Input of science to the international climate regime

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Abstract

Negotiations on a post-Kyoto international climate agreement to combat climate change are painfully slow and highly contentious. Given that an important aspect of a successful environmental regime is a constant flow of scientific and technical information, with its further processing into decision-making, this article examines input of science to international climate negotiations and the current state of climate science and policy interplay. It identifies issues, which hamper the effective scientific contribution into climate policymaking and suggests ways to integrate scientific input into the UNFCCC process more effectively. Suggestions relate to improvement in processes and procedures of the UNFCCC and the Intergovernmental Panel on Climate Change (IPCC), quality of scientific input, credibility of scientific message and public awareness of climate change.

Key words: climate science, Intergovernmental Panel on Climate Change, United Nations Framework Convention on Climate Change, climate negotiations.

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1. Introduction

Since the first successful decade of UN climate negotiations leading to the conclusion of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, the global community has desperately been looking for ways to intensify the negotiating process aimed at striking a succeeding deal, which could ensure a safe pace of change in the climate system for future life on the planet. Since mid-2000s, international climate negotiations have apparently been showing signs of ossification, a situation where policymakers stop learning from each other, thus hindering agreement (Depledge 2006). As an important aspect of learning in international negotiations is a constant flow of scientific and technical information, with its further processing into decision-making (Depledge 2006, p. 3), it is worthwhile to examine the current state of science–policy interaction and identify issues, which might hamper the effective scientific input in climate policymaking. The input of scientific information to climate policymaking is crucial. It was due to scientists and their research on climate change that the world community turned its attention to the problem of climate change caused by human activities (Epps and Green 2010). The efforts to fight climate change were eventually brought to the international level and culminated in the conclusion of the UNFCCC and its Kyoto Protocol. Today, scientific research continues to inform international climate negotiations, as well as national and regional climate policies. However, the message that climate scientists send to policymakers is not entirely reflected in the policy response. The current international climate regime established under the UNFCCC with its normative and policy framework falls far short of ensuring the tolerable level of global warming of 2 °C advocated by scientists (Bausch and Mehling 2011). While the discrepancy between the scientific message and the policy response is mainly explained by the complexity and high costs of solutions to climate change (Bausch and Mehling 2011), it also reflects the weaknesses of interplay between climate science and policy. In what follows, we take a critical look at institutional structures and procedures of the Intergovernmental Panel on Climate Change and the United Nations Framework Convention on Climate Change with a view to suggest improvements in the input of science to international climate politics.

2. Science-policy interaction in the international climate regime

2 With the current scale of global action, climate change is approaching an increase in temperature of 3.5–6 degrees Celsius by 2035. See IEA (2011).
2.1. The role of science in the UNFCCC process

Scientific research in climate change long preceded the reaction of the international community of policymakers to global warming. Scientific findings were essentially the first response to the global challenge. First conducted by individual scientists, climate change research was eventually taken up by the Intergovernmental Panel on Climate Change (IPCC) established under the umbrella of the United Nations (UN). The UN mandated the IPCC to provide internationally co-ordinated scientific assessments of the magnitude, timing and potential environmental and socio-economic impact of climate change and realistic response strategies.

The main outcome of the IPCC's work is assessment reports issued with an interval of five to seven years. Importantly, the IPCC does not conduct research itself but collects and assesses scientific work on different disciplines, which relates to climate change. It also provides scientific support to the work of the UNFCCC by making available methodological information on emissions inventories and other technical issues, which is used by governments. Parties to the Kyoto Protocol emphasize the role of the IPCC as a source of methodological information.

The IPCC is a unique organization to the extent that it has a scientific as well as a political character. While scientists collect and assess scientific information on climate change in assessment reports, politicians adopt the reports. The main decision-making body of the

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4 UN General Assembly Resolution A/RES/43/53 of 6 December 1988, para. 5.

5 The IPCC is expected to issue its fifth assessment report (AR5) in 2014.

6 There are three Working Groups working on assessment reports in their respective fields of climate change-related science. Their reports constitute part of the consolidated assessment report. There are also the Task Force on National Greenhouse Inventories, which works on developing internationally-accepted methodologies and software for calculating and reporting countries’ emissions, and the IPCC Task Group on Data and Scenario Support for Impacts and Climate Analysis, which manages the IPCC data supporting the work of international scientists.

7 The Kyoto Protocol endorses use of methodologies “accepted by the IPCC” in Art. 3.4 as regards the development of modalities, rules and guidelines for calculating emissions in the land-use change sector and forestry, in Art. 5.2 in relation to the establishment of national systems of estimation of emissions, and in Art. 5.3 in relation to the calculation of global warming potential and the carbon dioxide equivalence of GHG emissions.

8 Assessment work is done by thousands of scientists from different regions, who work on chapters of assessment reports from their country-based offices on a voluntary basis.
IPCC is the panel composed of government delegates, who decide on the content of assessment reports, and approve, adopt and accept them.

Despite the participation of government representatives in its work, the IPCC positions itself as a policy neutral organization. For instance, it does not give direct recommendations for the UNFCCC negotiators. Synthesis reports “address a broad range of policy-relevant but policy-neutral questions”, while a summary for policymakers (SPM), which is usually part of any IPCC report (assessment, special or synthesis) “provides a policy-relevant but policy-neutral summary of that Report”. Such a neutral position of IPCC fits the conventional expectation that scientific results are impartial with respect to politics and policy (Nelson and Vucetich 2009).

Nevertheless, IPCC reports have a considerable impact on the climate policymaking process (Kohler, et al. 2012). The drafting of the UNFCCC was largely guided by the information contained in the First Assessment Report released in 1990 (Miller 2004). Since the conclusion of the UNFCCC, IPCC reports have been an important source of information for guiding decisions taken at the UNFCCC. A post-Kyoto climate agreement will also be informed by the updated IPCC assessment. The Durban Platform, which launched a process for moving towards an international climate agreement in 2015, particularly states that

an agreed outcome with legal force … shall raise the level of ambition and shall be informed, inter alia, by the Fifth Assessment Report of the Intergovernmental Panel on Climate Change…”

It should be noted, however, that the IPCC is a major but not the only source of scientific information for the UNFCCC. Scientific input is also provided by other stakeholders,

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9 The IPCC is represented by governments of more than 120 countries, which are members of the UN and WMO.
10 Paras. 4.4–4.6 of Appendix A to the Principles Governing IPCC Work: Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports.
11 Para. 4 of the Principles Governing IPCC Work states: “IPCC reports should be neutral with respect to policy, although they may need to deal objectively with scientific, technical and socio-economic factors relevant to the application of particular policies”.
12 Paras. 2 and 4.6.1 of the Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports.
13 For instance, the Bali Road Map for a post-Kyoto agreement was driven by the urgency of climate action indicated in the Fourth Assessment Report. See Preamble to the Decision 1/CP.13.
14 It should be noted that given that the agreed deadline for a post-Kyoto climate deal is 2015, IPCC Fifth Assessment Report, the synthesis of which is expected for 2014, will provide a timely update of scientific knowledge, which can be taken into consideration at the final stage of drafting an agreement.
including individual scientists, and business and environmental non-governmental organizations (Lohan 2006). For instance, scientists are often included as advisors in official delegations to UNFCCC Conferences of the Parties (COPs), and science is increasingly used as a basis for forming positions of individual countries in climate negotiations (Andonova and Alexieva 2012). Business stakeholders actively participate in various COP side events where they communicate their positions, and their role in informing the UNFCCC negotiating process is increasing (De Sepibus and Holzer 2014). Different international organizations (IOs) provide technical information and expertise to the UNFCCC. The UNFCCC, for instance, uses UNEP guidelines for reporting on vulnerability and adaptation, and the expertise of the UN Food and Agriculture Organization (FAO) on land-use, land-use change and forestry (Yamin and Depledge 2004). Finally, scientific support is also provided by the UNFCCC Subsidiary Body for Scientific and Technological Advice, whose role is discussed below.

### 2.2. The process of IPCC–UNFCCC interaction

Scientific input to an environmental regime is generally supplied through two mechanisms: scientific assessments and scientific advice (Glaser and Bates 2011). Scientific assessments involve the collection, evaluation and synthesis of scientific information and evidence; this is usually done by external organizations. Scientific advice consists of science-based recommendations on various policy issues commonly provided by an internal scientific advisory body of a multilateral environmental agreement (MEA). In the climate regime, scientific assessments are mainly contributed by IPCC, while scientific and technical advice on the implementation of the Convention is provided by the UNFCCC Subsidiary Body on Scientific and Technological Advice (SBSTA), which also serves as the main channel for processing IPCC assessments and their incorporation into UNFCCC decisions. The SBSTA is a permanent subsidiary body of the UNFCCC. It is a political body composed of UNFCCC national delegates, who are mandated to “provide the COP with timely information and advice on scientific and technological matters relating to the Convention” 16. The SBSTA obtains scientific information from outside (including from IPCC reports) and makes it available for the COP decision-making process through its session reports, thus serving as a bridge between climate science and climate policy (Yamin and Depledge 2004).

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16 UNFCCC Art. 9.1.
The main interaction between the IPCC and the SBSTA occurs at the stage of defining the scope of IPCC reports, when the SBSTA gives its input in defining a set of policy-relevant questions to be addressed in research assessment.\textsuperscript{17} The SBSTA is particularly involved in defining the content of synthesis reports, which combine the main findings of the three Working Groups reports with an emphasis on further application of the information to the policy.\textsuperscript{18} It also commissions the IPCC to prepare small reports on particular issues of climate change, either already covered by assessment reports (technical papers) or totally new ones (special reports). Furthermore, representatives of the UNFCCC Secretariat attend IPCC meetings at the invitation of IPCC chairs, while IPCC staff attends SBSTA sessions (Yamin and Depledge 2004). IPCC representatives are regularly invited by the Chair of the SBSTA to speak at its sessions on various technical issues, and the IPCC chair occasionally speaks at UNFCCC COP sessions presenting the latest IPCC reports and participating in question and answer sessions (Lohan 2006). Moreover, the UNFCCC as a whole contributes to the IPCC budget (Yamin and Depledge 2004).

\section*{2.3. Criticism of IPCC work and the IPCC response}

Notwithstanding the long established interaction between climate science and climate policy, its effectiveness faces barriers of climate change scepticism, mistrust and criticism. Criticism of IPCC work has long been accompanied by heavy anti-climate policy propaganda. While a majority of natural scientists are convinced by the evidence that climate change is mainly caused by human activities, there are some scientists, primarily from other fields, who deny human impact on the climate system or diminish negative consequences of climate change. Despite the fact that dissenting scientists constitute a very small minority, their voice is well heard and propagated by media. A prominent example of a climate change denial campaign is \textit{The Great Global Warming Swindle}, a documentary issued by the UK TV Channel 4 in early 2007 featuring interviews with scientists questioning the fact of global warming. The film has become a powerful tool used by climate sceptics to increase public mistrust in climate science and policy.\textsuperscript{19}

Furthermore, a strong wave of criticism of IPCC work was provoked by a number of mistakes uncovered in the Fourth Assessment Report (AR4). One mistake relates to the rate of melting

\textsuperscript{17} The IPCC Third Assessment Report was the first one to consider input or requests on structure and content from the SBSTA.

\textsuperscript{18} Government delegates attending IPCC plenaries are usually the same people, who work in the SBSTA.

\textsuperscript{19} \url{http://web.archive.org/web/20070308093308/http://www.washtimes.com/world/20070306-122226-6282r.htm}
of glaciers in the Himalayan mountains. With a reference to the World Wide Fund for Nature, which used an unpublished source, the Working Group II report states that glaciers in the Himalaya are receding faster than in any other part of the world and are likely to disappear by the year 2035 or even sooner.\textsuperscript{20} The IPCC admitted that the statement was false. It attributed the mistake to “poorly substantiated estimates of rate of recession and date for the disappearance of Himalayan glaciers” and stated that it happened because “the clear and well-established standards of evidence, required by the IPCC procedures, were not applied properly”.\textsuperscript{21}

Another mistake concerns the estimation of the territory of the Netherlands that lies under sea level. Based on the data of the Dutch Environmental Assessment Agency, the Working Group II report contains a statement that 55% of the territory of the Netherlands lies below sea level,\textsuperscript{22} whereas the correct statement would be that 55% of the territory is susceptible to floods, as 26% of the territory is below sea level and another 29% is susceptible to river flooding.\textsuperscript{23} This mistake was blamed on the Dutch Ministry of Transport, which confused the figures in the publications used by the Dutch Environmental Assessment Agency and eventually by the IPCC Working Group II.\textsuperscript{24}

These few errors in AR4 were used to spur a new wave of climate science scepticism, which was further fuelled by the leakage of emails from the Climatic Research Unit of the University of East Anglia in the run-up to the Copenhagen COP in November 2009.\textsuperscript{25} The private correspondence was taken out of context to accuse scientists of conspiracy. Scientists responded to the accusations by giving assurance that

\textsuperscript{20} See para. 2, section 10.6.2 of the Working Group II report, which states: “Glaciers in the Himalaya are receding faster than in any other part of the world (see Table 10.9) and, if the present rate continues, the likelihood of them disappearing by the year 2035 and perhaps sooner is very high if the Earth keeps warming at the current rate. Its total area will likely shrink from the present 500,000 to 100,000 km\textsuperscript{2} by the year 2035 (WWF, 2005)”.


\textsuperscript{22} See para. 3, section 12.2.3 on current adaptation and adaptive capacity in Europe of the Working Group II report.

\textsuperscript{23} http://www.volkskrant.nl/vk/nl/2672/Wetenschap-Gezondheid/article/detail/979214/2010/02/20/Onder-waterniveau-maar-de-vraag-is-nog-even-welk-water.dhtml.

\textsuperscript{24} Ibid.

\textsuperscript{25} http://www.theguardian.com/environment/2009/nov/20/climate-sceptics-hackers-leaked-emails
no individual scientist in the IPCC assessment process is in a position to change the conclusions, or to exclude relevant peer reviewed papers and scientific work from an IPCC Assessment Report.26

Faced with criticism, the IPCC had to react and learn how to deal with possible mistakes and better withstand powerful anti-climate policy propaganda of its opponents. To this end, in 2010, the IPCC and the UN Secretary General commissioned the InterAcademy Council (IAC)27 to conduct a study on IPCC procedures. The IAC produced a report containing important recommendations related *inter alia* to the structures, review process, scientific uncertainty, communication, transparency and the use of unpublished and non-peer-reviewed sources (IAC 2010, pp. 57-65). To modernize management structures, the IAC recommended to establish an Executive Committee, which would act on behalf of the IPCC between plenary sessions, elect and not appoint the Head of Secretariat, adopt a rigorous conflict-of-interest policy with respect to all staff involved in the assessment, including IPCC leadership, authors, reviewers and technical units staff. The term of IPCC leading staff should be limited to the time frame of one assessment. To strengthen the review process, the IAC recommended introducing into practice written summaries of the most important comments of reviewers, which could be sent to the authors, and written responses to the comments of reviewers by authors. The IAC also stressed the importance of careful assigning of probabilities to scientific statements. Quantitative probabilities should be used to describe the probability of well-defined outcomes only when there is sufficient evidence. The IAC also recommended the IPCC developing a communication strategy, procedures for the use of unpublished and non-peer-reviewed literature, transparent process of selecting authors and considering alternative views in the assessment.

Furthermore, the IAC came up with a number of suggestions that were not directly related to procedures but that affect the quality of the assessment reports. The IAC stressed the importance of full participation of experts from developing countries, use of commercial databases and other modern technologies for improving access to information, re-evaluation of the scope of the Working Groups taking into account the multidisciplinary nature of the science and coordination across Working Groups. Moreover, it suggested issuing the reports

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27 The InterAcademy Council is an international organization formed by national science academies to produce reports on the areas of the global challenges, with recommendations for national governments and international organisations.
of three Working Groups within certain time intervals, with the report of Working Group I to be issued first. Issuing reports with time intervals can enable other Working Groups to take advantage of the results of Working Group I and give Working Group II, which largely relies on experts from developing countries with limited resources, more time for its regional assessments.

The IPCC considered the IAC recommendations and implemented most of them at its 32nd, 33rd, 34th and 35th sessions during 2010-2012. The measures taken in response to the IAC review include the revision of the procedures for preparation, review, acceptance, adoption, approval and publication of IPCC reports. The IPCC also adopted the protocol for addressing possible errors in the reports and the guidance for lead authors of AR5 on the consistent treatment of uncertainties. As recommended by IAC, the IPCC decided to issue Working Group reports at different points of time, with the WGI AR5 report already issued in October 2013 and WGII and WGIII reports to be issued in March and April 2014 respectively. The IPCC also established the Executive Committee, set limits to the term of office of the management staff and adopted the communication strategy, the conflict of interest policy and established the Conflict of Interest Committee. The idea of electing the head of Secretariat was however rejected. The IPCC continues to appoint the head of its Secretariat, keeping with general UN practice.

Building on the recommendations of the IAC and the steps already taken by the IPCC on their implementation, we further explore ways to improve the science–policy interface in the international climate regime.

3. Making science-policy interaction work: Insights from theory and practice

3.1. Theories of science-policy interaction

One of the most influential theories on the relationship between science and policy-making is the theory of co-production, which is “the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it” (Jasanoff 2004, p. 2). Building on the constructivist paradigm, which states that scientific knowledge is socially constructed, the theory of co-production goes further and stresses the mutual influence of science and policy (or, more precisely, social order), which have an equal power to induce transformation in each other. The idiom of co-

http://www.ipcc.ch/organization/organization_review.shtml
production is well tested in the realm of climate change. The interaction of climate science and climate policy is characterized by a long evolutionary transformation of the understanding of climate change as a local concern to its perception as a global challenge. The role of climate science in shaping the perception of climate as a global phenomenon and in globalizing climate policy was crucial. Only when scientific understanding of climate as long trends in local weather changed in the late 1980s into the perception of climate as a global climate system influenced by world oceans, winds and other global factors, did changes in climate begin to be presented as a global challenge requiring a global policy response (Miller 2004). As long as climate change and its consequences had only a local dimension, there was no justification for the creation of an international institution for dealing with the challenge.  

However, when the IPCC began to base its assessments of climate on global climate models and revealed the global character of climate change, it showed the need for the formulation of global climate policy and the creation of an international institution for global action on climate change.

While co-production of climate science and politics continues, transformation of the perception of climate change is not yet finished. The process of co-production faces the barriers of the traditional understanding of state sovereignty and international governance represented by nation states (Miller 2004). A truly global response to climate change requires a reconsideration of the concept of sovereignty on the basis of the emerging principle of common concern of mankind (Cottier 2012b). In accordance with the principle, if poor national management of the environment begins to threaten all life on the planet, there must be limits to the full jurisdiction of states over exploitation of natural resources and all states must contribute to global action against a global challenge.

Without changing the traditional sovereignty paradigm, it is still possible to accommodate common concerns of mankind within the traditional understanding of sovereignty comprising the components of autonomy, control and authority. Climate change as a global concern reduces the component of autonomy, i.e. independence of the state in policy-making. Yet, in certain cases, it reinforces the ability of the state to control the negative impacts of climate change and adds to the state’s authority, especially when authority is based not only on public

29 Earlier US National Academy of Sciences reports on climate change concluded that climate change poses a risk only for local communities and not for the planet as a whole. See Miller (2004).
30 Some argue that globalization of climate policy has a negative side too. Global response to climate change is less concrete than it could have been at the level of local policies. It is also more difficult to mobilize resources for addressing a global risk than allocate resources for local needs. See Miller (2004).
awareness and support of climate change action – the ‘consent’ of the contemporary
governed, but also on intergenerational responsibility (Litfin 2000). Thus, the emerging
common concerns of mankind do not lead to ‘the erosion of sovereignty’ but simply require
trade-offs and put different weights on the three components of sovereignty.

To overcome barriers of effective interaction between science and policy for sustainable
development, it is also important to enhance communication, translation (comprehension) and
mediation between scientists and policymakers (Cash et al. 2003). Research has also been
made to examine the circumstances under which “power listens to truth”, or, in other words,
when science really influences policymaking (Haas 2004). It reveals that an important
condition of the effective interplay between science and policy is the production of scientific
knowledge behind a politically insulated wall and its further transmission by epistemic
communities to policy-makers. Policy-makers cannot make use of all the knowledge
produced by science. They can only use knowledge with a practical value. The content of
‘usable knowledge’ is of great interest and value for policymakers because it is characterised
by credibility, legitimacy, salience and the availability of a mechanism of transmission from
the epistemic community to policymakers (Haas 2004).

3.2. Science-policy interaction practices at international level

The input of science into policy is best felt in international environmental regimes established
under multilateral environmental agreements (MEAs). The international regime of ozone
layer protection under the Montreal Protocol on substances that deplete the ozone layer offers
a best practice example in this respect. Scientific assessments and scientific advice, along
with the availability of technological solutions, were crucial for the conclusion of the
international agreement (Morrisette 1989). The effectiveness of science–policy interaction
under the Montreal Protocol is to a large extent attributed to the direct participation of
scientists in policymaking through scientific and technical assessment bodies, which are all
part of the structure of the treaty body (WBCSD, et al. 2010). In the Montreal Protocol
negotiating process, an internationally recognized group of scientists directly participated in
negotiations along with government delegates. Scientific support is in fact incorporated into
the decision-making structure of the treaty. Technical and scientific advice is provided by
three technical bodies: the Technical and Economic Assessment Panel (TEAP), the Scientific
Assessment Panel, and the Environmental Effects Assessment Panel.31 The TEAP, for

instance, directly advises the Meeting of the Parties (MOP) when it takes decisions on the measures under the Protocol, and makes suggestions for the future by issuing follow-up reports (WBCSD, et al. 2010). It makes direct recommendations for the parties. Members of the TEAP (22 people representing different geographical regions) are representatives of business and academia nominated by state parties but acting in their own capacity independent from their governments. While the ozone layer protection regime was at the beginning characterized by scientific uncertainty, scientific knowledge about the stratospheric ozone layer has improved over time, and based on the updated knowledge, the Montreal Protocol has been amended four times since its conclusion (Glaser and Bates 2011). Importantly, scientific findings on the links between ozone layer depletion and the incidence of skin cancer were particularly crucial for the conclusion of the agreement on phasing-out the use of ozone depleting substances. The threat of cancer raised public awareness and generated public support for the ozone layer protection regime (Morrisette 1989).

The Convention on Biological Diversity (CBD) and its Cartagena Protocol on Biosafety is another example of a strongly science-driven international framework. The science–policy interaction in the biodiversity regime is akin to the climate change model. However, while the Subsidiary Body on Scientific, Technical and Technological Advice has been part of the CBD body since the conclusion of the convention, the external source of scientific information for the biodiversity regime has been established only recently. In 2010, the task of conducting scientific assessments of global ecosystems was assigned to the Intergovernmental Platform on Biodiversity and Ecosystem Services, which structures similar to the IPCC.32

In international economic regimes, the role of science is less prominent than in MEAs. Unlike in MEAs, where science determines the whole strategy of environmental regimes, in international economic regimes, science represents the interests of sustainable development, which compete with the purely economic interests lying at the core of these regimes. The WTO Agreement, for example, recognizes sustainable development as an accompanying objective to the overarching goal of promotion of trade and economic development.33 Scientific evidence and scientific advice are mainly used in WTO dispute settlement, particularly in judgments about the legitimacy of trade-restrictive measures taken for public health and environmental policy reasons under the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) and the Agreement on Technical Barriers to

32 http://www.ipbes.net/about-ipbes.html
33 Preamble to the Marrakesh Agreement Establishing the World Trade Organization.
Trade (TBT Agreement). Science is particularly used to separate legitimate policy objectives from measures taken with protectionist intentions (Green and Epps 2007). Science also guides trade policy related to SPS and TBT regulations at a national and regional level, and informs legislative process in the WTO when it comes to adoption of decisions related to public health and the environment. The WTO does not have an internal body charged with assessing scientific information or providing scientific advice to the WTO adjudicative and legislative bodies. However, a WTO panel adjudicating on SPS measures usually needs to use the results of risk assessment to be able to judge whether existing scientific evidence on the matter at issue is sufficient to serve as grounds for application of trade-restrictive measures. In judging such an issue, a panel may seek expertise from scientists, including experts from other international organizations and research institutions. In other words, panels themselves engage in scientific assessment.

Thus, the review of science-policy interaction in different international regimes shows that science is an important driver of international policymaking in the field of management of risks for human beings and the environment. However, there is no uniformed approach. The modes of interaction vary from case to case, and depend largely on the regulatory object.

4. Addressing deficiencies of climate science and policy interface

4.1. Structure and procedures

A fundamental question that needs to be answered is whether the “external scientific assessment-internal scientific advice” model is sufficiently effective in advancing the UNFCCC objectives. With respect to the reception of scientific input, it might be argued that science input to the UNFCCC would be greater if the SBSTA could assess scientific information itself and not just collect it from external sources. By only gathering information...
and not assessing it the SBSTA turns into a buffer between science and policymaking, hampering and slowing down the effective processing of scientific input to decision-making (Lohan 2006). Yet, if assessments are made by the SBSTA, there is a risk that they will be biased. The SBSTA comprises different government delegates, who defend their national interests, whereas a merit of the IPCC assessments is that they are made by scientists acting in their own capacity and only approved by government delegates at the final stage (Glaser and Bates 2011).

It might also be argued that the impact of climate science on international climate policymaking could have been much bigger, if countries had agreed at the beginning on the IPCC being a forum for negotiating the UNFCCC (Miller 2004). At the start of international climate negotiations, the UNEP, inspired by the success of the ozone layer protection regime, intended to copy the Montreal Protocol’s model of direct participation of scientists in negotiations for the UNFCCC system. The Montreal Protocol model, however, was opposed by some countries in climate negotiations, including the US, which were afraid of the far-reaching liberties of scientists in political decision-making (Miller 2004).

While the idea of the IPCC becoming a forum for climate policy negotiations is unrealistic at this stage and certainly conflicts with the ideal of political neutrality of science or ‘disinterested knowledge’, one question that arises is whether the IPCC can still be incorporated in the structure of the UNFCCC. In this respect it can be argued that the IPCC is a political body in any case and that IPCC assessments are reviewed, approved and adopted by national delegates, most of whom are also engaged in climate negotiations at the UNFCCC. As already mentioned, there is an example of an effective “internal” scientific assessment process under the Montreal Protocol. However, the incorporation of a scientific assessment body into the UNFCCC structure might not work for the climate change regime. Climate science differs from the research on the ozone layer to the extent that climate science is much more complex, interdisciplinary and complicated. To ensure completeness, impartiality and effectiveness, climate change assessments need to be outsourced to an independent external body with its own rules and procedures and an established broad network of scientific experts. The political approval of such assessments seems also to be more feasible if they are made outside the UNFCCC political process. The latter holds
particularly true given the extension of the scope of socioeconomic assessments in the work of IPCC. 39

Another important issue that relates to the processing of science input is the timing of SBSTA sessions. 40 It might be more effective to hold SBSTA sessions before rather than simultaneously with COPs. 41 This could give COP delegates enough time to process scientific information provided by SBSTA and then use it at COP negotiations. It is particularly important in light of the 2013-2015 review of the adequacy of 2°C global temperature goal, to which SBSTA provides technical and scientific input. 42 The review can influence the UNFCCC long-term goal and post-Kyoto mitigation targets (Freier et al., 2012).

4.2. Scientific message

The experience of climate science-policy interaction over two decades shows a need for reinforcing and improving the quality of the scientific message. Climate science is characterized by considerable uncertainty, which negatively influences the reception of scientific messages by policymakers and the public. There is uncertainty with respect to the pace of climate change and its effects, and hence there is also uncertainty as to the timing and scale of action required to fight climate change (Tol 2008; Houghton 2009). It should be noted, however, that uncertainty related to climate change research has not always to be blamed on scientists. In fact, there are two types of uncertainty pertinent to climate change research. The first concerns climate system uncertainty, which is caused by incomplete understanding of the physical and biogeochemical processes in the climate system, insufficient and inaccurate observations, incomplete coverage both in space and time of observations, limited modelling capability, shortcomings in model parameterisations etc. This type of uncertainty can further be reduced by science as it develops, even though there is a growing recognition that some amount of uncertainty is irreducible due to the non-linear and sometimes chaotic nature of ocean and atmosphere circulations and other processes. The second type of uncertainty concerns ‘scenario uncertainty’, that is, emissions pathways that can be chosen. It is obvious that natural science cannot reduce that uncertainty and that there is no scientific method to anticipate social decisions far in the future.

39 While the contribution of the Working Group III to AR4 consisted of 13 chapters, the one in AR5 is planned to have 16 chapters, including equity issues, national and regional policies and international cooperation.
40 On the importance of timing for the uptake of scientific advice by policymakers, see Kohler, et al. (2012).
41 The simultaneous holding of SBSTA and COP sessions can however be justified by costs saving considerations. See Lohan (2006).
42 Decision 1/ CP.17 at the Cancun conference.
(sometimes not even over a few days, as estimates of outcomes of votes and referenda regularly demonstrate).\textsuperscript{43}

Even though for these reasons uncertainty is unavoidable, climate change-related uncertainty is politically salient and used to call into question the credibility of climate research results and as an excuse for not moving on a global climate deal. To minimize the negative impact of uncertainty of climate science on the credibility of its results, IPCC assessments should be accurate in giving statements and assigning probabilities to them. Since the preparation of AR4, all three IPCC Working Groups have been following common guidelines on the treatment of uncertainty in assessments. Scientists working on assessments usually deal with two types of uncertainty – “value uncertainty”, when inaccurate data do not allow values to be assigned to certain phenomena, and “structural uncertainty”, when, for instance, there is a lack of understanding of processes behind climate change or there are shortcomings in models.\textsuperscript{44} “Value uncertainty” is communicated by assigning probabilities (likelihoods) based on statistical methods (e.g. “very likely”, which corresponds to >90% probability, or “likely”, which corresponds to >66% probability).\textsuperscript{45} “Structural uncertainty” is defined qualitatively by assigning different levels of confidence to statements based on the level of evidence and the degree of agreement in expert judgements (e.g. “high confidence”, “medium confidence” etc.).\textsuperscript{46} Formulating key findings of assessments when evidence is not sufficient or data are missing presents a serious challenge for climate researchers.

Inaccurate statements were a subject of criticism with respect to AR4, particularly the Summary for Policymakers written by Working Group II. On one hand, there are statements in the SPM that are formulated with high confidence despite being based on little evidence (IAC 2010, p. 61). On the other hand, there are statements that have little practical value as they had to be formulated in very vague terms to be assigned high confidence (IAC 2010, p. 62). The new guidelines on uncertainty treatment for lead authors of AR5, which have been revised to take into account the uncertainty-related inaccuracies of AR4 and the recommendations of the IAC report, are expected to increase accuracy and credibility of the forthcoming assessments.

\textsuperscript{43} We thank Prof. Thomas Stocker, a Co-Chair of IPCC Working Group I, for this remark.
\textsuperscript{44} The IPCC Assessments of Climate Change and Uncertainties, available at http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch1s1-6.html#footnote1
\textsuperscript{45} For the full range of degrees of likelihood, see Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties, available at http://www.ipcc.ch/pdf/supporting-material/uncertainty-guidance-note.pdf
\textsuperscript{46} Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties, pp. 2-3.
Taking into account the criticism of scientific statements in previous IPCC reports, it is necessary to handle properly any possible mistakes made in future assessment reports in terms of public communication. An important step in this direction has been the recent adoption of the protocol for addressing possible errors in IPCC reports. The IPCC Secretariat, which is designated to be the entry point for all claims of errors, maintains the internal error tracking system and works directly with the working group co-chairs to correct mistakes and inform claimants about the conclusion of the error handling process.

An important question is also whether IPCC reports should contain recommendations on the implementation of the Convention. While policy recommendations may add practical value and increase the applicability of scientific assessments, they may also call into question the impartiality of scientific research and thus undermine its credibility among the UNFCCC parties (Glaser and Bates 2011). It should be noted that the two latest assessment reports - AR4 and AR5 - provide policymakers with the comparison between climate change action and inaction in terms of environmental, economic and social implications. The choice between action and inaction is still left to the policymakers, but their choice can now be based on scientific information. Such an approach, in our view, cannot compromise credibility of IPCC assessments.

With a view to increasing policy relevance, and given the complex nature of climate change, more weight should be given to conducting interdisciplinary research, which would combine research in natural sciences and socioeconomic disciplines. Research in socioeconomic disciplines, while being less quantitative, can offer ideas for sound policy responses. It is questionable, however, whether the effective combination of research in natural sciences with social, political and legal studies is possible. It is already difficult to produce interdisciplinary research within the socioeconomic field itself, when one attempts, for instance, to supplement economic models with legal analysis, to say nothing of adding a natural science dimension. Nevertheless, scientists representing different scientific areas pertinent to climate change need to learn how to cooperate and to overcome barriers posed by different terminology and research methods.

47 IPCC Protocol for Addressing Possible Errors in IPCC Assessment Reports, Synthesis Reports, Special Reports or Methodology Reports, adopted by the Panel at its 33rd Session in Abu Dhabi, 10–13 May 2011.
48 In AR5, a direct comparison is made between massive mitigation scenario (RCP2.6) and business as usual scenario (RCP8.5). See e.g. the WGI SPM, in which RCP2.6 is compared with RCP8.5 in the projection figures (Fig. SPM.7, SPM.8, SPM.9).
More attention should also be given to the language in which the scientific message is formulated and communicated. In order to be understood and then used in policymaking, the language of the scientific message has to be adjusted to be understandable by laypeople, as policymakers do not usually have a scientific background. It should be noted, however, that considerable progress has already been made in this respect, especially as regards the language used in Summaries for Policymakers of the IPCC reports. Nevertheless, the language can be further simplified thus increasing the comprehensibility of the message (Glaser and Bates 2011).

Finally, while not being able to completely solve the problem of climate research-related uncertainty, the next generation of IPCC assessments is likely to contribute to its diminishing. It is therefore essential for the effectiveness of scientific input that updated knowledge will duly be taken into consideration by policymakers and used as a basis for amendment of the UNFCCC or future climate agreements, as has been the case with the Montreal Protocol.

### 4.3. Credibility issues of climate science

Credibility of climate research is another problematic issue of climate science–policy interaction. After more than two decades of IPCC activity, climate research is still characterized by considerable mistrust among policymakers and the public. This mistrust is particularly strong in developing countries and countries in transition (CIT). One possible explanation for the existing mistrust of climate science is that “scientific judgments … inevitably involve tacit value assumptions and choices that can have important social and political consequences” (Miller 2004, p. 59). Science implicitly advocates certain policy choices (Nelson and Vucetich 2009). Moreover, science is inevitably political in its implications so long as the application of certain knowledge or scientific understanding through political decisions tends to benefit some and harm others (Haas 2004, p. 571). For instance, developing countries tend to believe that climate change science produced by developed countries promotes the interests of the developed world (Rowe 2009). In reality, however, scientific assessments of climate change come into conflict with the economic interests of developing countries, most of which rely on fossil fuels in their economic growth. Climate science calls for a decrease in the use of fossil fuels and for sharing emissions reduction efforts among all countries. The latter is justified by the fact that some countries

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49 An exception is small-island developing states, which take seriously the warnings of scientists about the risk of inundation of their lands as a consequence of climate change. See Ashe, et al. (1999).
traditionally considered to be developing are not poor any longer. Thus, it seems that the credibility problem is caused to a large extent by the conflict of scientific authority with political authority, which is grounded on the fossil-fuel-driven wealth production (Litfin 2000). In the end, the credibility problem is created artificially so that countries can retain the possibility for unrestrained economic development.  

While credibility of climate science is closely linked to legitimacy of IPCC assessments, legitimacy does not seem to be an issue. Legitimacy of IPCC assessments can be drawn from different aspects of the IPCC assessment process. First, the IPCC is a daughter organization of two UN agencies (the WMO and the UNEP) whose governing councils exercise supervision over its work, and the establishment of the IPCC was approved by the UN General Assembly. Second, governments are extensively involved in the preparation and approval of assessment reports. The panel, which adopts (section by section) overview chapters of methodology reports and longer report parts of synthesis reports and approves (line by line) summaries for policymakers in the synthesis reports, consists of governmental representatives of practically all UN countries (Kohler, et al. 2012). This implies a sort of international political acknowledgement of summarized scientific evidence of climate change and acceptance of the IPCC's work. Governments also participate in the process of reviewing Working Group assessment reports, sending their comments on each report to Working Group/Task Force Bureaus. Third, the content of assessment reports is defined with inputs from the delegates to the SBSTA, membership of which overlaps with that of the UNFCCC. Finally, IPCC assessments of climate change are mainly based on peer-reviewed literature, which attests to their scientific quality and creates trust in scientific inferences.

The lack of credibility, however, is partly caused by an unequal contribution of developing country scientists to the IPCC's work. The problem of limited participation of developing countries in IPCC assessments was especially acute in the first years of the IPCC. To increase the involvement of developing countries, in the early 1990s the IPCC introduced some

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50 Rowe, for instance, argues that mistrust of climate science is just used as grounds for not participating in the international efforts to fight climate change and for not sharing the costs of such efforts. See Rowe (2009), p. 597.  
51 See A/RES/43/53. The IPCC shares its headquarters with the WMO in Geneva and it is guided in its work (e.g. election of staff) by the General Regulations of the WMO. See Yamin and Depledge (2004).  
52 The IPCC is characterized by universal participation. Currently 195 countries are members of the IPCC. Participation in the IPCC is open to all UN, WMO and UNEP members. See Principles Governing IPCC Work, para. 7. Summaries for policymakers present “a political-scientific hybrid”; it is “a politically negotiated document, but one that retains scientific rigour”. See Yamin and Depledge (2004), p. 478.  
53 See Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports, para. 4.3.4.2.
important changes to its institutional procedures and structures. It enabled scientists from developing countries to participate in IPCC assessments along with scientists from developed nations. Representatives of developing countries were included at different management levels of the IPCC. Furthermore, the IPCC committed itself to a more balanced consideration of scientific views of developed and developing countries. Despite these changes, however, the IPCC’s scientific expertise is still dominated by scientists from developed countries, which is mainly a consequence of the lack of scientific resources in developing countries (Kohler, et al. 2012, Lohan 2006, Miller 2004). As a result, there is a predominance of “western” views in IPCC assessments and assumptions based on modelling of climate systems of the North, while the trends in climate systems of the South are often ignored (Miller 2004).

Apart from the geographical imbalance in the IPCC expertise, there are also some flaws in the IPCC assessment and review process, which negatively influence credibility and trust. For instance, there is insufficient consideration of reviewers’ comments by lead authors in final reports. In this respect, the IAC recommended that review editors of IPCC assessment reports prepare written summaries of the reviewers’ main comments so that lead authors would be obliged to give detailed written feedback on the most important issues raised (IAC 2010, pp. 60-61). Another important factor in gaining credibility is the sources of scientific information used in the assessment process. The use of non-peer-reviewed sources was a point of criticism of AR4. Therefore, where non-peer-reviewed or unpublished sources are used, their inclusion needs to be justified and indicated in reports.

Finally, a necessary step in addressing the credibility problem is increasing the transparency of the IPCC assessment process. Scientists working on IPCC assessments must be ready to give explanations related to the working process and provide intermediate results of assessments in support of final conclusions (Glaser and Bates 2011). It is also important to enable public access via the Internet to all literature and methodological materials used for

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54 There are two chairs for each Working Group and the Task Force, one from a developed country and one from a developing one. Members of Working Groups’ and Task Force’s Bureau (and the main IPCC Bureau) are equally represented by geographical regions. See Principles Governing IPCC Work, para. 5. Also, teams of coordinating lead authors and lead authors of reports’ chapters, which are representative of different geographical regions, include scientists from developing countries. See Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports, para. 4.3.2.

55 Pursuant to the IPCC procedures on the use of literature, it is allowed to use non-peer-reviewed, “grey”, literature (except information from Internet blogs, networking sites, newspapers and broadcast media) provided that its quality and validity has been checked and it is made available for storage in the IPCC Secretariat. See Annex 2 of Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports.
assessments. The recently established IPCC Executive Committee, working on a permanent basis in the period between annual plenary sessions of the IPCC, should facilitate continuous communication between scientists and stakeholders (policymakers and the public) and enable the rapid and timely reaction of the scientific community to criticism related to credibility of IPCC assessments.  

4.4. Public awareness

The issues of credibility and quality of climate science message are closely linked to the issue of public awareness. Public awareness of climate change and its impacts is important for generating public support for climate policy aimed to restrain fossil-fuel-driven economic growth. Increased public support will generate a new source of political authority, which will be in line with the authority of climate science and which will challenge the traditional source of political authority – the economic well-being (Litfin 2000).

Public support for action on climate change is currently lacking, especially in developing countries and CIT. Increasing public awareness of human-induced climate change in developing countries is crucial for ensuring participation of these countries in global climate change actions and their cooperation in the formation of a post-Kyoto climate regime. The increased awareness of climate change in constituencies from developing countries would influence the position of representatives of developing countries in international climate negotiations facilitating consensus on global climate policy. There is thus a need to develop global strategies of climate change communication, which closely relate to the exercise of human rights to freedom of information and expression (Cottier 2012a).

The IPCC can play a significant role in the creation of public awareness in developing countries. For instance, it could organize workshops and educational courses on climate science in developing countries, including training for government delegates. However, the

56 The IPCC Executive Committee was established on recommendations of the InterAcademy Council. It comprises the IPCC Chairs, Working Groups and the Task Group on Inventories Co-Chairs, IPCC Vice-Chairs, the Head of Secretariat and four Chairs of Technical Support Units. See Decisions taken with respect to the review of IPCC processes and procedures/governance and management, 33rd IPCC session, 10–13 May, Abu Dhabi.

57 The position of the public on climate change in developing countries and CITs ranges from ignorance and indifference, resulting from the lack of information and poverty concerns, to a complete rejection of the phenomenon of climate change as such, supported by climate-sceptical views of local scientists and the expectation of positive consequences of climate change. See Luta, et al. (2009), Rowe (2009). At the same time, public support has recently started growing due to the increased awareness of opportunities that the Kyoto flexible mechanisms (CDM and JI) could offer in terms of investment and economic gains. See Andonova and Alexieva (2012).
problem is the limited capacity of scientists who would render such training services and the limited financial resources. The IPCC budget is composed of the voluntary contributions of participating governments and grants from the core budgets of UNEP, WMO and UNFCCC, which are insufficient to support extensive outreach activities.\footnote{The annual budget of the IPCC in 2012 is slightly over 8 million CHF (Swiss franks). Its considerable portion goes on supporting the travel of experts to IPCC meetings and support of the work of chairs and co-chairs, while outreach activities are only covered by 140,000 CHF. See IPCC-XXXV/Doc. 2, p.10, http://www.ipcc.ch/meetings/session35/doc2_budget.pdf.}

Furthermore, being a major tool of transfer of scientific information to the public, the media play an important role in the creation of public awareness about climate change. Given the economic, social and political dimensions of climate change and the urgency of policy responses, the relationship of climate scientists with the media and the public is crucial and even more important than for other areas of science. It is necessary to establish an effective interaction between scientists and the media to send the right message at the right time to the public and eventually to policymakers. However, this interaction is quite tricky. It is the nature of the media to look for sensational stories, which are not always important or based on facts.\footnote{For instance, the email leakage story on the eve of the 2009 Copenhagen conference was popularized by the media heating up the debate about the credibility of IPCC assessments and undermining the support of the public for climate policy. See Glaser and Bates (2011).} Consequently, the scientific opinion that receives the most attention from the media is not necessarily the opinion that is supported by the majority of scientists. Thus, the interaction between scientists and the media requires special skills, especially on part of scientists, who are traditionally not used to publicizing their research. The organization of courses on communication with the media for scientists could help to build the skills needed. Such courses could be organized by the IPCC in various countries with a special focus on developing countries and CIT.\footnote{There is the IPCC fellowship programme for capacity building of developing countries’ scientists funded by the Nobel Prize. There is, however, a need for a broader scale of capacity building. See IAC (2010), p. 67.}

5. Conclusions

Science is at the core of climate policymaking and IPCC assessments are crucial for the progress in building the global climate change regime. Upon the examination of the current state of the IPCC and UNFCCC interaction, we identified some issues, which hamper the effective scientific contribution into climate policymaking and require improvement. They include credibility and clarity of scientific message, as well as public awareness of climate change.
The challenge of uncertainty of the IPCC scientific message can be mitigated by increasing the accuracy of scientific statements and assigned probabilities. Improving the quality of scientific message requires monitoring and minimizing the number of mistakes in assessments and enhancing policy relevance of assessments by highlighting consequences of action and inaction, intensifying interdisciplinary research and simplifying the language of the scientific message.

The lack of credibility of climate research is to a large extent a consequence of the interests of countries in unrestrained economic development based on the traditional use of fossil fuels. Mistrust is also generated by the unequal contribution of developing country scientists to the IPCC’s work, which is a result of the lack of scientific resources in developing countries. Credibility of scientific assessments can be improved by enhancing transparency of the assessment process, including providing open access to information sources and intermediate results, and increasing the rigorousness of the review process.

Public awareness of climate change and its impacts is important for generating public support for climate change action. As public awareness is lacking, especially in developing countries and countries in transition, there is a need to develop strategies for climate science communication, including public education, training for policymakers, and interaction with media.

**References:**


