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Climate change: What do we know about the IPCC?

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Abstract

This is the first of a series of three biennial reviews of research on the subject of climate change. This review is concerned with the UN Intergovernmental Panel on Climate Change (IPCC): its origins and mandate; its disciplinary and geographical expertise; its governance and organizational learning; consensus and its representation of uncertainty; and its wider impact and influence on knowledge production, public discourse and policy development. The research that has been conducted on the IPCC as an institution has come mostly from science and technology studies scholars and a small number of critical social scientists. The IPCC's influence on the construction, mobilization and consumption of climate change knowledge is considerable. The review therefore ends by encouraging geographers of science to turn their research and scholarship to understanding the roles played by the IPCC, and equivalent institutional processes of climate change knowledge assessment, in the contemporary world.

Keywords

climate change, IPCC, learning, science governance, uncertainty and consensus

I Introduction

It is over a decade since I wrote the last of my annual review articles for *Progress in Physical Geography* (Hulme, 2000). The subject of the eight reviews I wrote during the 1990s was 'global warming'. The subject of these new biennial reviews is to be 'climate change', the change of nomenclature reflecting an interesting change of perspective and framing. The significance of language in social discourse, public perceptions and policy framing of climate change has recently been explored, respectively, by Nerlich et al. (2010), Whitmarsh (2009) and Nisbet (2009).

The subject of the first of these new reviews for *Progress in Physical Geography* is the United Nations Intergovernmental Panel on Climate Change (IPCC). The institution received, jointly, the 2007 Nobel Peace Prize for 'its effort to build up and disseminate greater knowledge about man-made climate change and to lay the foundations for the measures that are needed to counteract such change'. Yet during 2010 the IPCC has come under unparalleled public and political scrutiny (Bagla, 2010; Schiermeier, 2010). It is therefore timely to survey the scope and depth of academic research into the nature of this institution – its origins and mandate; its mobilization of expertise; its governance; its representation of uncertain knowledge; and

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its impact and influence. I am also partly inspired to this task by the 'spatial turn' in the history and philosophy of science (eg, Shapin, 1998; Livingstone, 2007; Finnegan, 2008): space matters in the making and mobilizing of knowledge. The literature reviewed here comes mainly from science and technology studies, policy studies, political science, environmental sociology, philosophy of science and a few areas of academic geography.

II Origins and mandate

Two large-scale experiments are being conducted in the world today in relation to climate change. One of these was famously described by the American geophysicist Roger Revelle in the 1950s: 'Human beings are now carrying out a large-scale geophysical experiment of a kind that could not have happened in the past nor be reproduced in the future' (Revelle and Suess, 1957: 19). The other experiment is also one which has not before been attempted. It is a worldwide sociocultural experiment to see whether the whole panoply of human behaviours, preferences and practices can be directed towards achieving one overarching goal: to change the terms of Revelle's experiment by bringing the worldwide emissions of greenhouse gases under directed management. We do not know the outcome of either experiment, but what connects them together is predictive knowledge – putative knowledge about how future climate may evolve over decades to centuries. Central to the assessment, validation and mobilization of such knowledge claims about climate change has been the IPCC.

The IPCC was officially constituted during its first meeting in Geneva in November 1988 (IPCC, 1988). The scientific and diplomatic politics surrounding the formation of this new institutional process of knowledge assessment in the late 1980s have been described and analysed by Hecht and Tirpak (1995), Franz (1997), Agrawala (1998a, 1998b), Skodvin (2000a) and, in a rather more personal and anecdotal manner, by Bolin (2007). Yet, other forms of institutional processes for bringing climate change knowledge to bear on the international policy process could have emerged at the time. For example, the World Meteorological Organization, the United Nations Environment Programme (UNEP) and the International Council for Scientific Unions could each have ended up with the responsibility for such a knowledge assessment, as for a while did the Advisory Group on Greenhouse Gases whose origins and functions were strongly influenced by non-governmental organizations. As Agrawala (1999) argues, the emergence in the late 1980s of the IPCC as the politically favoured means of climate change knowledge assessment owed much to American unease about UNEP and to their desire to find a means of balancing the advocacy positions of the fossil fuel and environmentalist lobbies in the USA.

More critical readings of the emergence of the IPCC have also been offered. Boehmer-Christiansen (1994a, 1994b, 1994c) argued that establishing the IPCC as a 'single established source' of information about climate change suited a convergence of scientific, political and some business interests. She pointed to dangers for scientific practice and scientific institutions from scientists being used to feed this new politically charged activity. Shackley and Skodvin (1995) offered a measured response to Boehmer-Christiansen (others have been less forgiving), arguing that such a 'conspiratorial' account of the emergence of the IPCC was too simplistic. Yes, interests were being mobilized for all sorts of reasons and certain voices being privileged over others, but such a complex process of institution building could not be reduced to science exerting its hegemony over policy or a cabal of scientists seeking means to secure their own further funding.

Shackley and Skodvin therefore advocated an expanded role for interpretative social scientists in understanding the internal and external dynamics that led to the construction of the IPCC and in scrutinizing the types of knowledge it

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produced – which is what Elzinga (1996), Demeritt (2001) and Miller (2004, 2007), for example, later produced. Miller approached the origins of the IPCC from a more analytical and much wider historical perspective than Boehmer-Christiansen, drawing upon social studies of science to inform his analysis. Using Sheila Jasanoff's idiom of co-production (Jasanoff, 2004), Miller showed how many things converged in the late 1980s to allow a fruitful space within which a body such as the IPCC could emerge: the loss of cultural and social readings of climate and the reframing of climate as 'global'; the rising power of climate modelling and Earth system science; the rise of global environmental politics during the 1980s; the politics surrounding the end of the cold war; and a new 'green' imperialism in European societies.

In a short 1997 commentary, Simon Shackley asked four pertinent questions about the status and future of the IPCC. To paraphrase them: (1) can the IPCC involve more scientists from developing countries, (2) will it preserve its authority as a trusted expert body, (3) can it avoid its open processes becoming hostage to endless political negotiation, and (4) will the IPCC define a clear role for itself, sufficiently distinct from the policy process itself? Shackley concluded his commentary by noting: 'Of particular concern is whether the IPCC can make its knowledge more socially relevant and trusted by bridging the gulf which exists between scientific experts and on-the-ground decision-makers and members of the public' (Shackley, 1997). These questions relating to participation, trust, governance and policy advocacy remain as critical today as they did then. The rest of this review will summarize research that has been completed since Shackley asked these questions and help point towards some possible answers.

III Expertise and participation

The two main questions that research in this area has sought to address are (1) what forms of disciplinary expertise are enlisted in IPCC assessments, and (2) what are the geographical biases in the recruitment of expert authors and reviewers?

With respect to the first of these questions, Bjurström and Polk (2010) have conducted the most thorough analysis to date of the disciplinary biases in the knowledge assessed by the IPCC. They categorized the 14,000 references cited in the IPCC Third Assessment Report (2001) into different disciplines. Of these references, 62% were to peer-reviewed journals (the remaining 38% referred to books, conference proceedings and grey literature). Of this peer-reviewed subset, just 12% were from the social sciences. Remove economics from this category and less than 8% of the cited peer-reviewed literature in the Third Assessment Report was from the social sciences. This powerful bias to the natural sciences in the construction of 'IPCC knowledge' about climate change has been remarked on for many years. Even before the Second Assessment Report was published in 1996, Shackley and Skodvin (1995) were critical of the lack of appreciation by the IPCC of the interpretative social sciences, what Howard Newby referred to as the 'IPCC fallacy' (cited in Cohen et al., 1998). Malone and Rayner (2001) repeated this criticism with respect to both the Second and Third Assessment Reports (as has Yearley, 2009, with respect to the Fourth Assessment) and offered a number of epistemological, institutional and political reasons why the social science disciplines were marginalized by the IPCC.

Other analysts from more specific perspectives have examined the disciplinary biases in, or profiles of, the knowledge assessed by the IPCC. Caseldine et al. (2010), for example, concentrated specifically on how palaeoclimate research has been represented in the two decades of IPCC reports, welcoming the greater prominence given to such research in the IPCC Fourth Assessment (AR4). From a different disciplinary standpoint, Nordlund (2008) examined 13,000

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cited references in Working Groups 2 and 3 of IPCC AR4 for evidence of work related to the 'futures' community – work either published in core futures journals or by known futures experts. His argument was that for an assessment which is so heavily futures-oriented, the inclusion of futures research in the 2007 Fourth Assessment was depressingly thin; the IPCC would benefit from assessing research from a community which specializes in 'the philosophical and methodological aspects of prediction and forecasting' (p. 875).

Hiramatsu et al. (2008) followed a different methodology, but reached a similar conclusion. They developed a mapping framework for climate change research content based on the relationships between nature and human society. This framework comprised seven elements: (1) socio-economic activity and greenhouse gas emissions; (2) carbon cycle and carbon concentration; (3) climate change and global warming; (4) impacts on ecosystems and human society; (5) adaptation; (6) mitigation; and (7) social systems. Applying the framework to the contents of IPCC AR4 showed that the quantity and reliability of assessed research in elements (2) and (3) had increased relative to the Third Assessment Report. But research evidence addressing elements (1), (5) and (7) was lacking and these were the elements where social sciences and humanities research had most to contribute.

Godal (2003) too has criticized the disciplinary biases and rigidities of the IPCC assessment structure (a criticism also voiced by Leemans, 2008). Scrutinizing the assessment of knowledge about greenhouse gas emissions indices, Godal points out that the disciplinary silos maintained across the respective IPCC Working Groups restrict the usefulness of the assessment. 'The structure of the work within the IPCC seems to be based on ... the understanding that the science of climate change follows a clear-cut "disciplinary line" – from the natural sciences to the social sciences, where the latter is based on the former' (p. 247).

This existence of knowledge hierarchies is of course not unique to the IPCC. These have also been seen at work in other international fora, such as the Copenhagen Climate Change Congress, organized by the University of Copenhagen in March 2009. O'Neill et al. (2010) analysed the 600 research abstracts presented during that week and found evidence of disciplinary, gender and geographical biases in the knowledge being mobilized around climate change. In the wider setting of socio-ecological research, Miller et al. (2008) argue in favour of epistemological pluralism when it comes to understanding complex systems that embrace the human and non-human worlds; and climate change is surely one such system. Echoing Jerome Kagan's three cultures – knowledge as mechanistic (predictable physical systems), contingent (complex adaptive systems) and narrative (socially constructed systems) (Kagan, 2009) – Miller et al. seek to subvert conventional hierarchies of knowledge by offering a different hierarchical structure: transdisciplinary, interdisciplinary, multidisciplinary and disciplinary knowledge.

Yet the IPCC remains largely conventional in its hierarchical instincts. In a recent sociological critique of the IPCC, Yearley (2009) argues that climate science is currently constructed through assigning the (interpretative) social sciences a specific role – a subsidiary one. 'The institutional assumption of the IPCC is that the most relevant social science is economics' (p. 401), thus marginalizing knowledge about climate change which emerges from disciplines such as anthropology, psychology, communication science, philosophy and history. Yearley's assertion is certainly borne out by Bjurström and Polk's (2010) analysis.

The second area where critical analysis of the expertise mobilized in the IPCC assessments has been made is with respect to the participation of developing country experts. Despite increasing attention paid by the IPCC governing bureau to these concerns since they were first expressed in the early 1990s (and continue to be expressed;

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eg, Demeritt, 2001; Miller, 2007; Grundmann, 2007; Runci, 2007), the proportion of IPCC authors and reviewers from OECD versus non-OECD has not changed. For each of the Second, Third and Fourth Assessments Reports of the IPCC, the%age of both authors and reviewers from the OECD nations has remained remarkably constant at between 80% and 82% (authors' own assessment). For example, Kandlikar and Sagar (1999) examined the IPCC First and Second Assessment Reports with respect to the participation of Indian expertise and found the participation 'heavily skewed in favour of some industrialized countries' (p. 134).

The consequences of this 'geography of IPCC expertise' are significant, affecting the construction of IPCC emissions scenarios (Parikh, 1992), the framing and shaping of climate change knowledge (Shackley, 1997; Lahsen, 2007; O'Neill et al., 2010) and the legitimacy of the knowledge assessments themselves (Elzinga, 1996; Weingart, 1999; Lahsen, 2004; Grundmann, 2007; Mayer and Arndt, 2009; Beck, 2009). As Bert Bolin, the then chairmen of the IPCC remarked back in 1991, 'Right now, many countries, especially developing countries, simply do not trust assessments in which their scientists and policymakers have not participated. Don't you think credibility demands global representation?' (cited in Schneider, 2001). Subsequent evidence for such suspicions has come from many quarters (eg, Karlsson et al., 2007) and Kandlikar and Sagar concluded their 1999 study of the North–South knowledge divide by arguing that 'it must be recognized that a fair and effective climate protection regime that requires cooperation with developing countries, will also require their participation in the underlying research, analysis and assessment' (Kandlikar and Sagar, 1999: 137). This critique is also voiced more recently by Myanna Lahsen (2004: 161) in her study of Brazil and the climate change regime: 'Brazilian climate scientists reflect some distrust of … the IPCC, which they describe as dominated by Northern framings of the problems and therefore biased against interpretations and interest of the South'.

IV Governance and learning

Since its foundation in 1988, the IPCC has evolved its own rules of governance and procedure in response to both internal and external events and criticisms. How well it has done so – how well it is an exemplary learning institution – has been the subject of a number of studies. We do not mean 'learning' in the sense of Doherty et al. (2009), in which a group of IPCC Working Group 1 lead authors reflected on what changes may be desirable to the specific content of future IPCC reports. We mean learning in the sense of 'organizational social learning' (Siebenhüner, 2008) and in the practices of knowledge assessment.

The formal work of the IPCC is governed by its rules of procedure. These have undergone two major revisions, in 1993 and again in 1999 (IPCC, 1999; Skodvin, 2000b). The 1999 changes introduced review editors, adopted formal rules for the adoption of the IPCC Synthesis Report and made clear the circumstances under which non-peer-reviewed literature would be acceptable. The changes adopted in 1999 were partly in response to controversies around Chapter 8 ('Detection of climate change and attribution of causes') in Working Group 1 of the IPCC Second Assessment (see Lahsen, 1999; Edwards and Schneider, 2001) and partly to accommodate more diverse regional sources of knowledge for the regionally focused chapters of Working Group 2.

It is these latter 'grey literature' sources which have come under close scrutiny in recent months (*Nature*, 2010) and which may now – in 2010 and under some duress – lead to further changes in procedure.[1] As Skodvin (2000b: 414) remarked presciently in 2000, 'using information from non-published sources may compromise the scientific authority the IPCC has gained over the years it has been in operation'. Maintaining

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scientific integrity and quality control, while retaining political credibility and salience – the classic twin goals of a science-policy boundary organization (Guston, 2001) – is not easy.

With regard to wider organizational learning, studies by Siebenhüner (2002, 2003) and Tonn (2007) offer a positive view of how the IPCC has been governed and how it has learned. Siebenhüner (2003) argues that the evolution of the IPCC has led to 'a decreasing influence of national governments on the climate negotiation process through the [knowledge] assessment process' (p. 121), claiming this to be a positive achievement. Yet this has perhaps only been achieved at the cost of greater procedural bureaucracy and complexity and hence loss of transparency and accountability (Grundmann, 2007; Beck, 2009). Like Siebenhüner, Tonn (2007) and Dahan-Delmedico (2008) also take a rosy view of the IPCC, Tonn (2007: 214) claiming it has been an 'amazingly successful transformative initiative' and that it should act as a design model for other forms of global knowledge assessment.

Others, however, have taken a more nuanced or critical position. Rothman et al. (2009) in their study of a number of different global knowledge assessment processes, including the IPCC, suggest that improvements need to be made: for example, improved communication of sources of uncertainty (see section V below) and the use and presentation of more qualitative data and knowledge. Demeritt (2001), Miller (2007), Grundmann (2007) and Yearley (2009) also offer more penetrating critiques. Miller's analysis, for example, argues for the need to be vigilant of the ways in which international knowledge institutions like the IPCC gain power and influence in international deliberations and yet are not always open, democratic or accountable in their own modes of operation.

Saloranta (2001) and Yamineva (2010) both approach the question of the governance and operation of the IPCC through the lens of post-normal science (Funtowicz and Ravetz, 1993), yet they reach almost diametrically opposite conclusions. Saloranta argues that the IPCC is an example of how the philosophy of post-normal science is reflected in practice, whereas Yamineva is critical of the Panel's reflexivity: 'the IPCC is clearly not a post-normal science institution in this regard' (Yamineva, 2010: 178). This lack of reflexivity is echoed by Beck (2009) in her study of the appropriateness of the IPCC model of knowledge production for the difficult questions surrounding adaptation policy and decision-making. She offers evidence suggesting that Miller's (2007) anxiety that the IPCC has not earned the political legitimacy it needs to exert constraints on the global exercise of power may be well founded.

And legitimacy is what has been tested in the recent controversies surrounding various 'errors' in the IPCC Fourth Assessment Report. This has been a test for the leadership and transparency of the IPCC and of its peer-review system. Shackley's perspective on the IPCC from 1997 is again prescient, warning of the 'danger(s) of the IPCC peer reviewing process becoming too self-contained and insulated from criticism at the paradigm level' (Shackley, 1997: 79). Yearley (2009) has also made similar observations with respect to peer-review and the IPCC, suggesting again that sociology, and the social sciences more generally, has much to offer those responsible for the leadership and management of the IPCC. As Whatmore (2009) has pointed out, knowledge controversies are moments for learning, 'when what we presumed we knew becomes fluid, molten or dislodged'. It remains to be seen how the IPCC will learn from this moment and seek to 're-solidify' its knowledge, status and credibility in the eyes of decision-makers and the public. Political credibility continues to trade on scientific credibility, which in turn is grounded as much in trust as in truth (Beck, 2009).

V Consensus and uncertainty

Since its origins, the IPCC has been open and explicit about seeking to generate a 'scientific

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consensus' around climate change and especially about the role of humans in climate change. Yet this has been a source of both strength and vulnerability for the IPCC. Understanding consensus as a process of 'truth creation' (or the more nuanced 'knowledge production') which marginalizes dissenting voices – as has frequently been portrayed by some of the IPCC's critics (see Edwards and Schneider, 2001; Petersen, 2010) – does not do justice to the process.

Consensus-building in fact serves several different goals. As Horst and Irwin (2010) have explained, seeking consensus can be as much about building a community identity – what Haas (1992) refers to as an epistemic community – as it is about seeking the 'truth'. Equally, as Yearley (2009) explains, IPCC consensus-making is an exercise in collective judgement about subjective (or Bayesian) likelihoods in areas of uncertain knowledge. Consensus-making in the IPCC has been largely driven by the desire to communicate climate science coherently to a wide spectrum of policy users – 'to construct knowledge' (Weingart, 1999) – but in so doing communicating uncertainties has been downplayed (Van der Sluijs et al., 1998). As Oppenheimer et al. (2007: 1506) remark, 'The establishment of consensus by the IPCC is no longer as critical to governments as [is] a full exploration of uncertainty'.

Without a careful explanation about what it means, this drive for consensus can leave the IPCC vulnerable to outside criticism. Claims such as '2,500 of the world's leading scientists have reached a consensus that human activities are having a significant influence on the climate' are disingenuous. That particular consensus judgement, as are many others in the IPCC reports, is reached by only a few dozen experts in the specific field of detection and attribution studies; other IPCC authors are experts in other fields. But consensus-making can also lead to criticism for being too conservative, as Hansen (2007) has most visibly argued. Was the IPCC AR4 too conservative in reaching its consensus about future sea-level rise? Many glaciologists and oceanographers think they were (Kerr, 2007; Rahmstorf, 2010), leading to what Hansen attacks as 'scientific reticence'. Solomon et al. (2008) offer a robust defence, arguing that, far from reaching a premature consensus, the AR4 report stated that in fact no consensus could be reached on the magnitude of the possible fast ice-sheet melt processes that some fear could lead to 1–2 m of sea-level rise this century. Hence these processes were not included in the quantitative estimates.

This leads on to the question of how uncertainty more generally has been treated across the various IPCC Working Groups. As Ha-Duong et al. (2007) and Swart et al. (2009) explain, despite efforts by the IPCC leadership to introduce a consistent methodology for uncertainty communication (Moss and Schneider, 2000; Manning, 2006), it has in fact been impossible to police. Different Working Groups, familiar and comfortable with different epistemic traditions, construct and communicate uncertainty in different ways. This opens up possibilities for confusion and misunderstanding not just for policy-makers and the public, but also among the experts within the IPCC itself (Risbey and Kandlikar, 2007).

For Ha-Duong et al. (2007) this diversity is an advantage: 'The diverse, multi-dimensional approach to uncertainty communication used by IPCC author teams is not only legitimate, but enhances the quality of the assessment by providing information about the nature of the uncertainties' (p. 10). This position reflects that of others who have thought hard about how best to construct uncertainty for policy-relevant assessments (Van der Sluijs, 2005; Van der Sluijs et al., 2005). For these authors 'taming the uncertainty monster' requires combining quantitative and qualitative measures of uncertainty in model-based environmental assessment: the so-called NUSAP (Numerical, Unit, Spread, Assessment, Pedigree) System (Funtowicz and

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Ravetz, 1990). Webster (2009) agrees with regard to the IPCC: 'Treatment of uncertainty will become more important than consensus if the IPCC is to stay relevant to the decisions that face us' (p. 39). Yet Webster also argues that such diverse forms of uncertainty assessment will require much more careful explanation about how different uncertainty metrics are reached; for example, the difference between frequentist and Bayesian probabilities and the necessity of expert, and therefore subjective, judgements in any assessment process (see also Hulme, 2009a; Guy and Estrada, 2010).

This suggests that more studies such as Petersen's detailed investigation of the claim about detection and attribution in the IPCC Third Assessment Report (Petersen, 2010; see also Petersen, 2000, 2006) are to be welcomed. He examines the crafting of this statement in both scientific and policy contexts, explores the way in which the IPCC mobilized Bayesian beliefs and how outside review comments were either resisted or embraced. While he concludes that the IPCC writing team did a reasonable job of reflecting the state of knowledge in this specific area, he is also critical of the inconsistencies and ambiguities in the ways in which the IPCC, more broadly, handled and presented uncertainty (cf. Swart et al., 2009). Betz (2009) offers a second example of a detailed case study of how the IPCC constructs its knowledge claims, this time a more theoretical and methodological example. Betz contrasts two methodological principles which may guide the construction of the IPCC climate scenario range: modal inductivism and modal falsificationism. He argues that modal inductivism, the methodology implicitly underlying the IPCC assessments, is severely flawed and advocates a radical overhaul of the IPCC practice to embrace modal falsificationism.

Equally important for the IPCC is how the uncertainties embedded in its knowledge claims are communicated and received more widely. This too is an area where scholars have been at work. Patt (2007) and Budescu et al. (2009) approach the question empirically and draw upon psychological theory to examine how different forms of uncertainty communication used by the IPCC – for example, uncertainties deriving from model differences versus disagreements between experts – alter the perceived reception of respective knowledge claims. Patt (2007) found that these two framings of uncertainty *did* influence lay perceptions and Budescu et al. found that respondents interpreted IPCC's quantitative uncertainties in ways rather different from that intended by the Assessments. They both call for the social features of uncertainty to be attended to more carefully in future IPCC assessments and suggest some alternative formulations.

Schenk and Lensink (2007) and Fogel (2005) examine more precise examples of uncertainty communication from IPCC assessments: uncertainty about future emissions of greenhouse gases and uncertainties in national inventories of greenhouse gas emissions. Schenk and Lensink (2007), for example, suggest improved communication of complex messages from the IPCC through clearer reasoning when communicating with non-scientists, by making emissions scenarios explicitly normative and through increasing stakeholder participation in scenario development.

VI Impact and influence

One thing that nearly all commentators and critics agree on about the IPCC is that it has had a significant influence on climate change knowledge, on public discourse about climate change and on climate policy development. They may disagree about the exact reasons for this influence and whether this influence has always been for the best. We will finish this review article by commenting briefly on research which has examined each of these three areas of IPCC's influence.

The IPCC has helped fashion and consolidate a global climate change epistemic community (Haas, 1992; Elzinga, 1996). Gough and Shackley (2001) remarked on the importance

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of this function with respect to the status of the IPCC within non-governmental organizations and their mobilization of science in support of campaigning agendas. The impact and status of this IPCC epistemic community has been examined from a number of different regional perspectives: for Brazil (Lahsen, 2004); for France (Dahan-Dalmedico and Guillemot, 2006); and for China (Mayer and Arndt, 2009). Dahan-Dalmedico and Guillemot (2006) conclude that IPCC knowledge 'travels well', but others have drawn out some of the problems with the circulation of IPCC knowledge (Grundmann, 2007; Hulme, 2008), problems which geographers of science have been pointing out in other spheres (eg, Powell, 2007; Carolan, 2008). Mayer and Arndt (2009) warn against the 'epistemological hegemony' of the IPCC and sociologist Bruno Latour goes so far as to describe the IPCC as an 'epistemological monster' (cited in Dahan-Dalmedico, 2008). Despite these examples, there remains considerable detailed empirical work to be done around the world on exactly where, how and why the practices of climate change knowledge production developed by the IPCC have altered scientific practice, not only in the biogeophysical sciences and social sciences, but also in the design of interdisciplinary work around climate change.

The IPCC has also gained visibility in public spaces as the authoritative voice of climate change knowledge – 'the privileged speaker and discursive leader' (Elzinga, 1996) – a visibility enhanced through being awarded the 2007 Nobel Peace Prize. Researchers have found various ways to study this influence. Hulme (2009b) dissected how UK print media reported and reframed key messages from Working Groups 1, 2 and 3 of the IPCC AR4, while Walsh (2009) examined how rhetorical devices used in the Summary for Policymakers of Working Group 1 of AR4 allowed the IPCC to work publicly and visibly across the boundaries between science and policy. The 'boundary work' (Gieryn, 1983) that the IPCC performs is also explored by Gough and Shackley (2001) with regard to legitimizing the scientific vocabulary NGOs have been able to deploy in public spaces. Hjerpe and Linnér (2009) examine how visions of future society have been employed in IPCC assessments, finding evidence of utopian thinking. Such visions of future society fall into three categories – projections, dystopian thought, and utopian thought – which shape public discourse around climate change.

With regard to the impact of the IPCC on policy development, opinions become more polarized. Early on in the IPCC history, Moss (1995) laid out claims for the IPCC being policy relevant (ie, neutral), but not policy driven (ie, partisan), but even in the 1990s such claims of policy neutrality were challenged (eg, Boehmer-Christiansen, 1994a). Miller (2001) examined whether the management of this science-policy boundary has been effectively secured by the body established by the UN Framework Convention on Climate Change to do just that: the Subsidiary Body for Science and Technology Assessment (SBSTA). Miller suggests that SBSTA constructs boundaries and confers legitimacy, enabling the 'maintenance of a productive tension between science and politics' (p. 495). This optimistic reading of SBSTA is echoed by Dahan-Delmedico (2008) who claims that the IPCC has thereby been able to deflect a certain category of criticism for being too close to policy advocacy.

This is not a conclusion shared by others. In his analysis of the knowledge politics of climate change, Grundmann (2007) concludes that using science to provide 'the basis for the legitimation of political decisions is a tried and tested instrument' (p. 428) and that the IPCC fits this pattern very well. Pielke (2007) and Sarewitz (2010) agree that the IPCC has failed in its role as an 'honest broker' and has moved towards being an 'issue advocate' in Pielke's terminology, or even on some occasions a 'stealth issue advocate'. Drawing upon insights from science and technology studies and citing wider examples of science controversies, Carolan (2008)

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explains some of the reasons why this may have been the case with the IPCC. None of this has stopped some researchers from holding up the IPCC as a role model for knowledge assessments that other areas of global environmental policy concern could emulate (eg, Dahan-Dalmedico and Guillemot, 2006; Tonn, 2007).

VII Conclusion

During its 20-year history, the IPCC has been examined critically from a number of different standpoints: dissecting its 1980s origins; revealing its norms, practices and modes of self-governance; debating the role of consensus in its assessments; policing characterizations of uncertainty; and tracing the relationship of its institutional function and knowledge claims to emerging ideas of global environmental governance. But other questions about the status of climate change knowledge synthesized by the IPCC remain less widely investigated, questions which emerge from the agendas raised by the new geographers of science (eg, Powell, 2007; Finnegan, 2008). As Sheila Jasanoff has shown in many of her writings (eg, Jasanoff, 2004, 2010; Jasanoff and Martello, 2004), knowledge that is claimed by its producers to have universal authority is received and interpreted very differently in different political and cultural settings. Revealing the local and situated characteristics of climate change knowledge thus becomes central for understanding both the acceptance and resistance that is shown towards the knowledge claims of the IPCC. It is a task for physical and human geographers to take seriously, and a task for them to do together.

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Note

1. In March 2010, the United Nations Secretary-General and the chair of the IPCC invited the Inter-Academy Council, a multinational organization of the world's science academies, to conduct an independent review of the IPCC processes and procedures. The review will guide the processes and procedures of the IPCC's fifth assessment report and future assessments of climate science.

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