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Knaggård, Åsa

2005

[Link to publication](#)

Citation for published version (APA):

Knaggård, Å. (2005). *Framing the uncertain: The case of the IPCC*. Paper presented at 7th Nordic Environmental Social Science Research Conference.

Total number of authors:

1

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Framing the uncertain: The case of the IPCC

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To be presented in
Workshop 8 “A new generation of environmental knowledge-politics relations” at the 7th
Nordic Environmental Social Science Research Conference, Göteborg 15-17 June 2005

ABSTRACT

Human-induced climate change presents grave challenges to society. We have to find ways both to mitigate the changes and adapt to them. However, this is not all, for politics climate change represents a problem with large scientific uncertainties. This is evident in the Intergovernmental Panel on Climate Change (IPCC) assessment reports. In this study, scientific uncertainty is discussed and systematized. Two dimensions of uncertainty are established and used to discuss framings of uncertainty in the summaries for policy-makers of the IPCC assessment reports. It is argued that framings of the uncertain formulated in the space where science meets politics, are important for the process and outcome of the international negotiations on climate change.

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UNCERTAINTY IN CLIMATE POLITICS

Human-induced climate change presents grave challenges to our societies. The decision stakes are high, with possible irreversible consequences, like the destruction of some small island states through rising sea levels. At the same time, the scientific uncertainties in climate change are high. For many aspects of the issue, probability assessments are not possible. This combination of high stakes and uncertainties means that we cannot wait to act in anticipation of further research (cf. Funtowicz & Ravetz, 1992). Due to these circumstances, it is central for the political management of climate change to manage uncertainty as well. A problem is that scientific uncertainty can have many different sources and issues can be uncertain to different degrees. This is not often made explicit. To enable political decision-makers to deal with climate change and other issues with high stakes and large uncertainties, it is crucial that the uncertainties in the scientific knowledge are made explicit and that their character is better understood (cf. Lemons, 1998: 77).

As one of the main scientific actors on the climate change issue, the IPCC (Intergovernmental Panel on Climate Change) plays an important role in understanding and communicating uncertainties. How the IPCC presents uncertainties can influence how international policy-makers choose to act on climate change. In this study I will discuss how scientific uncertainties are presented, or framed, in the IPCC assessment reports², making comparisons within the reports as well as looking at changes over time. Further, I will address the question to what extent the framings of uncertainty have influenced the international negotiation process of climate change.

Since the beginning of the 90s research has been conducted on how knowledge and organizations that produce or assess knowledge affect the formation of international environmental regimes³ (e.g. Andresen et al., 2000; Bäckstrand, 2001; Corell, 1999; Dimitrov, 2002; Litfin, 1994; Underdal, 1998). The aim of these studies has been to better understand if and how scientific knowledge and/or scientific experts influence the likelihood of regime formation and its effectiveness. There are some studies that have focused

² IPCC is an international body created to assist the international negotiation process through assessments of the state of knowledge on climate change. So far, the IPCC has produced three assessment reports (in 1990, 1995, and 2001) and a number of special reports.

³ Regimes are seen as “sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors’ expectations converge” (Krasner, 1983: 2).

specifically on the climate case (e.g. Miller & Edwards, 2001; Skodvin, 1999; Skodvin, 2000). This literature has increased our understanding greatly of how knowledge influences international efforts to manage environmental problems, but our knowledge is still far from comprehensive. One of the problems is that scholars have come to contradictory findings – some see a rather strong relation between scientific knowledge and regime formation, others only a marginal one. Some reasons for this contradiction are that knowledge as such has been conceptualized in different ways in these studies, as has the relation between science and politics.

The above mentioned studies are focused on what we know, not on what we do not know. Of course, uncertainty is implicitly discussed, but its problematic character is frequently left unanalyzed. Uncertainty has been discussed in other studies. However, these have not been focused on political processes but rather on the characteristics and production of knowledge (e.g. Collins & Evans, 2002; Funtowicz & Ravetz, 1992; Lemons et al., 1997; Ravetz, 1993; Wynne, 1992). There are some exceptions. For example, Shackley & Wynne (1996) have studied the influence of uncertainty on the relation of science and politics. Their study does not include interesting developments before and after the latest IPCC assessment report (published in 2001) and the study is focused foremost on science as authority and not on framings of uncertainty. Therefore, there are good reasons to study framings of uncertainty and their role in political decision-making.

Framing contextualized

This paper will focus on framings of scientific uncertainty and not on the uncertainties as such. The reason for this is that scientific texts in most cases are discipline-specific, making it hard for someone without the proper training to understand its content and implications (cf. Edwards & Schneider, 2001). It is therefore unlikely that political decision-makers should grasp what framings of uncertainty refer to. The uncertainties as such do not influence politics. Instead, it is the way in which uncertainties are framed that can have an influence on politics.

Framing will be understood in a context of translation of scientific knowledge into policy-relevant knowledge. In this translation process, scientific knowledge (or uncertainty) is framed in a political context, which makes it possible and meaningful to discuss in political

terms.⁴ In this translation process “frames provide a singular interpretation of a particular situation and then indicate appropriate behavior for that context” (Payne, 2001: 39). For example, Schön & Rein (1994: 23ff) discuss two framings, or stories told, of urban housing in the US: one describes an area as a slum and the other as a low income community. These framings require different measures – in the former rebuilding might be necessary but in the latter community support might be a better strategy. “Through the process of naming and framing, the stories make the ‘normative leap’ from data to recommendations, from fact to values, from ‘is’ to ‘ought’” (Schön & Rein, 1994: 26). These stories, or framings, “build upon specific models of agency, causality, and responsibility” (Jasanoff & Wynne, 1998: 5). Due to this, frames exclude some options and thus “delimit the universe of further scientific inquiry, political discourse, and possible policy options” (Jasanoff & Wynne, 1998: 5). Tversky & Kahneman (1981) have shown that framing affects decision-making. They assert that preferences can change with different framings, so that an individual faced with the same problem in a second decision can make a contradictory decision to the first one if the problem is framed differently.

In the theoretical part of the paper, different dimensions of uncertainty are discussed and the translation process is conceptualized. In the empirical part, framings of scientific uncertainties in the IPCC assessment reports are analyzed. The paper concludes with a discussion of the possible influence of these framings on the international negotiation process on climate change.

UNCERTAINTY

Uncertainty is a concept that is understood and used in a variety of ways. This often leads to some confusion in political discussions and in comparisons of academic studies. Yet there has been a tendency both in the academic and the practical use of uncertainty to understand it as one-dimensional, formulated as risk (Wynne, 2001). While this could be viewed as a development facilitating discussions about uncertainty, some scholars (e.g. Klinke & Renn, 2002; Lemons, 1998; Wynne, 1992) have pointed to the importance of seeing uncertainty as a multi-dimensional concept in order to strengthen decision-makers in their management of uncertain issues.

⁴ Framings can be understood outside the context of translation. However, in this study, focus is on framings that function as translations of scientific uncertainties into policy-relevant uncertainties.

Scientific uncertainty

The focus in this study is on scientific uncertainty, which can be seen as a specific type of uncertainty. It refers to uncertainties about the problem under study, about cause and effect relations. However, science cannot inform us about all types of uncertainty. What *actually* will happen is outside the domain of science (maybe in the domain of oracles). The actions of others will affect the outcome of my own action, making it impossible for me to know what will happen. Also, even if we know the likelihood of what might happen we can never know beforehand what the actual outcome will be. It is always possible that the unlikely happens. Otherwise people would not continue buying lottery tickets. This can be called strategic uncertainty.

The difference between scientific and strategic uncertainty is thus a matter of source. This difference is manifested in two schools of thought on regime formation in international relations. Neoliberalists argue that regimes decrease the uncertainty about the behavior of other states, which in turn makes cooperation more likely (see e.g. Keohane, 1984). This is an example of strategic uncertainty. Cognitivists, on the other hand, focus on the inability to assess even the *possible* consequences of ones actions, due to lack of knowledge on cause and effect (see e.g. Litfin, 1994). This exemplifies scientific uncertainty.⁵

Scientific uncertainty cannot be seen as static. The state of scientific knowledge is constantly changing. However, this change is not necessarily consisting of a reduction of uncertainties. The common assumption that more research will lead to less uncertainty is inherently flawed. More research can lead both to less uncertainty and to more uncertainty, as the expansion of the limits of our knowledge can reveal new uncertainties. It is also possible that expanding knowledge reveals earlier uncertainties that were not perceived at the time. Many substances were first thought to be safe, but with more research have been shown to be dangerous. One example is the case of asbestos that went from “‘magic’ to malevolent mineral” (Gee & Greenberg, 2001: 52). In this example, we have gone from certainty to certainty, although we today know that our earlier understanding of cause and effect relations was very limited. It is thus not given that uncertainty is being decreased by scientific advances or if it is “‘endlessly increasing as scientific and technological expansion themselves open up new fields of

⁵ For a discussion of neoliberalists’ and cognitivists’ views on uncertainty see Hasenclever et al. (1997: 141).

complexity, ignorance and manifest lack of control” (Wynne, 2001). Scientific uncertainties can be compared to sandbanks just under water. Even if the banks are mapped by ships passing, the maps might be useless the next time they pass by as the sandbanks have moved.

Dimensions of scientific uncertainty

To be able to study scientific uncertainty we have to choose some dimensions of this multi-dimensional concept to focus on. It can be divided along numerous lines. Two of the main analytical dimensions that will be used here are *level of lack of knowledge* and *degree of consensus*. When discussing uncertainty most people would probably think about some form of lack of knowledge – something that we do not know. This way of thinking about uncertainty is the norm in technical literature, where focus is on how uncertainty can be calculated. This dimension can thus be called a technical one.

The second analytical dimension is degree of consensus. For knowledge to be established, it is often not enough if only a few scientists have come to a certain conclusion. This has been shown in a number of case studies in the report *Late lessons from early warnings* (Harremoes et al., 2001). Further, it has been shown that the existence of knowledge does not necessarily lead to consensus about that knowledge. There are two reasons for this. First, it is possible that different data sets about the same problem can provide different understandings of a problem. According to Sarewitz (2004: 389), this can be understood as an “excess of objectivity”. Scientific uncertainty can thus be seen “not as a lack of scientific understanding but as the lack of coherence among competing scientific understandings” (Sarewitz, 2004: 386). Second, the same data set can be interpreted in different ways (see e.g. Wynne, 2001, for a discussion of ambiguity). In fact, Klink & Renn (2002: 1085) argue that most disputes about uncertainty are dependent on different interpretations of what the same data means for society. These interpretations or framings can in turn result in diverging recommendations for political action.

The possibility to interpret and frame uncertainty in different ways gives a completely different understanding of uncertainty, as compared to technical uncertainty. Wynne (2001) has characterized this form of uncertainty as structural uncertainty. The two analytical dimensions of technical and structural uncertainty can be understood independently or

combined. If combined, the result can be seen as four analytical types of uncertainty, see figure 1.

Technical uncertainty

		Limited lack of knowledge	Extended lack of knowledge
<i>Structural uncertainty</i>	High degree of consensus	Established knowledge	Established uncertainties
	Low degree of consensus	‘Excess of objectivity’	No established uncertainties

Figure 1. Two dimensions of scientific uncertainty

When there is only a limited lack of knowledge combined with a high degree of consensus we have knowledge that is established. Here uncertainties are very small, and established knowledge will therefore not be seen as an analytical type of uncertainty here. Despite this, it is possible that political actors can frame even this consensual knowledge in different ways when coupling it with a political context. When lack of knowledge is limited and the degree of consensus is low, we get what Sarewitz calls ‘excess of objectivity’. In a situation like this, it will be difficult for political decision-makers to know whom to listen to. Due to this, an excess of objectivity may entail that scientific advice is ignored altogether. In situations with extended lack of knowledge we can speak of high technical uncertainty. When consensus is high about these uncertainties, we *know* what we do not know. When consensus is low, on the other hand, we do *not know* what we do not know. In the latter case, there is a risk of nasty surprises that we did not anticipate.

Three of the analytical types of uncertainty in figure 1 (not including established knowledge) will be used to analyze the framings of uncertainty in the IPCC assessment reports. Technical and structural uncertainty will also be used to understand what dimension of uncertainty is used in different frames. Before continuing, a further specification of uncertainty is needed, as the IPCC assessment reports to an extended degree are formulated in a scientific/technical tradition.

Technical uncertainty specified

In the technical literature, the source of uncertainty is usually specified. Thus there is not a lack of knowledge, but a lack of knowledge about outcomes and/or probabilities. When different levels of uncertainties about outcome and probabilities are combined, the dimension of lack of knowledge can be divided into three subgroups, namely risk, uncertainty, and ignorance.⁶ Risk is often defined as a situation where the possible outcomes are known as well as their probabilities. Ignorance is usually defined as a situation where neither possible outcomes nor their probabilities are known. And uncertainty is normally defined as the middle ground between them, describing a situation where outcomes are known but not probabilities (see e.g. Wynne, 2001). Risk, in this technical definition, cannot be categorized as scientific uncertainty as both outcomes and probabilities are known. The uncertainty here is rather strategic, as it is about what the actual outcome will be. Despite this, the separation of lack of knowledge into risk, uncertainty, and ignorance is an important one when studying scientific uncertainty, as it is typical for technical language, for example found in the IPCC assessment reports.

However, the division is also problematic. It misses that many problems can lie in between risk and uncertainty or uncertainty and ignorance. Often we do not know all outcomes beyond reasonable doubt. We might be fairly certain that some outcomes are possible, but we can also only suspect other outcomes to be possible. In order to capture the whole range from knowing to not knowing it is better to think about risk, uncertainty and ignorance as located on a continuum where there are no sharp boundaries between different levels of lack of knowledge.

FROM SCIENTIFIC TO POLICY-RELEVANT UNCERTAINTY

In order to understand the process of translation from scientific to policy-relevant uncertainties, we need a conceptualization of how the science-policy relation is structured. Some argue that the relation is straightforward, that science is “speaking truth to power” (Price, 1965). Others see it as a far more complex process where politics affects science as much as the opposite (e.g. Shackley & Wynne, 1995). Litfin (1995: 275) states that

⁶ The combination of not knowing the outcomes but the probabilities is a situation that cannot exist in a technical sense, as we cannot calculate probabilities for unknown outcomes.

the relationship between science (and scientists) and policy (and policy-makers) is *multi-dimensional*, not uni-directional. Scientists might join together to influence the policy process, but their power is circumscribed by a host of contextual factors. Policy-makers may co-opt or manipulate the scientists, or they may simply ignore their advice. Alternatively, scientists may deliberately refrain from making controversial policy recommendations.

In this quote, Litfin points to the multidimensionality of science-politics interactions. Today, most of those studying the role of knowledge in politics do embrace the idea that science and politics are mutually constructed. Despite this, many conceptualizations of how the relation is actually structured can be found in the literature. Some see it as two spheres, one scientific and one political, that are partly overlapping. This overlapping area has, for example, been called advisory science, trans-science and hybrid science (see Bäckstrand, 2001: 26). How the relation between science and politics is understood depends to a large degree on how science and politics are defined. In this study, science and politics will be seen as two separate spheres, or arenas, guided by different rules and driving forces. Between these two arenas actors can move (cf. Boholm & Ferreira, 2002: 37ff). Scientists can participate on the political arena at times, whereas in other situations they are situated on the scientific one. The two arenas can sometimes meet in an actual place where knowledge is translated.

Science is guided by its search for reliable knowledge and is assessed, among other things, by the validity of the argumentation. Politics, on the other hand, is guided by the balancing of different values and interests. Where scientists are assessed internally by peer-review, politicians are assessed externally in elections. Scientists are trained not to speculate when scientific proof is inconclusive or missing. This means that science is biased towards production of false negatives, which entails that an existing problem or danger is concluded not to exist. A goal of politics is to avoid harm, which fits badly with the scientific training of not speculating. Decision-makers tend to produce false positives, which entails that a non-existing problem or danger is acted upon (see Lemons et al., 1997, for a discussion of false positives and negatives). This bias towards false negatives and false positives, respectively, derives from the rules and driving forces on the two arenas. For politicians, the main driving force is (or should be) to protect the public from harm. If they fail to do this, they might be punished in the next elections. This leads to an attitude of being better safe than sorry. Scientists put their academic reputation on the line if proven wrong when speculating, which provides strong incentives not to speculate.

As actors can move between the scientific and the political arena, taking on different roles, a person can experience conflicts between his/her different roles. As a citizen, a scientist is expected to speak out if (s)he believes that there is a risk of harm, but this conflicts with his/her role as a non-speculating scientist (Lemons, 1998: 99). This could be a reason why many actors choose not to move between arenas. Others move more regularly between the arenas, translating between them. Actors performing the task of translation through the use of framing have by Karen Litfin been called 'knowledge brokers' (Litfin, 1994).

Knowledge brokers are "intermediaries between the original researchers, or the producers of knowledge, and the policymakers who consume that knowledge" (Litfin, 1994: 4). They translate and interpret scientific knowledge. They are thus actors who move between the arenas and frame scientific knowledge in policy-relevant terms. Many kinds of actors can take on a role as knowledge broker. In complex scientific issues it is not uncommon that scientists act as knowledge brokers, but politicians, officials, lobbyists, NGOs representatives, and journalists can also be knowledge brokers. Epistemic communities, networks of knowledge-based experts with shared causal and normative beliefs (Haas, 1992: 2f), can also be seen as a collective knowledge broker. Litfin focuses less on the actors who function as knowledge brokers and more on the framings as such: "what is fundamentally important is not their identities, but rather their ability to translate and interpret knowledge in accordance with new or pre-existing sets of linguistic practices which entail specific constructions of the world" (1995: 253, footnote 14). The same stance is taken here – focus will be on the framings of uncertainty rather than on the IPCC as an actor in the climate change issue. Despite this it is necessary to give some background information about the IPCC.

CLIMATE CHANGE AND THE IPCC

IPCC was created in 1988 by UNEP⁷ and WMO⁸ to assess the knowledge on the scientific basis of a possible human-induced climate change. It should also support the international negotiations process on climate change (see IPCC, 2003 [1998]). The IPCC has produced three major assessment reports and a number of special reports. Work to adapt the IPCC to new circumstances and enable it to better meet the needs in the international negotiation

⁷ United Nations Environment Programme

⁸ World Meteorological Organization

process are carried out continuously. The three working groups, in which the scientific work of the IPCC is conducted, have changed with time. Today they consist of (1) *The scientific basis*, (2) *Impacts, adaptation, and vulnerability*, and (3) *Mitigation*. A lot has been written about the IPCC, about its structure and process (e.g. Agrawala, 1998; Siebenhüner, 2003), about the effect of its institutional design on science-politics interactions (e.g. Skodvin, 1999), about how it handles uncertainty (e.g. Patt & Schrag, 2003; Saloranta, 2001; Weiss, 2002), etc. My focus is on the IPCC as a knowledge broker and, more specifically, on its framings of scientific uncertainty in a policy-relevant language.

The IPCC as knowledge broker

The IPCC can be seen as an intermediary “between the original researchers, or the producers of knowledge, and the policymakers who consume that knowledge” (Litfin, 1994: 4). It does not produce knowledge, but only assesses already existing knowledge. Due to this it cannot be seen as an original researcher. The IPCC in its entirety cannot be seen as a knowledge broker, as only a part of the work that it does can be seen as translated to policy-relevant knowledge and thus directed at “the policymakers who consume that knowledge”. Most of the work done in the working groups (WGs) can be understood as produced within the scientific arena, following scientific rules for a scientific audience. This is often pointed out as one of the prerequisites for IPCC’s status as authority on climate change. But IPCC is also a site where science and politics meet and the translation between the two takes place. This meeting is institutionalized in the structure of the organization.

The scientific part of the IPCC consists of the three working groups. When drafts have been produced and reviewed, the text has to be accepted at a session of the working group with scientists and governmental representatives⁹ present. The working groups write a summary of their respective report for policy-makers. This is the most important translation work that the IPCC does. As the IPCC assessments are very long and consist of highly scientific language, it is the summaries that public debate and media reports are mostly based upon. Therefore, “the Working Groups consider their exact wording with extreme care before they are published” (Edwards & Schneider, 2001: 220). These summaries are not only *accepted* at a session of the working group but *approved line by line*. The participants at these meeting are

⁹ Participation is open to all UNEP and WMO member states.

mainly governmental representatives, but lead authors of the working group also participate. The lead authors have a fairly good control of the content of the text due to their scientific authority (Skodvin, 1999: 158). After the approval at a session of the working group, the summary is accepted together with the rest of the working group report in a session of the panel, with almost exclusively governmental representatives. In *Appendix A to the Principles Governing IPCC Work* the summary is said to provide “a policy-relevant but policy-neutral summary” (IPCC, 2003 [1999]). Skodvin (1999: 159), on the other hand, describes the line by line approval as a highly political process, where the main conclusions are subject to efforts at both strengthening and watering down. Agrawala (1998: 627) states that “the IPCC plenary approval process of policymaker summaries often resembles a fox-trot performed by a drunken couple: one lurch forward, followed by a sideways stagger, then a stumble backwards”. IPCC is, at the same time, a scientific organization, a political one, and a mixed one. It can be pictured as in figure 2.

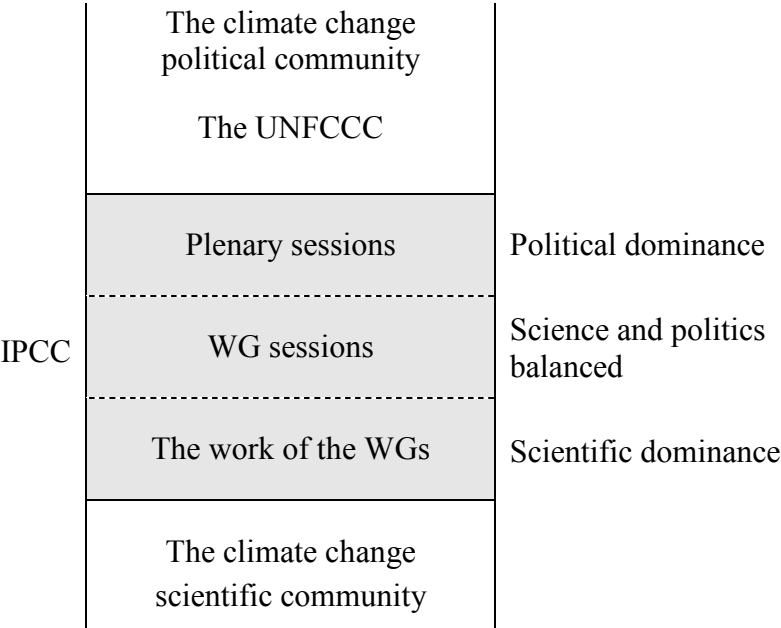


Figure 2. The institutional set-up of the IPCC (based on Skodvin, 2000: 152).

The summaries for policy-makers of the three IPCC assessment reports can be seen as translated products. They are no longer scientific knowledge only, but formulated in such a way that political decision-makers should be able to understand and use them. In the assessment reports there is a special focus on uncertainty, as it was realized when creating the IPCC that the need for clarity on the gaps in knowledge is as great as on the knowledge as such. Therefore, one of IPCC’s main tasks is to identify uncertainties and gaps in the

knowledge on climate change and on its impacts (see IPCC, 2004). Many other knowledge brokers do not focus on scientific uncertainty as such. This gives IPCC a special position in the framing of climate change uncertainty.

Framings of uncertainty in IPCC reports

As IPCC from the beginning has had as its mission to map out uncertainties and communicate them to the scientific community as well as the political, framings of uncertainties have been present in the summaries for policy-makers of all its three assessment reports. Over time there has been a change in the attitude towards uncertainty and the way it has been framed. After the second assessment report (SAR) from 1995, the IPCC decided that a more coherent and nuanced treatment of uncertainty was needed. A paper on uncertainty was produced (Moss & Schneider, 2000) to guide authors in the writing of the third assessment report (TAR), completed in 2001. As a result of this guidance paper there are substantial differences in the way uncertainty is framed, at least on the surface, in summaries for policy-makers, on the one hand, of the first and second assessment reports and, on the other, of the third. There are also interesting differences within the assessment reports, foremost in TAR, between working groups. The work that started with the guidance paper on uncertainty is continued after the publication of TAR with a workshop evaluating the guidelines and suggesting changes for the coming fourth assessment report. This paper will focus on the differences in framings of uncertainty between SAR and TAR as well as the differences between working groups within TAR. The first assessment report (FAR) will not be discussed as the differences between this report and SAR are not so marked.

The second assessment report

In the summaries for policy-makers of the SAR there is no explicit discussion of how uncertainty is understood and defined. The result has been that there is no consistency between working groups, or sometimes even within the groups. Uncertainty has mostly been framed in terms of lack of knowledge or even just as an unspecified knowledge gap. In working group I (WGI) uncertainty has been framed as lack of knowledge in the following way: “There are *inadequate data* to determine whether consistent global changes in climate variability or weather extremes have occurred over the 20th century” (IPCC, 1995: 22, emphasis added). A similar framing by working group II (WGII) states that: “...quantitative

projections of the impacts of climate change on any particular system at any particular location are difficult because regional-scale climate change predictions are *uncertain*” (IPCC, 1995: 29, emphasis added). In the first quote uncertainty is framed as an extended lack of knowledge as that lack is specified to come from “inadequate data”. The second quote does not specify from where the uncertainty derives, whether it is a technical uncertainty (with consensus or not) or an excess of objectivity (inter alia competing explanations). It only states that “regional-scale climate change predictions are uncertain” and can thus be seen as an unspecified knowledge gap.

However, uncertainty is also framed in a more nuanced way in the summaries for policy-makers. In WGI it is stated that: “The *magnitude is uncertain*, but could be between zero and 200 GtC...” (IPCC, 1995: 23, emphasis added). Here possible outcomes are discussed and framed as surrounded by an extended lack of knowledge (in the language of outcomes and probabilities it is somewhere in between uncertainty and ignorance). Compared to the quotes above, much more information about the uncertainty is given. In both WGI and WGII surprises are discussed. In WGI is said that “[t]his implies that future climate changes may also involve ‘*surprises*’” (IPCC, 1995: 24, emphasis added). And in WGII one can read that “[a]s future climate extends beyond the boundaries of empirical knowledge...it becomes more likely that actual outcomes will include *surprises* and unanticipated rapid changes” (IPCC, 1995: 29, emphasis added). To talk about surprises is to frame uncertainty as unestablished, as something that we do not know that we do not know (can also be called ignorance). This frame, as with the frame of uncertain magnitude, gives information about the characteristic of the uncertainty.

It is interesting to note that WGII and WGIII not only use a technical dimension of uncertainty but also considers structural uncertainty. In WGII it is used in very few paragraphs, for example stating that: “[*e*]xperts disagree over whether water supply systems will evolve substantially enough in the future to compensate for the anticipated negative impacts of climate change...” (IPCC, 1995: 32, emphasis added). Experts apparently have different answers to how water supply systems will evolve. Here uncertainty is framed as an excess of objectivity. WGIII discuss uncertainty to a larger extent in structural terms than in technical: “Some studies suggest that the cost of delay is small; others emphasize that the costs could include imposition of risks on all parties...*No consensus* is reflected in the literature” (IPCC, 1995: 47, emphasis added). This is another example of excess of

objectivity. WGIII also frames some uncertainties as on the border to political decisions: “There is *no consensus* about how to value statistical lives...” (IPCC, 1995: 50, emphasis added). This could be understood as an excess of objectivity but it can be questioned if it expresses a scientific uncertainty at all, as it is not self-evident that science can give us an answer to what the value of a statistical life is.

In summaries for policy-makers of SAR, it is primarily the technical dimension that is used in framing uncertainty. These frames are focused on lack of knowledge. In most cases, the knowledge gaps are not discussed in terms of outcome and probability. This is remarkable as the scientific and technical character of a large part of the content is biased towards this kind of language. Structural uncertainty is discussed chiefly in WGIII. A possible reason for this difference in focus on structural uncertainty is the different subjects that the three working groups deal with¹⁰. Whereas WGI and WGII are more focused on natural scientific aspects of climate change, the focus of WGIII is on economic and social factors. Economics and social sciences could be said to be more focused on structural uncertainty than technical. The absence of structural uncertainty in WGI and WGII could be explained thus: when there is technical uncertainty, authors perceive the possible existence of a (non-)consensus as secondary.

The third assessment report

In the TAR, working groups are dealing more explicitly with uncertainty, taking a unified approach to it within each group, with the exception of WGIII. As discussed above, this decision derives from the guidelines formulated in the guidance paper on uncertainty. The guidelines include a quantitative scale for assessing the state of knowledge. This scale includes five steps of confidence in the knowledge, ranging from very high confidence to very low confidence with probability ranges attached to each level (see figure 3).

very low confidence	low confidence	medium confidence	high confidence	very high confidence
0%*	5%	33%	67%	95%
				100%

* Observe that this is an ordinal scale and not an interval one.

Figure 3. Scale for asserting state of knowledge (based on Moss & Schneider, 2000: 44).

¹⁰ *The science of climate change* (WGI), *Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses* (WGII), and *Economic and Social Dimensions of Climate Change* (WGIII).

A distinction is also made along two dimensions of uncertainty: level of agreement/consensus and amount of evidence. The result is four concepts describing the qualitative aspects of uncertainty – established but incomplete, well established, speculative, and competing explanations (Moss & Schneider, 2000: 45). The discussion of uncertainty, unprecedented in the history of the IPCC, helped guiding TAR authors. However, the guidelines were used to very different degrees by the three working groups. WGII adopted the quantitative scale of confidence as well as the four qualitative concepts. WGI picked up the idea of a quantitative scale for confidence, but decided to construct their own scale. Finally, WGIII did not use a scale of either confidence or probabilities and seems to have no common approach to the framing of uncertainty.

Uncertainties in the summary for policy-makers of WGII has to a very large extent been framed with the help of the confidence scale: “More people are projected to be harmed than benefited by climate change, even for global mean temperature increases of less than a few °C (*low confidence*)” (IPCC, 2001b: 8, emphasis in original). Even if there is a consistency in how uncertainty is framed, it is unclear what it really refers to. It does not tell us if there is a lack of knowledge (with or without consensus) or if there is an excess of objectivity. The framings here can thus be compared to the framings of lack of knowledge in SAR. The qualitative concepts of uncertainty are only used a few times in the summary.

WGI chose to use another scale of confidence than the one suggested in the guidance paper. Their scale included seven levels (IPCC, 2001d: 2): virtually certain (99%-), very likely (90-99%), likely (66-90%), medium likelihood (33-66%), unlikely (10-33%), very unlikely (1-10%), and exceptionally unlikely (-1%). A very interesting question, that will unfortunately not be answered here, is what the reason for the choice was. A conclusion drawn in the report from the IPCC workshop *Describing scientific uncertainties in climate change to support analysis of risk and of options* from 2004 is that the scale of confidence formulated in terms of likelihood was intended to be interpreted as probability of outcomes and not as estimates of confidence, as was stated in the WGI summary for policy-makers (Manning et al., 2004: 6). When looking at the way WGI used the scale, it is evident that it has been used for two separate purposes. First, the scale has been used to frame the level of confidence in knowledge: “Globally, it is *very likely* that the 1990s was the warmest decade and 1998 the warmest year in the instrumental record, since 1861” (IPCC, 2001d: 2, emphasis added). What is discussed here is not likelihood of something happening but our level of confidence

in the knowledge about what already has happened. Second, the scale was used to frame the probability of possible outcomes: “By the second half of the 21st century, it is *likely* that precipitation will have increased over northern mid- to high latitudes and Antarctica in winter” (IPCC, 2001d: 13, emphasis added). Here it is not the confidence in knowledge that is estimated but the likelihood of increased precipitation. The use of the confidence scale in these two very different ways is confusing, and the reason for why it is used in this way is unclear. A possible reason could be that WGI wanted to frame uncertainties as a limited lack of knowledge. By referring to probabilities of outcomes the reader will believe that science has the uncertainties under control and will be able to reduce them further. However, this is only speculation.

In the summary for policy-makers of WGI, uncertainty is not only described in terms of probabilities, although this is by far the most common. In one figure structural uncertainties are expressed, see figure 4.

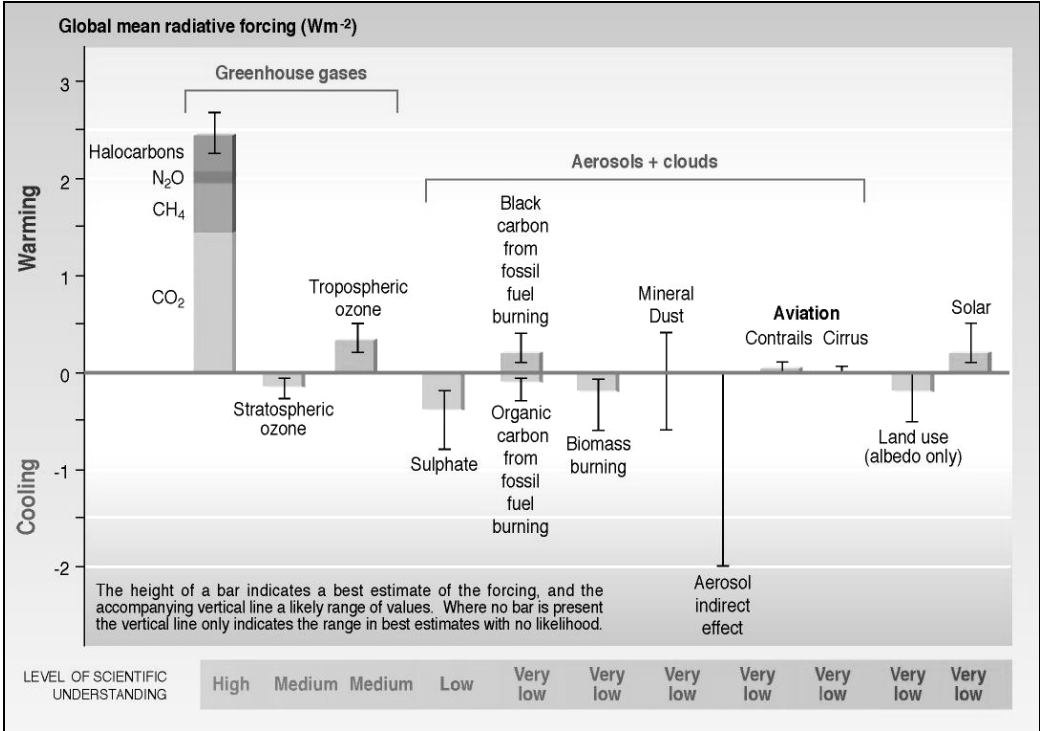


Figure 4. Anthropogenic radiative forcing of the climate system for 2000 relative to 1750 (IPCC, 2001a, the figure is similar to the one in summary for policy-makers of WGI , page 8).

In figure 4, the rectangular bars form best estimates of the effect of a number of variables on global warming. Of interest for this study are the vertical lines connected to the bars. These lines indicate that there is an excess of objectivity: they “indicate *a range of estimates*, guided

by the spread in the published values” (IPCC, 2001d: 8, emphasis added). However, the fact that a best estimate could be made indicates that the range of estimates converge around a certain point. In those instances where there are no bars, no best estimate could be made, which signifies a real excess of objectivity in that scientists cannot agree at all.

In summary for policy-makers of WGIII, finally, uncertainties were not framed by means of a confidence scale. A reason for this might be that the science on which WGIII is based, which is mostly economics, builds its arguments on a number of assumptions. If these are changed, the result will also change: “Costs associated with each concentration level depend on numerous factors including the rate of discount, distribution of emission reductions over time, policies and measures employed, and particularly the choice of the baseline scenario” (IPCC, 2001c: 10). This kind of uncertainty is built into the models used and can be compared with the uncertainty in climate models, which are also built on a number of assumptions, for example, of GHG emission levels and population growth (see e.g. Jasanoff & Wynne, 1998 for a discussion of climate models).

The differences in how the three working groups have framed uncertainty in their respective summary for policy-makers are large. This might to some degree, as with the SAR, be explained by the different topics of the three groups and the different sciences they are based upon. This pattern can be seen in all three assessment reports. What is more interesting is the differences between WGI and WGII that to some extent are based on the same kind of science. In both working groups a tendency to transform and condensate uncertainty into one category is visible, although stronger in WGI. According to Shackley & Wynne (1996: 283ff), transformation and condensation of uncertainty are common processes that create more tractable framings of uncertainty. They define transformation, as when different types of uncertainty are framed as captured in one category; and condensation, as when the differences are accepted but framed in one category. WGII has made an effort to frame uncertainties in a more nuanced way, yet ends up using confidence in knowledge almost exclusively. This can be interpreted as a process of transformation. WGI, on the other hand, chose to use a condensed measure of uncertainty from the beginning. As discussed above, it is, in this study, not possible to give an answer as to why this difference came about.

In conclusion, the differences between the second and third assessment reports are large on the surface, partly as a result of the guidance paper on uncertainty. However, when comparing

how uncertainties are actually framed, the differences do not seem that large. For example, in WGII of both SAR and TAR, the main focus is on lack of knowledge. What stand out are the framings in WGI of TAR, where uncertainties have been condensed into probability estimates.

FRAMINGS OF UNCERTAINTY AND POLITICAL DECISION-MAKING

Finally, we have to ask what influence these framings of scientific uncertainty can have had on the international negotiation process. As discussed above, framings have been shown to affect decision-making, arguably because they are based on a specific image of agency, causality, and responsibility. It is also argued that these frames delimit the space of possible actions, both for further research and for political action. Framing can thus be categorized as path dependency.

According to Agrawala (1998: 633), the IPCC has had a significant influence on the policy process even if it has been occasional. She argues that the influence can be understood primarily in terms of triggering and less in terms of shaping policy options. This concurs to some extent with other studies that point to the small influence the IPCC has had on policy options (e.g. Harrison, 2004). Two issues are important here. The first is Agrawala's distinction between process and outcome. Even if no influence on the policy outcome can be found, IPCC's framings of uncertainty may still have influenced the process of negotiation significantly. The second issue is that it could be premature to conclude that the IPCC has had no influence on the policy outcome. A distinction has to be made between taking policy measures to avoid possible unwanted outcomes, for example by following the precautionary principle, and using uncertainty for other purposes. It is possible that policy-makers decide to do nothing until knowledge gaps can be filled. To blame the slow or non-existing progress in international negotiations on the disagreements and lack of knowledge in the scientific community can be a useful strategy for policy-makers, as responsibility for managing a problem is moved from them to the scientists. It is also possible that policy-makers ignore the scientific reports due to the framings of uncertainties. Another possible response is that policy-makers can use framings of uncertainty to stall negotiations, once again moving responsibility onto the scientific community. By studying the influence of framings of uncertainty on both process and outcome as well as on both the management and use of

uncertainty, the conclusion about IPCC's influence could differ significantly from those of earlier studies.

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