related to environmental, social, and political issues (e.g., the fear of nuclear annihilation during the Cold War; Weart 1988), our interest here is to explore its impact on climate policy, in particular on the arguments favoring robust mitigation measures and their implications for the policy framing of climate change as an environmental threat.

Atmosfear is created through assumptions that link climate change to severe weather events in ways in which such events become *signifiers* of a peril that goes beyond their limited individual impact. Thus, atmosfear consolidates assumptions, values, and apprehension about the atmosphere in a state of a long-term, unpredictable, human-induced excitability. As we argue below, such values and apprehensions, whether or not warranted by scientific results, are expected to play a role in mobilizing public and political support for climate change policies, particularly (if not exclusively) those formulated around the mitigation of greenhouse gas emissions. Thus, is a policy driven by fear providing a robust enough ground for the kind of climate action needed to address the socioenvironmental risks that, in their complexity and magnitude, surpass the mere increase in weather severity?

Public salience of atmosfear derives from the perceived need to make climate change visible (Rudiak-Gould 2013; Kerr 2013). Leiserowitz (2007, p. 48) wrote that ''climate change is unlikely to become a high-priority national issue until Americans consider themselves personally at risk,'' advocating for a need to link extreme weather events to climate change. Proving such a link scientifically can be seen as acting in the name of a good cause, which may or may not have an effect on the robustness of scientific reasoning: ''The good cause—one that most of us support—can all too readily corrupt the conduct of science, especially science

informing public policy, because we prefer answers that support our political preferences, and find science that challenges them less comfortable'' (Kellow 2008). Although this *noble cause corruption* (Pielke 2014) may compromise the standards of science, it can serve higher political and moral goals. In 1989, Stephen Schneider, one of the leading twentieth-century climate scientists, summarized the need for this particular form of scientific-cum-moral double engagement to *Discover* magazine in the following terms (Schell 1989; see also Schneider 1996):

> On the one hand, as scientists we are ethically bound to the scientific method, in effect promising to tell the truth, the whole truth, and nothing but—which means that we must include all doubts, the caveats, the ifs, ands and buts. On the other hand, we are not just scientists but human beings as well. And like most people we'd like to see the world a better place, which in this context translates into our working to reduce the risk of potentially disastrous climate change. To do that we need to get some broad based support, to capture the public's imagination. That, of course, means getting loads of media coverage. So *we have to offer up scary scenarios, make simplified, dramatic statements*, and make little mention of any doubts we might have. This ''double ethical bind'' we frequently find ourselves in cannot be solved by any formula. Each of us has to decide what the right balance is between being effective and being honest. I hope that means being both.

Schneider was not speaking about extreme weather reports or climate attribution claims, but the subsequent history has made such claims particularly advantageous in making the case for reducing ''the risk of potentially disastrous climate change.'' Furthermore, Schneider's admission illustrates that a need for media coverage represents a key step in transforming a latent environmental threat into a social problem. In the words of the sociologist Sheldon Ungar, ''while many environmental threats contain a strong dread factor, dread is latent; it must be evoked and transformed to foster a social scare.'' Social scares often result in brief episodes of ''collective fear that accelerate demands in the political (or related) arena'' (Ungar 1992, p. 485). Ungar described what was perhaps the most important trigger of global warming awareness in the United States: the meteorologically record-breaking summer of 1988 that brought about ''*concatenating* physical impacts *felt* by the person in the street'' (Ungar 1992, p. 490, italics in the original). But, as the person on the street experienced heat, the media made the heat signify something beyond itself. On 11 July 1988, *Newsweek* asked if humanity was playing ''lethal games with vital support systems'' [quoted in Ungar (1992)]. More generally, as highlighted by the sea change in industrial perceptions of climate change since the losses incurred by Hurricanes Katrina, Rita and Wilma, the claims regarding global environmental hazards are usually honored when they piggyback on dramatic real-world events (Capstick et al. 2015).

We refer to Schneider and Ungar mostly to establish the political proficiency of attribution claims and their presumed influence in stimulating the climate decision-making process. Although attribution claims are ostensibly about climatological facts, they also provide moral and political support for climate change policies. Yet, the assumptions and implications underlying such appeals require further analysis in the interest of reaching a more nuanced understanding of the relationships among climate change, severe weather events, and climate decision making.

## 4. Four premises underlying atmosfear

In what follows, we briefly focus on key underlying assumptions that legitimate the presumed political expediency of atmosfear. Atmosfear enjoys an appeal among scientists, public, and policy-makers because it favors a climate policy based on four seemingly self-evident principles. These assumptions are routinely taken as self-evident, but which we believe require careful deconstruction and a full disclosure of their unstated premises, all in the interest of reaching a more nuanced—and politically more responsible—understanding of the relationship between climate, climate change, and severe weather. These assumptions are 1) a clearly *identifiable* target problem in the form of anthropogenically forced weather extremes and 2) a collective moral *responsibility* to enact climate policy based on 3) a mitigation imperative and 4) the benignity of a postanthropogenic climate system. We proceed by analyzing the rationales and implications of these premises and conclude by revisiting the effectiveness of climate policy processes that explicitly rely on fear appeal.

### *a. Clearly identifiable target problem in the form of anthropogenically forced weather extremes*

The political attractiveness of the first premise is intuitive: rather than working toward a political consensus amid a host of scientific, economic, and political imponderables, tackling climate change becomes an imperative if framed as a *proxy* of tackling the extreme weather. Through a proxy, the psychological distance of climate change gives way to dealing with a concrete problem of extreme weather. A climate policy relying on clear objectives of mitigating observed extremes has an advantage over a policy advocating a radical transformation of socioeconomic behaviors geared toward preventing a distant climate Armageddon.

*b. A collective moral responsibility to act*

Second, attribution science appears to have a unique potential to boost motivation for climate action because of its appeal to *responsibility* to prevent socio-environmental impacts of the anthropogenically charged atmosphere. If scientists and decision-makers agree that weather events produce larger damages because they are partly man-made, then it is paramount to assume an ethical stance of responsibility for the observed (if any) rise in the intensity or frequency of hazardous weather. This ethical rationale bolsters the more general ethical stance of current climate policies whose creators share a broad underlying sense of responsibility to ensure for humanity's past and present environmental actions, intergenerational justice, the future of the nonhuman world, and a responsibility to provide a meaningful distributive justice (e.g., Shue 1999; Jamieson 2001, 2005; Gardiner 2004; Klinsky and Dowlatabadi 2009).

The issue of responsibility is especially invoked in regard to innocent victims of climate change impacts. In this context, some commentators resort to the language of human rights, government's malfeasance, and corporate liability. In one example from the United Nations Conference on Climate Change in Paris 2015 (COP21), the Commission on Human Rights—responding to the complaint of typhoon survivors, activists, and a host of nongovernmental coalitions including the Philippine Movement for Climate Justice—announced that it would seek, for the first time in history, an investigation into the world's top 50 greenhouse gas–emitting companies and their liability for recent extreme weather events in East Asia (Abad and Baghai 2015). The moral and legal issues of responsibility, liability, and accountability are thus streamlined into policy considerations with an explicit recognition of the salient political importance of attribution claims. In the words of the Court Case Summons that Urgenda Foundations won against the Dutch government regarding the failure to take sufficient action to prevent dangerous climate change, ''[i]f we fail, [we] will face ... a world in which large increases of extreme weather events will make parts of the world uninhabitable and where extreme weather will regularly cause significant damage to society. No one can be pleased at the thought of leaving behind such a legacy'' (Urgenda Summons 2014, 20–21).

*c. The imperative to mitigate against future losses*

Third, implicit in such and similar claims is the representation of emission reductions as the most effective, if not the only, approach to curbing future extremes. Such claims stress that, regardless of any adaptation policies and increases in social and infrastructural resilience, the anthropogenically charged extreme weather will nevertheless cause an *inevitable* increase in the socioeconomic and environmental losses. The ruling of the Hague court in Urgenda versus Kingdom of the Netherlands, for example, called for an immediate action toward reducing emissions levels to 25% below those in 1990 to prevent the ''imminent danger'' of disastrous climate change. Of course, mitigation policies must and will remain the fulcrum of climate protection plans. Yet, it remains to be determined whether such plans ought to be legitimized by a presumed rise in future weather extremes and whether a successful implementation of such plans would result in a demonstrable reduction of socioeconomic damages caused by supercharged weather. If neither of these results is justified, a policy based on attribution claims (and atmosfear) runs the risk of being ill advised, ineffective, and disingenuous.

*d. The benignity of a postanthropogenic climate system*

The fourth assumption of the atmosfear-driven policy thinking is that the end result of mitigation measures would, ideally, restore a climate system to a state spared from ''weather on steroids'' (UCAR 2012). It is assumed that a new postanthropogenic atmosphere will be graced by a more benign weather than the anthropogenic one preceding it and would stabilize around a state characterized by ''natural'' extremes regardless of their absolute magnitude, intensity, and damages caused. Naturally occurring extremes will thus continue, but their effects would become a matter of planning and protection, rather than a concern for mitigation-centered climate policy. Attribution science would become a matter of the past.

## 5. How atmosfear misstates and oversimplifies scientific understanding and policy choices

Before explaining the epistemological and historical reasons behind the appeal attribution claims, we first address several difficulties arising from the above premises. First, the intensity and frequency of future severe weather episodes is only one of the threats associated with the increase in atmospheric greenhouse gases. The predicted future retreat inland of coastal communities due to rising sea levels, especially in developing countries, could create socioeconomic, demographic, urban, and political disturbances that could render the impact of heavy weather events frivolous in comparison. In the developed countries, despite

resources for adaptation, the situation could be as treacherous. For example, in Virginia, where tourism generates 13 600 jobs and $864 million in revenues (Yochum and Agarwal 2009), the beach recession due to sea level rise could threaten billions of dollars worth of oceanfront investments. The consequences of such decadal-scale process for the Hampton Roads area and beyond would be of an entirely different scale than those wrought by the physical impact of individual hurricanes or storm-surge inundation (Stiles 2012).

Second, we note the ambivalence surrounding the climate system that is hoped to be achieved as a result of mitigation policies. Scientists and policy-makers sometimes refer to the status of the unadulterated climate by the preindustrial levels of carbon dioxide, under the assumption that staying below 350 ppm would entail a climatically safer world characterized, among other things, by a decrease of anthropogenically driven extremes. Does a world under the 350-ppm limit (or any other limit) automatically translate into one characterized by a more favorable climate? Can the preindustrial climate envelope be considered to be ''natural,'' and what makes it so? Furthermore, is a desired future climate meant to satisfy a set of specifiable criteria, or is it simply a climate system representing the behavior of a nonanthropogenic atmosphere? Is there a tendency to idealize preindustrial climates as representing a prelapsarian world made up of ''all things bright and beautiful'' (Gould 2002, p. 179). More generally, as the geographer Chris Caseldine (Caseldine 2015) writes, ''do we want climate as it *would have been without us* or climate that is in line with our needs and aspirations to maintain and improve current levels of human civilization?'' (emphasis in the original). Similarly, Jamieson (1996, p. 325) asks if ''we really know what the climate would be like were it not affected by humans; and if so, is this a realistic target at which to aim?''

As debates on what constitutes an acceptable climate have only started—and are likely to involve thinking about what policy-makers and people *want* rather than what they *do not*—we note one substantial difficulty with the assumption of a prelapsarian climate as the policy goal. Were all current greenhouse gas emissions stopped immediately, climate model simulations suggest that the Earth's climate would not return to its preindustrial state (e.g., Armour and Roe 2011). Instead, the globally averaged temperature would stabilize at or just below its present value. Even after waiting the hundreds of years for the climate to return to its nominal natural state, external forcing on the climate and internal climate variability (i.e., global-scale teleconnections such as El Niño and the Pacific decadal oscillation) might challenge the desired state of equanimity.

Third, and related, if in an ideal-case scenario long-term mitigation policies achieve the stabilization of atmospheric greenhouse gases (to whichever agreed upon levels), would such an accomplishment result in a reduction of damages caused by extreme weather events? We do not think this would necessarily follow because mitigation of greenhouse gas emissions, as currently conceived, does not address the nonatmospheric sources of vulnerability, nor can it suspend processes that increase asset exposures. We ought to bear in mind that increases in vulnerability and asset exposure (outcome risk) remain independent from the risk of the occurrence (event risk; Sarewitz et al. 2003). Furthermore, recent research in industrial and forensic meteorology shows weather damages to be highly dependent on nonclimatic factors such as the nature of industrial activities, global scales of operation, fragile supply chains, greater asset exposure, and risk-assessment oversight (e.g., Janković 2015; Home Office 2002). The shift toward leaner supply systems, for example, makes the economic system more vulnerable as there is less inventory to buffer any disruptions caused by bad weather. Furthermore, weather-related risks increase with deregulated development, lack of planning, aging infrastructures, and migration toward vulnerable areas (Kunkel et al. 1999), while many areas have inherited vulnerabilities due to the effects of colonization, conflict, and other forms of compound injustices (Gardiner 2011, p. 119). The chronic socioinfrastructural vulnerabilities to *any* kind of weather can explain recent findings by Swiss Re (2015) that the financial impact of moderately adverse weather is of the same order of magnitude as those caused by *force majeure* episodes.

These considerations lead us to suggest that reducing the event risk of future extreme weather cannot of itself reduce the outcome risk because the latter depends in large measure on nonatmospheric variables. ''It is well known that the frequency and intensity of extreme weather and climate events are only one factor that affects risks, as changes in population, exposure of people and assets, and vulnerability determine loss potentials'' (IPCC 2012, p. 273). This means that understanding and mitigating the impact of the severe weather and climate change on society involves understanding and managing the *interaction* between atmospheric and social environments. Rather than privileging the atmospheric threat as the main source of societal risk, climate scientists and science communicators could subscribe to a broader remit of research and policies aimed to ''alleviate known causes of people's vulnerability to harm, to pay attention to the distribution of risks and benefits, and to reflect on social factors that promote or discourage learning'' (Jasanoff 2007).

In addition to mitigation, a comprehensive climate policy would require adopting adaptation strategies, not simply because of the now inevitable effects of the anthropogenic forcing, but also because of the growing risks of declining baselines of resilience to climate change impacts (IPCC 2012). As Klein and Möhner (2011) note, effective ''policies to address loss and damage are far more likely to be influenced by the prospects of reducing vulnerability and increasing coping capacities than by whether or not the meteorological component of a disaster can be attributed to human agency'' (quoted in Hulme 2014). A comprehensive policy would thus need to include the existing and new institutional mechanisms dedicated to the streamlining of climate services, warning systems, infrastructural resilience, weather ''optimization'' of public and industrial activities, and risk/vulnerability assessment procedures. Reducing carbon emissions, regardless of how effective, cannot of itself reduce weather impacts (e.g., Schultz and Janković 2014).

## 6. Taming climate change

Why then, despite the insights into the complexity of climate-cum-societal change, does the discourse of climate change continue to privilege atmospheric over socioeconomic sources of climate risk? Consider the statement recently issued by a group of leading hurricane scientists:

> As the Atlantic hurricane season gets under way, the possible influence of climate change on hurricane activity is receiving renewed attention. While the debate on this issue is of considerable scientific and societal interest and concern, it should in no event detract from the main hurricane problem facing the United States: the ever-growing concentration of population and wealth in vulnerable coastal regions [Emanuel et al. (2006), cited in Callison (2014)].

Callison (2014, p. 188) has noted that, ''there aren't any analogues to Al Gore, Greenpeace, Sierra, or WWF [World Wide Fund for Nature] looking to rein in and assess coastal development.'' There is clearly a concern that the widespread focus on extremes has a tendency to downplay or even ignore the socioeconomic processes that make such extremes even more damaging. Very little science or science communication goes into conveying the message that any climate risk depends on the magnitude of atmospheric threat multiplied by the magnitude of local vulnerability to such a threat. Reducing one or the other in isolation will not necessarily reduce the overall climate risk.

We believe that the weatherward rather than landward attention results in part from an uncritical adoption of attribution claims that, in turn, shape the perception of climate change as a long-term *weirding of weather*, bolstered by the cultural and media propensity for hyping extreme events (Leyda and Negra 2015). Attribution claims and atmosfear have helped to consolidate the representation of climate change as a material threat with origins in an adulterated atmosphere, safety from which must be sought in tackling that threat. As a result, in popular parlance, climate change is often represented as a carbon-driven entity (or agency) endowed with a causal power that alters social life and the natural environment (Fleming and Janković 2011; Hulme 2015). Climate change thus impacts economy, affects societies, harms national security, hurts the world's poor, and leads to global conflicts. Scientists argue that ''[c]limate change also decreased the Antarctic sea ice extent in 2014 and increased the strength and likelihood of high sea surface temperatures in both the Atlantic and Pacific Oceans'' (Herring et al. 2015, p. vii). In response, the Chachibaia (2014) calls for a ''fight against climate change,'' and the United Kingdom Department for Environmental Food and Rural Affairs (2013) writes of ''tackling climate change.'' Speaking in Jakarta on 16 February 2014, U.S. Secretary of State John Kerry described climate change as ''perhaps the world's most fearsome weapon of mass destruction'' (Mohammed 2014), whereas U.S. Navy Admiral Samuel Locklear of the Pacific Command identified climate change as the largest U.S. security concern (Dokoupil 2015).

Climate change is not an entity, of course. It has no physical powers associated with it. Climate change is an indication of long-term atmospheric trends that, in combination with the socioeconomic conditions, may or may not result in short-term devastation and irreversible environmental damage. What do have causal agency are the meteorological and environmental events—droughts, landslides, heat waves, sea level rise—that are governed by the increasing concentration of greenhouse gases in the global atmosphere. Whether or not reducing their impact on societies and biota is successful depends in part on our ability to stop their intensification and improve coping capacities.

But, there are deeper historical, epistemic, and institutional reasons for the policy significance of extreme weather events and of the representation of climate change as a material threat. We earlier alluded to the practice of reducing complex problems to their simpler proxies. This practice can occur when complex problems (e.g., urban planning, genetically modified foods, terrorism) are handled by means of public policy based on scientific expertise. Science-based approaches to such problems, however, cannot fully accommodate for the full dimensionality of these problems. Rittel and Webber

(1973), who introduced the issue in relation to the general theory of planning, wrote that "[t]he search for scientific bases for confronting problems of social policy is bound to fail, because of the nature of these problems. They are 'wicked' problems, whereas science has developed to deal with 'tame' problems." Climate change is a wicked problem in that it involves the phenomena, decisions, values, and uncertainties that are at once natural and social and that require urgent action on matters involving highest stakes (Lazarus 2009). These complications explain the almost universal disaffection with the international process on greenhouse emission regulations and the almost universal pessimism regarding any future clean-cut "solution for climate change." But, as Rittel and Webber (1973) argued, wicked problems cannot have definitive solutions; hence any assumption that they *can* may result in a belief that little or nothing "has been done."

In this context, atmosfear begins to make sense as a discursive practice. The simplified, policy-tailored representation of climate threat as supercharged weather translates the wicked nature of climate change into the scientifically tractable—and tame—problems of hurricane winds, heavy precipitation, human losses, or agricultural failures. Translating future scenarios into immediately observable damage overcomes the psychological resistance of institutions attempting to "restrain the present to liberate the future" (Lazarus 2009). As a result, arguments in favor of climate action (mitigation *or* adaptation) can be justified in terms of actions intended to protect the victims of anthropogenic extremes. Indeed, there is nothing controversial or wicked about such a self-evident moral imperative.

Yet, this translational practice that results in the problem taming reflects a longer institutional path dependency based on the so-called *pollution paradigm* of the post-1960s environmental policy. Nordhaus and Shellenberger (2007) argue that the environmental laws of the 1960s and 1970s have long provided the framework of thinking about the nature and solution of ecological crises. The legislative solutions of crises such as pesticides, urban air pollution, water contamination, acid rain, or the ozone hole were the identifiable *target problems* whose solutions were about limiting human intrusion and contamination of nature. Such crises were manifested as smogs, mortality rates, deforestation, toxic streams, etc. For Nordhaus and Shellenberger (2007), current approaches to global warming mimic this approach in seeking to "fix" the easily identifiable causes of environmental decline, but as climate change does not belong to the category of visible and legally tractable "pollution" hazards, the old approach cannot result in an effective policy.

Climate change is not a discrete problem independent of development imperatives, nor is it manageable by a policy based on a mere scientific consensus (Prins et al. 2010). It lacks the mundane visibility that can galvanize public opinion or, more importantly, provide an actionable target problem that all can agree with. With extreme weather attribution claims and the associated politics of atmosfear a target problem seems to be within a reach, allowing for a possibility to argue climate action in terms of conventional problem solving: documented hazards, known causes, and meaningful solutions. Thus, attribution claims allow policy-makers to put forward a case for morally robust policies based on mitigation of greenhouse emissions. Weather extremes are proxies of climate crisis, dismantling the climate complexity into the simpler and more visible conventional idiom of atmospheric hazard.

## 7. Conclusion: Atmosfear appeal

Determining the influence of anthropogenic drivers on individual weather events is a matter involving methodological difficulties. Not all extreme weather events will change, nor will some of the changes—if they even occur—be detectable amid the large interannual variability of events (IPCC 2012; Kunkel et al. 2013). Some of these changes have already been observed, and others have not been detected (e.g., Kim et al. 2016). Some extreme events are expected to become less frequent, but become some will become more intense (e.g., IPCC 2012). Some areas of the globe will benefit; others stand to lose. Thus, reducing the complexity of climate change (as if a single outcome were known) into the soundbite of "climate change means more extreme weather" is a massive oversimplification—if not misstatement—of the true state of the science.

Furthermore, no estimate about the relative contribution of greenhouse drivers to future weather extremes could distinguish meteorological from societal causes of damages. Future socioeconomic expansion in vulnerable areas, such as megacities and coastal settlements, are likely to lead to an increase in infrastructural damage, social vulnerability, and loss of life even during "normal" weather extremes. Attributing such increases to anthropogenic drivers only masks the social causes of hazard and, consequently, fetishizes climate change into a sole-source danger and a sole target of climate policy.

An important corollary is that such policy fixates on atmospheric sources of risk and leaves socioeconomic contributors of risk to conventional welfare policies and emergency protocols. The disconnect may result in a complete failure to prevent mounting damages.

Ironically, the qualitative measures needed for planning against the ''weather on steroids'' (UCAR 2012) such as greener economies would turn out to be the same as those used in planning for the ''natural'' severe events: building more resilient communities, better levees and seawalls, more effective emergency services and evacuation planning, land-use planning and zoning in hazard-prone areas such as floodplains and coastal areas, strengthened building regulations and construction codes, and any other initiatives aimed at reducing socioenvironmental injustice and self-inflicted sources of risk (e.g., Schultz and Janković 2014). We suspect that such measures would eventually eclipse most of the other measures imposed as a result of attribution science. In this way, we disagree with Dilling et al. (2015), who argued that adapting to current climate may lead to more vulnerability rather than less. A world in which socially induced sources of risk are at their minimum is the world in which the climate-driven sources are at a minimum as well.

There is a need to change the view that mitigation and adaptation cannot be part of the same solution. Mitigation policy is the key to enabling the world to avoid the possibility of irreversible changes that might result in irreversible damages to the world's societies. Adaptation addresses the reality that global climate has already changed and that we should be prepared to live in such a world. However, the insistence on linking extreme weather to climate change reduces the political will to deal with these types of problems and climate-driven vulnerability. Fear-induced appeals to more extreme weather in a changed climate are unlikely to succeed because people view weather events (and hence climate) as less predictable than other risks and thus may lead to an inability to take action (Bostrom and Lashof 2007). Recipients of fear appeals may try to act to reduce the danger, but when they have no access to concrete means to do so, recipients suppress the fear without reducing the danger either by ''denying that there is anything to fear or concluding that the fear appeal was a manipulation attempt by an untrustworthy source'' (Stern 2012; also Witte and Allen 2000). Furthermore, audience receptiveness to the claims of atmosfear tends to diminish as concern with the dramatic event attenuates; keeping up the interest requires a constant supply of ever more dramatic claims (Kerr 2013; Pielke 2014, p. 89). Also, counter extremes, such as cold spells, can work to diminish concern and reduce interest in anthropogenic warming (Zaval et al. 2014).

More generally, the tendency to fixate on preventing one type of threat by action is not just misleading; the fixation on discrete episodes of damaging weather may rob resources from policies addressing the slow, low-intensity, high-frequency, locally enhanced, and irreversible impacts. For example, contemporary urban climate change policies that prioritize high-intensity but low-frequency events such as heat waves, flooding, sea level rise, and hurricanes downplay chronic, small-scale risks associated with urban heat island, microvariations of temperatures, street-level winds, traffic heat, air conditioning, street cover, and solar glare—all of which shape the day-to-day life of an urban population (Janković 2014). This policy blind spot may well have to do with the results of research in public risk perceptions that show that people generally downplay the risk of things they commonly encounter and over which they think have control as compared to random, severe, and involuntary events (e.g., Slovic et al. 1981).

To summarize, we argue that attribution or linking climate change to the frequency or intensity of extreme weather events (what we call atmosfear), although perhaps a scientifically interesting question, is not effective as a means to motivate or legitimize climate policies. By reducing the complexity of climate science down to its effect on weather events, proponents run the risk of underemphasizing the crucial socioeconomic components of increased risk (e.g., increasing exposure of assets in vulnerable locations). Moreover, even if anthropogenic climate change were effectively stopped, extreme weather would continue. Members of the public and governmental representatives who had been sold on the idea that ''stopping climate change will reduce extreme weather events'' would understandably question their bill of goods, reducing scientific credibility.

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