Technology Assessment

# Room for climate debate

## Perspectives on the interaction between climate politics, science and the media

**Jeroen P. van der Sluijs, Rinie van Est and Monique Riphagen (editors)**

Rathenau Instituut

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Publisher: Rathenau Instituut

Quote preferably as:
Jeroen P. van der Sluijs, Rinie van Est and Monique Riphagen (eds.) (2010), Room for climate debate: perspectives on the interaction between climate politics, science and the media. The Hague, Rathenau Instituut.

Editors
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Final editing
Gaston Dorren and Hans van Scharen

Translation
Ruth Rose

Cover photo
Dreamstime, Eric Gevaert

Cover design
MaryAnn Smit, BOVEN DE BANK for graphic design & dtp, Amsterdam

Print:
SIL'S drukwerk, Amsterdam

# Foreword

Within the climate discussion, in 2009 all eyes were focused on the UN Climate Summit that was held last year in Copenhagen. A new climate convention was supposed to be signed at that summit, because the Kyoto protocol runs out in 2012. Scientific knowledge and uncertainties play an important role in the climate discussion. Policymaking around the climate has a complex national, European and worldwide character.

In 2009 the Rathenau Instituut collaborated with the project World Wide Views on Global Warming (WWViews). The central goal of this project was to give citizens worldwide a voice in the climate discussion. To accomplish this, a worldwide citizens' forum was organised on 26 September 2009. In 38 countries and 44 forums, one hundred informed citizens per country discussed climate change. They also answered questions about the experienced need and urgency for a climate agreement. The voice of these nearly 4000 citizens worldwide was presented at the COP15 climate conference in Copenhagen in December 2009.

World Wide Views on Global Warming was the first citizen participation project on a worldwide scale. The need for it can be found in the fact that climate change is a problem on a global scale; policymaking in this terrain takes place on a global scale too. The Rathenau Instituut has experience with citizens' panels on a national scale and knows how things are run in the Dutch Parliament. But how do you set up a worldwide citizens' panel, how do you offer balanced information to citizens, and how do you ensure that the results of the worldwide citizens' forum also get attention at a UN Climate Summit?

To gain insight into the answer to such questions, we had to delve into the way in which the complex international negotiations about climate change work and what role Dutch politics plays in this process. Is the standpoint of the European Union preceding the negotiations now a fully leading one, or does the Netherlands still have an independent position in it? To inform citizens well, we wanted to get a better picture of the scientific climate debate. What is actually the consensus about global warming among climate scientists? What is the status of dissent and sceptic voices, and how can they be properly processed into information material for citizens? We also asked ourselves what citizens know about the climate problem and how they become informed via the media. Do the various newspapers and newsmagazines report in different ways about the climate problem, and do they deal differently with dissent and sceptic voices? To gain insight into all these questions we started a research project together with the Copernicus Institute of Utrecht University.

Before the Copenhagen climate conference there was a political discussion about the objectivity of climate science. Hacked e-mails of climate scientists appeared on the internet; these emails suggested that these climate scientists wanted to keep inconvenient information from official IPCC publications. After news about errors in the IPCC report itself, the political discussion intensified. Politicians asked for faultless climate science on which to base their political judgements. At the same time, climate science indicated that the political expectations were not realistic, given that faultless science does not exist. In addition, according to the scientists the conclusions from the last IPCC report about the existence and severity of the climate problems were completely upright.

The Rathenau Instituut signalled that climate science itself had become a part of the political debate. We decided that, on the basis of the information we already had gathered in the context of World Wide Views, we were capable of making a positive contribution to the debate that had arisen. To that end it was necessary to shift the focus of our research to the interaction between climate science, politics and the media. The present document is the result of these efforts. With 'Room for climate debate' we hope

to offer you more insight into the relationship between politics and climate science and their representation in the media.

We wish to thank Gerbrand Komen and Wim Turkenburg for their valuable comments and suggestions in previous versions of the text of this report.

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# Abstract


## *Room for climate debate: perspectives on the interaction between climate politics, science and the media*

The present study offers a picture of the complex interaction between climate politics, science and the media.

During the 1970s and 1980s, politics and the sciences focused increasingly on the climate problem, at the time known as the greenhouse effect. Due to a lack of sufficient scientific evidence and absence of international policies, the Netherlands pursued a 'no regrets' climate policy. Measures such as energy savings, which were already justified in other policy domains, were sharpened. This all changed in the period between 1987 and 1994. Since then, the precautionary principle and the scientific consensus approach of the Intergovernmental Panel on Climate Change (IPCC) have determined how the political arena deals with scientific uncertainties in the field of climate change.

The precautionary principle entails that in order to intervene to limit an environmental risk no full scientific knowledge of that risk is needed – clear scientific indications suffice. To create a clear scientific knowledge base for the development and legitimation of an international climate policy, the UN established the IPCC in 1988. This made political actions at an international level dependent on the scientific consensus within the IPCC. The first IPCC report from 1990 indicated that it is likely that continued emissions of anthropogenic greenhouse gases would lead to global warming. On the basis of this knowledge the UN Framework Convention on Climate Change was signed in Rio de Janeiro in 1992. The second (1995), third (2001) and fourth (2007) IPCC reports showed a growing scientific evidence: instead of 'likely', the IPCC now considers 'very likely' that not intervening will cause 'threats of serious or irreversible damage'.

The interaction model between politics and science that was set up in domestic and international political arenas to deal with scientific uncertainties is also known as the linear or technocratic model. Its underlying assumption is that more scientific research will lead to more reliable knowledge and less uncertainty, and that that knowledge will then form a basis for political consensus and decision-making. One could say that, for the Netherlands, the linear model has worked for a long time, in the sense that it has provided a long-term and broad political consensus about climate policy.

This approach has hindered a full-blown political climate debate and has politicised climate science. Analysis of parliamentary debates over the last twenty years show that IPCC reports are continuously used to keep the political debate within bounds. Questions are repeatedly asked in the Dutch Parliament about scientific information and scientific uncertainties surrounding the climate issue. These questions come from the entire political spectrum. The government consistently answers that scientific uncertainties do exist, but that policies are based on the IPCC reports and the precautionary principle. Because the political arena has given the IPCC reports such a central role, the political conflict about climate change and the underlying ideological contradictions have penetrated deep into the field of climate science. In other words, political influence nowadays can be achieved most effectively via climate science. With the IPCC reports in hand, proponents of the climate debate claim a preferential position in the debate. Opponents try to reopen the political debate by magnifying uncertainties and imperfections in climate science.

In the post-Climategate discussion and the unearthing of faults in the fourth IPCC report the linear model has been harshly attacked, yet also strongly defended and upheld. Especially the PVV (Party for

Freedom) has dismissed the IPCC as an activity driven by left-wing political activity. The government side defended the linear model. To clean up the blemished blazon of the IPCC – that is, to restore the linear interaction model between climate politics and science – national and international political bodies ordered an independent evaluation of its procedures and practices.

Given the intense criticism, repairing the technocratic model by evaluating the IPCC is a logical and good step to take. A good picture of the status of climate science is in fact an important precondition for prudent domestic and international climate policies. Still, more is needed. The basic weakness of the linear model is that it underexposes the scientific as well as the political dissent. Both the scientific and the political climate debate need more space and attention for diversity and uncertainty in knowledge and views. To this end, it is necessary to make climate science less political. This can be accomplished by offering room for dissent within climate science and communicating about it with policymakers. An excessive dependence of science and policy should also be prevented. The political climate debate would benefit from clarification of the political values and visions that are at play in climate change. The climate debate could be expanded by paying attention to socially attractive development perspectives rather than doomsday scenarios only. The growing focus on climate adaptation also has the power to highlight and expand the political climate debate.

**Climate change in the media**

The written and edited press gives the Dutch public comprehensive and balanced information about climate change and the societal and political debate surrounding it. The Dutch media pay attention to the political and scientific debates. News coverage about climate science can be called nuanced. The attention for the political process focuses mainly on the international debate that unfolds primarily around the UN climate summits. News coverage about the Dutch political debate on climate change remains far behind.

# Content

# 1 Uncertain times for the climate debate

*Jeroen P. van der Sluijs, Rinie van Est, Monique Riphagen*

Climate change is an important issue for society, and it is surrounded by much public, political and scientific debate. The laborious climate negotiations of Copenhagen attest to this. The emails hacked right before the climate summit in Copenhagen (known in the media as 'Climategate') and the recent discovery of various errors in the climate reports of the Intergovernmental Panel on Climate Change (IPCC) have also led to much ado in the media and the parliamentary debate. Questions have emerged with regard to the scientific quality of the IPCC reports and the adequateness of the peer review process. Doubts have also arisen about the independence of some influential climate scientists. To what degree does climate science retain its impartiality with respect to political, economic, institutional and other interests?

This sort of criticism puts the legitimacy of and the confidence in scientific knowledge as input for climate policy and politics under pressure. By now, the political arena is demanding an evaluation of the work of the IPCC at a national as well as an international level. For example, the UN Climate Science Panel has asked the InterAcademy Council (IAC) to evaluate the IPCC procedures that led to the fourth assessment report from 2007. This evaluation is led by Robbert Dijkgraaf, president of the Royal Netherlands Academy of Arts and Sciences (KNAW) and his colleague Lu Yongxiang, president of the Chinese Academy of Sciences.

Because policy-oriented climate science works in a political context, it is important not to limit reflection to the methods of climate science but to involve the public and political debate about climate change in this reflection. This is about asking questions such as: How is politics dealing with the countless scientific uncertainties surrounding climate change? How does the national and internal political community inform itself about scientific knowledge related to climate change? How do scientific consensus and dissent each get a place in the political discussion, and how does the political arena deal with it?

In this report we thus investigate the interaction between climate politics and climate science. To that end, we describe the Dutch parliamentary debate about climate change from the 1970s up to now. We also describe the political role of policy-oriented climate science. In this way we search for ways to better safeguard the necessary interaction between politics, science and society from a democratic perspective.

## Politics and science, stuck with each other

The basic premise of this report is that when it comes to the climate issue, politics and science are stuck with each other. Science is of course a discipline a world away from politics. Politics are about the confrontation between ideals, world visions and future scenarios, as well as about weighing interests, formulating convincing arguments, the struggle for power, and reaching compromises. Science means acquiring objective knowledge in a systematic manner. This is done with controllable and reproducible research methods for the collection of data in combination with the formation of falsifiable theories to interpret those data. Still, science and politics are not entirely separate from each other – and this certainly applies to the climate issue, where next to a scientification of the political debate we also observe a politicisation of science. Both processes go steadily together.

A scientification of the political debate takes place because politics are dependent on scientific knowledge. Climate change actually involves complex and abstract problems; we do not experience its

causes and consequences immediately and directly. Insight in this respect depends on an understanding of the climate issue based on the natural sciences and the interpretation of satellite images, ice drillings, tree rings, historical studies, climate models, atmospheric measurements, solar radiation, etc. Scientific knowledge plays a key role in the political debate about climate change. Policy is developed and legitimated on the basis of this knowledge. In turn, policy-oriented climate science is always shaped starting from a political context or agenda. The results thus already have a pre-determined political significance.

To give an example: the IPCC was founded in 1988 by the United Nations. Its first assessment report (1990) formed the scientific basis under the Framework Convention that was signed in 1992. This put climate policy high on the national and international agenda. The main goal of this Convention – established in article 2 – was to stabilise concentrations of greenhouse gasses in the atmosphere at a level that prevents dangerous anthropogenic interference with the climate system. This level must be reached within such a sufficient time frame that ecosystems are allowed to adapt naturally to climate change, the food production is not threatened, and the economy can develop in a sustainable manner (read: is not disrupted by excessively interventionist climate policy). This politically determined goal has strongly guided the research agenda of climate scientists and the work of the IPCC. Since then, much of the research has focused on generating knowledge that can help make that goal operational and achieve it. Leading research questions have been: What is the maximum admissible degree of climate change? How far do emissions have to be reduced? And along which time path and with the deployment of which options must this be achieved? Only in the last five years has the question of how society can adapt to climate change (the adaptation question) also become of great interest and has been stimulated by demand-oriented research programs.

Because politics gives science a main role in determining good policy, science ends up at the heart of the political conflict. In other words, science politicises. Tensions in the current public and political debate are raised by climate alarmists, who take a warning tone, and climate sceptics, who relativise these warnings. Both camps appeal a great deal to scientific research. According to climate alarmists, climate change is a fact and the future of humanity is at stake (Monbiot, 2007). They believe the risks are too great to postpone decisions about solution strategies until there is more scientific certainty. If we underestimate the risks and act too late, we could be hit by climate disasters. In that case, the most important question is: can the climate change that is caused by human actions be stopped at this point? Climate sceptics, on the other hand, posit that human influence on the climate is limited and that climate change is a phenomenon common throughout the ages, to which man and nature have always been able to adjust. They point to the risk of overestimating the climate problem and, for example, banning all fossil fuels, whereas it might turn out after the fact that it wasn't necessary to do that. Society is then deprived of the advantages that these energy sources offer. Political and economic interests play an enormous role here, because the current world economy runs largely on fossil fuels.

## Coverage of the report

This report on climate change aims at providing insight into the complex interaction between science, policy and politics, and society (in the Netherlands). We will also be searching for new ways to look at the interface between climate policy and climate science and, where possible, improve it.

First we will explore the scientification of the political climate debate. We will examine how Dutch politics has dealt with scientific uncertainty and pluriformity in the terrain of climate change in the last 40 years. We also ask ourselves how the climate policy to be discussed is motivated and legitimated within the parliamentary debate, and what role science and especially the IPCC play here.

We will also discuss the politicisation of science, describing how scientific knowledge about the climate problem is produced and controlled for quality. We will search for consensus and dissent within climate science, and look specifically at the role that the political context plays in this process.

Finally, we are interested in the role of the media in the climate debate. We want to know how the media reports about the political climate debate (with its alarming and sceptical voices) and the scientific debate (within its knowledge and uncertainties). To get a perspective on this, we examined how several Dutch newspapers and weekly newsmagazines reported about this topic in the last four years – from 2006 to 2009.

### Structure of the report

Chapter 2 describes the historical trajectory of the Dutch parliamentary debate about the climate problem. We will look specifically at the role that scientific knowledge or the lack thereof have played here. How do politicians deal with scientific uncertainties and opposing voices? Hoe does politics legitimate its policy choices when it comes to climate change? We will also look at the international context. In the 1970s the greenhouse effect had already been signalled by the Dutch parliament. It wasn't until the late eighties and early nineties that a real climate policy was developed and politically accorded. At the 1992 environmental summit in Rio de Janeiro the Climate Framework Convention was signed. We offer an overview of the results of the various negotiation rounds within the Framework Convention, from the 1997 Kyoto protocol until the Copenhagen climate summit at the end of 2009. These negotiations keep taking place based on the latest IPCC scientific reports. We also give a picture of the last two decades' climate debate in the Dutch Parliament. In this period, dealing with scientific uncertainties and dissent was determined by the IPCC reports that were interpreted from the precautionary principle. Two characteristic events are the establishment of the Temporary Commission for Climate Change (Van Middelkoop commission) at the end of 1995 and the recent commotion in Parliament about errors in the fourth assessment report of the IPCC.

Chapter 3 aims at placing current societal and political criticism of the IPCC in context and interpreting it. We will discuss the political role of policy-oriented climate science. At an international level the IPCC plays a central role in the policymaking process. The IPCC reports constitute in fact the scientific basis for international climate negotiations. We will also look at the Dutch infrastructure surrounding climate change, then discuss how the editorial and reviewing process of the IPCC actually works, and how new knowledge is, as it were, certified as a robust scientific foundation to build climate policies. This is done within a context of vast scientific uncertainties, continuous developing insights and ongoing scientific debate. For this reason we will also discuss the scientific debate extensively: What do people agree on in terms of science, and which aspects of the climate issue are still being disputed? How does the IPCC deal with a diversity of voices within climate science, and how are uncertainties and dissent presented to the outside world?

Chapter 4 comprises a media analysis. Newspapers, magazines and television regularly discuss climate change. Some of these manifestations have an alarming streak, others are sceptical. Because of the influence of the media on the societal and political debate it is useful to know how the discussion about climate change takes place in the media. Which images of climate change set the tone? To what degree does the debate in the general media reflect the discussion in scientific circles? We examine how four Dutch newspapers (*Algemeen Dagblad*, *NRC Handelsblad*, *de Telegraaf* and *de Volkskrant*) and the weekly newsmagazines *Elsevier* and *Vrij Nederland* gave attention to climate change between 2006 and 2009. We analyse primarily to what degree these media offer a platform for sceptical and alarming voices, and how the media portray climate science.

In the main chapter we present the current state of affairs and examine how the interaction between science and the public and political debate has taken shape in the Netherlands in recent years. How do Dutch politicians, scientists and the media deal with the scientific knowledge and uncertainties surrounding climate change? Are we doing it right, or can possibilities for improvement be identified?

# 2 The scientification of climate politics

*Monique Riphagen, Rinie van Est, Jeroen P. van der Sluijs, Arjan Wardekker*

## 2.1 Introduction

The present chapter offers a historical perspective on the political discussion surrounding climate change. We describe the way in which the political debate has developed in the last 40 years, taking a closer look at the role of science within the political debate. How have politics dealt with scientific uncertainties and dissident voices? We also looked at the international context. Certainly from the late 1980s, the political discussion in the Netherlands was strongly focused on the international discussion. From the late 1980s onwards, there were ample consultations within a UN context about the establishment of an international agreement on global warming. This resulted in the UN Framework Convention on Climate Change (UNFCCC), signed in Rio de Janeiro in 1992. Another milestone in the history of the Kyoto protocol, signed in 1997, came about as a development of the first phase of this Climate Convention. The last climate summit, held in late 2009 in Copenhagen, where the second phase of the Convention was central, is still fresh in everyone's memory.

We will describe the political debate about climate change and the interaction between politics and science in the following five periods:

1. Political signalling of the greenhouse effect (1970s)
2. Climate change on the political agenda (1980s)
3. Domestic/international precautionary decision-making (1987–1994)
4. Implementation of Climate Convention, Kyoto phase (1995–2005)
5. Implementation of Climate Convention, Copenhagen phase (2006–present)

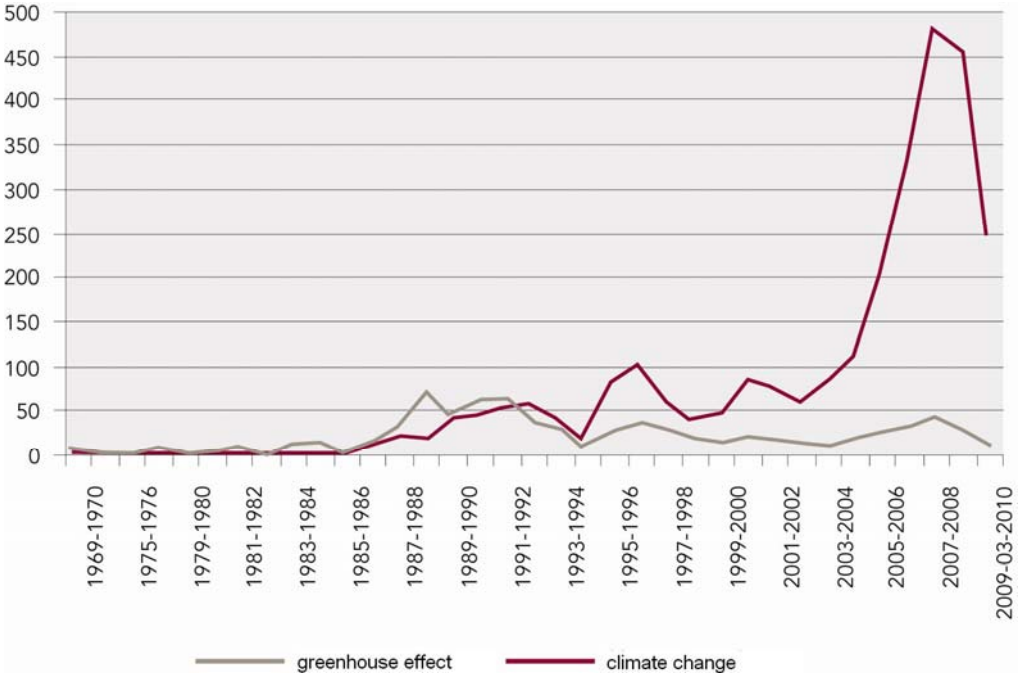
**Methodology**

For our analysis of the Dutch political climate debate from 1970 up to now, we studied the parliamentary debates and discussed parliamentary documents from this period. To that end, we used parliamentary records and documents from 1970 to 2010. This material can be found on the website www.statengeneraaldigitaal.nl (up to 1995) and in the Parlando system (from 1995).
We searched for the terms 'broeikasteffect' (greenhouse effect) and 'klimaatverandering' (climate change). In the seventies and eighties the climate problem was identified mainly with the term greenhouse effect; starting in the nineties it gradually transitioned into the term 'climate change'. Figure 1 shows how many records, documents, interpellations and motions were brought to the fore in the specific parliamentary year using these search terms. The results of both terms cannot be added up because in some documents or debates both were used.

Given the large number of hits, not all references in Parlando were examined comprehensively. We made an estimate of the relevance of the debates and documents in relation to the debate about climate change, looking specifically at the degree to which the debates offer insight into various

political positions in the discussion, such as climate alarmism and scepticism. Debates about other topics in which climate change was a secondary discussion were not analysed. This applies chiefly to documents and records about the topic of energy transition. In the 1990-2010 period many reports, appendices and documents were published about the implementation and effectiveness of climate policies. These were analysed to the degree that they give input to the political debate.

Figure 2.1 Frequency of occurrence of the terms 'greenhouse effect' and 'climate change' in Dutch parliamentary documents, actions, interpellations and appendices.




## 2.2 Political signalling of the greenhouse effect (1970s)

*'What is know about this greenhouse effect? Is it really so alarming? For a lay person it certainly sounds very alarming, but is this really the case? Do the experts agree on this?'*

(Jaap Boersma, ARP (Anti-Revolutionary Party) parliamentarian (Handelingen TK 1969-1970))

Climate science emerged as a scientific discipline in the 1960s (Schneider 2009). In the early seventies the first scientific signals that something was going on with global warming reached the Dutch Parliament. In a parliamentary debate about the Air Pollution Act, SGP (Reformed Political Party) parliamentarian Van Rossum mentioned the link between carbon dioxide and water vapour, which are released when burning fossil fuels in the atmosphere. Van Rossum indicated having read that 'in the last century $CO_2$ levels have risen by more than 10%'. He asked himself whether this could lead to a certain greenhouse effect that can negatively influence the atmosphere as such. Parliamentarian Boersma from the ARP also contended in this debate that 'one … could posit, slightly dramatising, that if we … continued another 50 to 100 years, the globe could perhaps be one big greenhouse …' (Handelingen TK 1969-1970, p. 3937). He was vocal about wanting to know present and future risks. The greenhouse effect had been signalled by the political arena, but was still too new and unknown a topic for further debate to be held. This changed in the 1980s.

## 2.3 Climate change in the political agenda (1980s)

*'The expected increase of $CO_2$ levels in the atmosphere will lead in the coming century to radical and unavoidable environmental effects on a worldwide scale. Existing uncertainties make it impossible to indicate the exact nature and scope of these environmental effects at the moment.'*

(Gezondheidsraad (1983, p. 159))

In the 1980s the greenhouse effect was put on the table on national and international political agendas, and was recognised as a problem. At an international level, the Organisation for Economic Cooperation and Development (OECD) created a work group to conduct further research into the $CO_2$ issue.

### The White Paper on Coal and the greenhouse effect

In the Netherlands, the greenhouse effect got attention within the politically-loaded discussion about the Dutch energy supply which had started in the 1970s. This involved, among other things, the choice between the use of more coal and the deployment of nuclear energy. As a supporter of nuclear energy, the VVD (People's Party for Freedom and Democracy, a right-wing-liberal party) shed light on the severity of the greenhouse effect. In the discussion about the Note on Coal in 1980, the VVD opined that large-scale reintroduction of coal is not advisable unless there is more clarity about the scope of the carbon dioxide problem and the solutions to it. According to the party, coal should be at least as safe as nuclear energy. According to the PPR (Political Party of Radicals, a left-wing Christian and green party) too, $CO_2$ can become a harsh limiting condition when it comes to whether or not to use coal.

VVD minister Ginjaar of the Ministry of Public Health and Environmental Protection adopted this standpoint. He recognised that in addition to advice about the risks of nuclear energy there was also – in the context of the discussion about the White Paper on Coal – a political need for advice about the risks of coal use (Dinkelman 1995). For this reason, Ginjaar asked the National Health Council for advice on the carbon dioxide issue. The report of the Health Council was offered in 1983 to Pieter Winsemius (1982-1986), by then minister of the new VROM (Housing, Spatial Planning and the Environment) department. The main conclusion is the beginning quote of this section. There was a plea for more research and advice to the government (Dinkelman 1995). According to the report, halting or strongly reducing $CO_2$ emissions were the only preventive option. The international context of the problem was signalled. As a consequence, an interdepartmental workgroup was created that announced a tri-directional policy: 1. getting national and international awareness of the problem on the political agenda; 2. stimulating scientific research to reduce the uncertainties and determine whether measures are needed; 3. taking measures.

In the second half of the 1980s, political interest on the climate issue grew. In debates about estimates on air quality politicians referred regularly to the greenhouse effect or $CO_2$ problem. This was also on the map as a problem in policy terms. In the Indicative Environmental Multi-year Program (IMP) 1986-1990 the $CO_2$ problem was discussed for the first time as a separate topic. According to the IMP the causes were clear and lay in the use of fossil fuels by industrialised countries. Scientific advice and policy notes about taking measures, as well as the second advice from the Health Council in 1986, were more cautious. Taking measures was seen as politically and economically unattainable. Because of the major interests concerned with energy policy in each of the countries involved, a common prevention-oriented policy did not seem possible in the foreseeable future – to the degree that it could ever be possible (Indicatief Meerjarenprogramma Milieubeheer 1986-1990,1985) (Notitie Klimaatverandering door $CO_2$ en andere sporengassen als methaan, 1985). Politicians took this advice. Even though the greenhouse effect was accepted by politicians as a serious environmental problem, Winsemius considered that the frameworks to give it policy-oriented attention were still lacking (Dinkelman 1995). His successor, VVD

minister Nijpels (1986-1989), also answered parliamentary interpellations by stating that there were no wide agreements or international policies yet to combat the $CO_2$ problem. Hence at this stage policy was geared mainly towards influencing the international political agenda.
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## 2.4 Domestic/International political precautionary decision-making (1987–1994)

*'During the 1988 climate conference in Toronto, several scientists proclaimed simultaneously that something was going on. They were more or less converted, stating: "Our insights have deepened, we just know". A climate convention was signed at the 1992 environmental summit in Rio de Janeiro. This agreement was a formality at that point; the Parliament did not realise what was actually in store – in hindsight, it was actually shameful'.*

(Eimert van Middelkoop (Slob 2006))

In the 1987-1994 period global warming came to be high on the international political agenda. Political decision-making was taking place at a domestic and international level. This period starts with the groundbreaking environmental report *Our Common Future* in 1987 and closes with the materialisation of the Climate Convention and its ratification in 1994.

### Brundtland report, Toronto and establishment of the IPCC

The 1987 report *Our Common Future* of the United Nations World Commission on Environment and Development (WCED), led by Gro Harlem Brundtland, gives a worldwide feeling of urgency for the tackling of environmental problems. In the Brundtland report a link was established for the first time between economic growth in the West, global environmental problems, and poverty and underdevelopment in the Third World. Environmental problems were explicitly seen as moral problems. The Brundtland report also meant a breakthrough for the concept of sustainable development, which is defined as a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. In this context, the precautionary principle is pushed to the foreground. This entails that if there is a chance of irreversible damage, a lack of full scientific proof may not be used to postpone measures. In this way the Brundtland commission brought moral notions of international and intergenerational solidarity and of precautionary action into the global environmental debate and thus also the climate debate.

In 1987, during workshops at Villach and Bellagio, the international Advisory Group on Greenhouse Gases (AGGG) proposed a number of climate norms. The AGGG wanted an upper limit for a maximally allowed temperature rise speed of 0.1°C per decade, with a maximum of 1.0 or 2.0°C total temperature rise compared to pre-industrial levels (Rijsberman et al. 1990; Jäger 1990; see also Intermezzo 1). The AGGG submitted these climate norms as input for the *Toronto Conference on the Changing Atmosphere*, which took place in 1988 as a result of political lobbying of the Netherlands and other countries. This is the first time that the climate issue appeared on the political agenda of world leaders. The most important recommendation that the conference produced is that there must be a global climate agreement. Governments worldwide also needed to obtain more knowledge about the Earth's warming before signing a climate agreement. To this end, in 1989 the Intergovernmental Panel on Climate Change (IPCC) was founded. The IPCC itself does not do any research, but has the task of making an overview of the scientific knowledge regarding climate change, its socio-economic impact, and possible solution strategies. It also has to offer advice on elements of a possibly future climate agreement. The first IPCC report from 1990 indicated that it is likely that continued emissions of anthropogenic greenhouse gases would lead to global warming. This first IPCC report provided the scientific input for the climate agreement which was

open to be signed in 1992 at the world environmental summit in Rio de Janeiro (Chapter 3 discusses more in depth the emergence, role, and practices and procedures of the IPCC).

### Concern for Tomorrow, NMP and Note on Climate Change

In the wake of the Brundtland report, the 1988 RIVM report Concern for Tomorrow (*Zorgen voor Morgen*) had a shock effect in the Netherlands – this first environmental investigation had a fairly alarming tone. Thanks to this scientific input, a National Environmental Policy Plan (NMP) was set up in 1989. In it, global warming is prominently named as a global environmental problem. Ambitious goals for $CO_2$ policy were formulated for the first time. In the short term, the government wanted to stabilise $CO_2$ emissions at 1989 levels (VROM 1989, p. 158). For 2010 it wanted to strongly reduce the atmospheric increase of $CO_2$ or even halt it. The goals may have been ambitious, but the policy certainly wasn't. The government wanted to achieve the mentioned goals through measures that are profitable from a cost-considerations perspective, thus opting for a 'no regrets' policy.

The idea behind 'no regrets' is that the uncertainties about the scope of the possible expected climate change are still so great that actually only those measures are justified which simultaneously help solve other problems whose severity is certain. Among the issues about which there was certainty at the time were the depletion of fossil fuels and the dependency on oil-producing countries for transportation fuel. Examples of no-regret climate measures are energy savings through improved efficiency, setting up agreements with businesses, and stimulating savings through subsidies. A measure such as $CO_2$ capture with underground storage does not fit in here: if it turned out later that the severity of the greenhouse effect was overestimated, high costs would have been incurred needlessly for this measure and people would have regretted the investment. An important reason to adopt a no-regrets policy is that, according to the NMP, more far-reaching measures are only useful at a global level. Hence the Netherlands pushed for an international climate convention in which agreements are made about reduction of greenhouse gasses, reforestation and an international climate fund. There was also a plea for more research. The NMP wanted a national research program of global air pollution and climate change (VROM 1989). Parliament extensively debated the NMP. Some parties called for a strong climate policy (Handelingen TK 1989-1990). This lead to a sharpening of the goals in the NMP+ from 1990.

The scientific information from the first IPCC report had a direct influence on Dutch climate policies, which guided further elaboration of the goals of NMP+. In the White Paper on Climate Change (VROM 1991) a long-term climate goal was drawn up in which the precautionary principle was central. This presumes that possible severe consequences of climate change must be prevented, even if there is still a lot of uncertainty about the exact nature and scope of those consequences. A common argument is that if you wait until you know for sure, it will be too late to intervene. It is also frequently argued that early implementation of measures is in the end cheaper than taking measures at a later stage or even after the fact. Although there is increasing scientific knowledge about global warming, there are also many uncertainties, as the IPCC report describes. To rule out any risk, the emissions of greenhouse gasses must be brought down to pre-industrial levels, but because it is impossible to do so within 100 years without disrupting the economy, a certain risk is inevitable. Using scientific input and based on the precautionary principle, in this White Paper the government aimed at a stabilisation of atmospheric $CO_2$ levels before the end of the 21st century at a level far below a doubling of pre-industrial levels. This means accepting a maximal rise of average world temperatures of 2°C compared to pre-industrial temperatures. It follows that by 2010 global emission of greenhouse gasses would have to drop by 50% compared to 1990.

### Climate debate in Parliament

With the increasing international attention for environmental problems and climate change, attention towards these problem also grew in the Dutch Parliament. In 1988 the RPF (Reformatory Political Federation) posed several critical questions about the pronouncement of Prof. Schuurmans, chair of the Royal Netherlands Academy of Arts and Sciences (KNAW) Climate Commission, Royal Netherlands

Meteorological Institute (KNMI) meteorologist and VROM (Housing, Spatial Planning and the Environment) adviser – that the described consequences of the greenhouse effect were 'utter nonsense'. According to VVD (People's Party for Freedom and Democracy) Minister Ed Nijpels there really was no difference of opinion and Schuurmans wanted mainly to warn against information in the media that had insufficient scientific foundations. Nijpels pointed to major uncertainties in scientific knowledge that can go both ways: the consequences can be less severe or actually turn out to be worse. He also appealed to the precautionary principle. Precisely because of the scientific uncertainties we should start tackling the problem now already, he argued. If we wait for more scientific certainty, the possibility to confront the problem will decrease (Aanhangsel Handelingen TK 1988-1989, p. 321). This is a discussion that would be frequently repeated in future years.

During this phase, sceptic voices that doubted the existence of a climate problem also reached the political community. From various political sides there were doubts about the need for a far-reaching climate policy. Parliamentary Janmaat of the Centre Democrats (extreme right wing party) blamed the left of misusing the environment to burden citizens with fees and taxes in order to generate extra income. 'We think that the environment is not in such bad shape. In the month of February we noticed no 'environmental blanket' covering our country. In this month the environmental minister certainly did not intensify his policy. We have seen nothing resembling a greenhouse effect. In short: we find that the minister does not have a realistic picture of things, to put it in friendly and diplomatic terms' (Handelingen TK 1990-1991, pp. 55, 3194). Janmaat also criticised Dutch Labour Party (PvdA) environmental minister Alders: 'Mr. Alders has already risked saying in Washington that within 100 years the temperature will rise by four degrees … What a pity for this Foreign Minister that there is little evidence of the greenhouse effect in recent months. That isn't an argument to defend Kok's gasoline tax either' (Handelingen TK 1990-1991, pp. 92, 5239).

Labour Party parliamentarian Zijlstra also questioned the greenhouse effect in the Upper House of Parliament, by pointing to scientific uncertainties. He did not believe that higher emissions of $CO_2$ would lead to global warming and rising sea levels (Handelingen EK 1992-1993, pp. 22, 857-858), and was actually afraid of a re-evaluation of nuclear energy. Environmental minister Hans Alders from the Labour Party pointed to the described uncertainties in the IPCC report and the notion of the precautionary principle in order to take measures despite scientific uncertainties. Because the measures that Alders proposed were also useful in the context of energy-saving policies, Zijlstra agreed.

In the debate about the White Paper on Climate Change, the VVD returned to this discussion. Given the field of tension between scientific uncertainties and the precautionary principle, the VVD pleaded for a realistic climate policy and for a goal that corresponded with the goal from the NMP, stabilisation in 2000 instead of 3-5% reduction in 2000, the goal of NMP+. The political debate was mainly about the planned climate summit in Rio de Janeiro and the carbon dioxide tax proposed by the cabinet (Handelingen TK OCV/UCV 39 1991-1992).

## The Climate Convention

The *United Nations Conference on Environment and Development* took place in Rio de Janeiro in 1992. At this environmental conference the Climate Convention was opened up to be signed. This agreement (internationally known as UNFCCC Climate Convention) made a distinction between annex-I countries (mainly the industrialised world) and developing countries. Annex-I countries were expected to attain a substantial reduction in the emission of greenhouse gasses; developing countries must keep some space for an increase in their energy use and thus their emissions, but in the long term must also limit these emissions. The ultimate goal of this Convention is formulated in article 2:

*'The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous*

*anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.'*

The Convention was thus aimed at preventing a warming of the Earth that is considered dangerous, without damage to the economy. What a dangerous warming of the Earth entails is not indicated though. The Climate Convention has been ratified by 192 countries since 1992, including the Netherlands. Hence nearly every country in the world is part of this Convention that became effective in 1994, when the previous threshold of number of ratifying parties was attained. The United States has also ratified the Climate Convention.

The Convention only established a qualitative climate goal for the long term: stabilisation of the concentrations of greenhouse gasses in the atmosphere. Because we emit more $CO_2$ and other greenhouse gasses than nature can absorb, atmospheric concentrations increase yearly. In order to stabilise the concentrations, emissions must be pushed back very far. The Climate Convention stated that developing countries must get the space to grow in their energy use; this means that in the long term industrialised countries must reduce their yearly emissions of greenhouse gasses by about 80% compared to 1990. This is a very large step, all the more because the economy and the demand for energy do keep growing. To make this step politically more feasible it was decided to split the long way to the end goal of the convention into 'budget periods', where a larger step must be taken in each subsequent period to attain the ultimate goal.

Accordingly, further agreements were needed to reach this goal. Negotiations were continued in a series of meetings of the Conference of Parties (COP; see Table 2.1 for an overview of decisions). The task of the COP was to arrive at concrete agreements about the effort (emission reduction of greenhouse gasses) that each country must produce under the Climate Convention.

Table 2.1 Most important decisions during the negotiation rounds (COP) within the Climate Convention for the 1995–2005 period.

| **Conference of Parties (COP)** | **Most important decisions, 1995–2005 period** |
|---|---|
| COP 1<br>Berlin, 1995 | • Industrialised countries must set up binding emission-reduction goals, developing countries not yet.<br>• Procedural agreements. |
| COP 2<br>Geneva, 1996 | • Guidelines for yearly national communications on greenhouse-gas emissions.<br>• For industrialised countries, *quantified emissions limitation and reduction objectives* (QELRO's) are established. |
| COP 3<br>Kyoto, 1997 | • Binding emission-reduction goals for industrialised countries until 2010.<br>• Flexible mechanisms (Joint Implementation, Clean Development Mechanism and emissions trading).<br>• Forest sinks may count under certain conditions. |
| COP 4<br>Buenos Aires, 1998 | • Buenos Aires plan of action: strengthen financial mechanism of Kyoto.<br>• Development and transfer of emission-reducing technologies. |
| COP 5<br>Bonn, 1999 | • Adjusted guidelines for emission reporting.<br>• Capacity-building, transfer of technology between countries. |
| COP 6 The Hague, 2000 & COP 6-bis | • Rules for the flexible mechanisms. |

| | |
|---|---|
| Bonn, 2001 | • Capacity-building in developing countries and countries with economies in transition (like the former Soviet Union). |
| COP 7<br>Marrakech, 2001 | • Rules for ensuring compliance.<br>• Sink-accounting methods within CDM.<br>• Marrakech Ministerial Declaration for Johannesburg Earth summit. |
| COP 8<br>New Delhi, 2002 | • Delhi Ministerial Declaration underlines importance of Johannesburg. |
| COP 9<br>Milan, 2003 | • Institutional strengthening and sharpening of procedures for Kyoto protocol and entire convention.<br>• Revised guideline for emission reporting.<br>• Establishment of Special Climate Change Fund and Least Developed Countries Fund (technology transfer and adaptation projects). |
| COP 10<br>Buenos Aires, 2004 | • Detailed resolutions about development and transfer of technologies, sinks, financial mechanisms, reporting obligations, capacity-building, adaptation, education, the needs of the least developed countries, and future policy strategies. |
| COP 11<br>Montreal, 2005 | • Strengthening the role of the Global Environment Facility (GEF) for the financial instruments of the Climate Convention.<br>• Procedural agreements for a protocol for the second budget period of the Climate convention, which starts after 2012. |

## 2.5 Implementation of Climate Convention, Kyoto phase (1995–2005)

At an international level this period was about translating the Climate Convention into a protocol that could guarantee its practical execution. It involved, among other things, concrete carbon dioxide reduction goals per country. This resulted in the signing of the Kyoto protocol in 1997. To prepare for the climate conference in Kyoto, the Dutch Parliament organised a Temporary Commission for Climate Policy. In this period the Netherlands was quite immersed in the implementation of our national climate policies. This was a cumbersome task. Goals were not being attained (Van der Sluijs et al. 2001). $CO_2$ emissions in the Netherlands kept rising instead of dropping. The period concludes with the taking effect of the Kyoto protocol in 2005.

### Temporary Commission for Climate Policy: focus on precaution

As international negotiations in preparation for Kyoto made progress, the Dutch Parliament started to feel increasingly uneasy. It actually agreed to the implementation of climate policies, whereas in fact little was known about this very complex problem (see statement of Eimert van Middelkoop at the beginning of the previous section). In 1995 the VVD asked for the opinion of environmental minister De Boer (1994–1998) about temperature increases due to increased solar activity and cooling of the Earth due to increased cloud formation. The minister answered that the second assessment report of the IPCC from 1995 described that the influence of man on global warming is greater than the influence of the sun. The influence of man on the climate is scientifically incontrovertible, according to the minister. The Dutch standpoints in the international negotiations, said the minister, were based on IPCC reports (Aanhangsel van de Handelingen TK 1994-1995). Because Parliament realised that it has little insight into the climate problem it was decided in 1995, in preparation for the Kyoto climate conference, to establish a Temporary Commission for Climate Policy, to be led by the GPV (Reformed Political League) parliamentarian Eimert van Middelkoop.

The goal of the parliamentary inquiry was to obtain more scientific information about certainties and uncertainties, causes and consequences of the climate problem, as well as to find out whether the IPCC reports, on which climate policy is actually based, provides a sufficient foundation to this end. The commission indicated wanting to give a value judgment about the scientific state of affairs and not wanting to be an executioner with respect to scientific truths and untruths. Although according to the commission a significant group of scientists raised questions about the analysis of the physical climate process and the used models, nearly all the experts pointed to uncertainties and gaps in the knowledge about the climate system. However, it is the task of politics to establish policy lines and make political choices on the basis of the best available information and without an absolute certainty (Tweede Kamer 1996). 'Otherwise', stated the commission, 'the leadership could have left the issue up to the experts for the sake of convenience' (Tweede Kamer 1996, p. 19). In the report of the Van Middelkoop commission the precautionary principle is central a starting point for policy.

The commission concluded unanimously that according to science the emission of large amounts of $CO_2$ lead to climate change with possibly sweeping and dangerous effects. Major global emission reductions were needed, especially in industrialised countries, to stabilise the level of greenhouse gasses. According to the commission it was therefore necessary to establish emission reduction goals, and the Netherlands should have a goal such that 'in international negotiations a maximal result is attained. The total emissions of our country are less than 1% of global emissions. A major emission lowering in the Netherlands must be accompanied by a comparable lowering, especially in the industrialised countries' (Tweede Kamer 1996, p. 2). The Netherlands wanted to keep pace at an international level. The commission stated that there is a large potential in the Netherlands for considerable emissions reduction. A reduction of 30 to 40% by 2020 compared to 1990 levels was possible, and could be realised through energy savings in businesses and households, application of solar and wind energy, and biomass with eventual $CO_2$ storage as interim solution. The commission made a plea for the Netherlands to follow a twofold policy by 1. promoting an emissions reduction by industrialised countries mainly of $CO_2$ in international climate negotiations; and 2. adopting a national reduction goal and setting up policies.

## Difficult implementation of climate policy

The parliament took over the conclusions of the report, as a result of which the political discussion no longer was about whether there was a climate problem but about what we would do about it. A stronger climate policy was demanded. In the meantime, implementation of the already existing policies was not going very well. Instead of the planned $CO_2$ emission reduction of 3%, RIVM (National Institute for Public Health and the Environment) figures show that in 2000 there would be a rise of 6.8%. The cabinet set up a $CO_2$-reduction plan and put down extra money for new measures. In the political debate following the Second Note on Climate Policy there were various motions to determine climate policy after 2000. The Parliament also pleaded for an international goal of 2% $CO_2$ emission reductions per year after 2000 (what would come down to 33% in 2020), short-term measures to be able to arrive at the desired reduction of 3% in 2000, and international deployment of wind and solar energy. The need for stronger climate policy, at least based on the wish to stabilise $CO_2$ concentrations at acceptable levels, would ensure that policy measures went further than the no-regret measures from the 1980s – as stated by the second assessment report of the IPCC (1995) too. In addition, the international political community was about to sign the international agreement in Kyoto. Hard political choices had to be made.

## Parliament asks for more scientific certainty

Although Parliament had done research shortly before this into the scientific uncertainties within the climate debate, it remained critical. Anticipating Kyoto, it longed for more scientific certainty about the role of man in global warming. Given the scientific uncertainties, a motion of the Socialist Party (SP) was accepted in order to have the KNAW do research into the effects of the human contribution to $CO_2$ in the atmosphere. At the same time, confidence in the established scientific institutes dropped. The VVD expressed criticism with respect to the role of the IPCC. The party posed interpellations in parliament

about the theory that the sun exerts the greatest influence on the greenhouse effect as alternative to the theory of anthropogenic climate change brought forward by the IPCC reports. It also asked about a possible politicisation of the IPCC. The minister answered (just like his respons to the questions of the RPF in 1988) that the sun influences climate but that this is not an alternative explanation for the enhanced greenhouse effect. The minister indicated that the IPCC works independently and that scientific uncertainties exist, but that the cabinet bases itself on the precautionary principle (Aanhangsel van de Handelingen TK 1996-1997).

### Kyoto protocol

In 1997 the Kyoto protocol was established during COP 3. Binding agreements were made about emissions reduction for 37 industrialised countries and the entire European Union. Together they were to lead to a reduction of yearly global emissions of greenhouse gasses by 5.2% in 2010 compared to 1990. It was established that 2010 would not be measured as target year – instead, the average yearly emissions in the 2008-2012 period would be measured. This would average accidental fluctuations in the economy from year to year. Economic crises lead to lower emissions even without measures anyway, but because of their generally temporary character this does not contribute to the long-term goal of the agreement. Reduction goals varied: Canada and Japan would reduce 6%, the US 7%, the European Union and most central and eastern European countries 8%. Australia and Iceland, by contrast, were allowed to grow by 8% and 10% respectively. This differentiation does justice to the fact that circumstances and reduction possibilities vary from country to country. Within the EU , the EU portion is further differentiated. Three 'flexible mechanisms' were determined in Kyoto which allowed countries to realise their emission reductions partially abroad when it is cheaper to do so. Cooperation with another industrialised country, especially in eastern Europe, is known as Joint Implementation. Cooperation with a developing country falls under the Clean Development Mechanism. And then there is emissions trading: countries that reduce their emissions of greenhouse gasses further than the Kyoto obligations impose on them may sell this margin to countries that have trouble reaching their goal.

The Kyoto reduction goals for the Netherlands amounted to 6%. That goal could be attained with reduction of six different greenhouse gasses: carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), perfluorocarbons (PFC's), hydrofluorocarbons (HFC's) and sulphur hexafluoride ($SF_6$ ). Sequestration of $CO_2$ due to changed land use and forestry also counts under strict conditions. In the Netherlands, minister Jan Pronk (1998-2002) got out the Climate Policy Implementation Plan, in which he substantiated how the Netherlands could achieve the 6% $CO_2$ reduction of the Kyoto protocol (Tweede Kamer 1999). The cabinet wanted to attain half of the $CO_2$ reduction abroad by means of the Clean Development Mechanism and Joint Implementation. This means that fewer measures were needed in the Netherlands itself, thus averting social resistance to unpopular measures.

The Kyoto protocol was ratified by 184 of the 196 countries and became effective in 2005 with Russia's ratification. The United States is one of the 12 countries that never signed the Kyoto protocol (but did sign the Climate Convention).

## 2.6 Implementation of Climate Convention: Post-Kyoto phase (2006–present)

*'The misuse that is made [in politics] of science distorts, politicises and perverts that same science, and now we not only must indignantly cry when science falters, we also must search our consciences'.*

(Diederik Samsom, Labour Party parliamentarian (Handelingen TK 2010, p. 4542))

In 2004 national and international preparations started for the follow-up to the Kyoto protocol. This protocol applied only to the first budget period, which goes until 2012. In 2005 procedural agreements were made in Montreal (COP 11) for the creation of a protocol for the second budget period. According to plans, that new protocol had to be established in 2009, be ratified by 2012 and then be implemented. To prepare for a post-Kyoto agreement, European environmental ministers chose a maximal temperature rise of 2˚C as starting point for the policies to be followed (Tweede Kamer 2004-2005a). In this section we offer a picture of the political debate on the follow-up to the Kyoto protocol.

## Parliament starts investigation into climate change

Because the Dutch Parliament wanted to enter into the discussion with the cabinet regarding the Kyoto follow-up well prepared, in 2004 another investigation was launched into climate change as a follow-up to the Van Middelkoop commission. The goal of the investigation was to bring up to date Parliament's knowledge about climate science and international climate policy, given that the state of affairs in both terrains changes quickly. Parliament also wanted to map out policy options for the future, as well as the instrumentarium to be deployed and the corresponding costs and profits (Tweede Kamer 2003-2004). The climate investigation was conducted by the research agency CE, the KNMI (Royal Netherlands Meteorological Institute) and Wageningen University & Research Centre (WUR).

Table 2.2. Most important decisions during the negotiation rounds (COP) within the Climate Convention in the 2006-2009 period.

| **Conference of Parties (COP)** | **Most important decisions** |
|---|---|
| COP 12<br>Nairobi, 2006 | Determining the financial mechanisms.<br>(Special Climate Change Fund and Global Environment Facility) |
| COP 13<br>Bali, 2007 | Timeline established for negotiations about a protocol for the 2nd budget period (after 2012).<br>Establishment of ad-hoc workgroup 'Long-term Cooperative Action under the Convention' (AWG-LCA). |
| COP 14<br>Poznan, 2008 | Fund to help the least developed countries cope with the effects of climate change.<br>Determining REDD mechanism (Reducing Emissions from Deforestation and Degradation). |
| COP 15<br>Copenhagen, 2009 | Determine 2-degree goal as long-term goal of Climate Convention. Developing countries will also be reporting their emissions.<br>30 billion dollars will become available in the coming three years and 100 billion per year starting in 2020. |

*Climate research*

In 1994 climate science was not yet able to establish an explicit and quantitative link between human activity and the observed temperature rise. The effects of climate change had not been observed yet either (Tweede Kamer 2003-2004). The findings of the investigations ordered by the parliament pointed out that by 2004 climate science had more insight into factors that influence the climate. According to the report, the largest portion of the warming since 1950 is probably caused by man. At this point, the expected temperature rise was estimated at 1.4 to 5.8˚C. The effects of climate change, not all of which necessarily have to be negative anyway, could be observed on a large scale, according to the researchers (Tweede Kamer 2003-2004). At the same time it was recognised that there are still many uncertainties and that some scientific conclusions are being doubted. The criticism of climate sceptics on the established science (see Chapter 3) was discussed in the report, but was not shared by the researchers. According to the report, climate policy was not having the desired effect so far: there was no structural reduction yet of the use of fossil fuels – on the contrary: domestic $CO_2$ emissions had increased by 8%. The Netherlands had probably met the Kyoto goals (6% emission reduction) through a

reduction of other greenhouse gasses and reduction of $CO_2$ abroad via Joint Implementation and the Clean Development Mechanism. From the round-table talks organised by Parliament it appears that the conclusions from the research report were widely shared by climate experts, social organisations and representatives from the business community.

*Parliamentary debate*
Although the severity of the climate problem was clear, Parliament expressed that there is still much scientific uncertainty. VVD Parliamentarian De Krom said that '… the complexity of the climate system excludes indisputable evidence; there is no clear cause-effect link. Making predictions is speculative, also because if the Earth's system is very out of balance, processes can take place that are not known yet' (Tweede Kamer 2004-2005b, p. 3 & Tweede Kamer 2004-2005c, p. 3). A related issue was whether the consequences of climate change are more severe than the consequences of an intensive climate policy. Environmental minister Van Geel (2002-2007) appealed, just like his predecessors, to the precautionary principle: 'If there are scientific uncertainties about the degree of risks of climate change, one should act aiming to prevent severe or irreversible damage' (Tweede Kamer 2004-2005b). Economic motives also play an important role in the cabinet's policy. Some parliamentarians were locking horns with D66 (Democrats 66) Economic Affairs minister Laurens Jan Brinkhorst (2003-2006) about annual energy savings that go further than the accorded 1.0%. The minister did not want to go over 1.3%, he considered more than that too expensive. In the end a motion was made to increase the goal for energy savings to 1.5%. International political considerations play a role in parliamentary debates too. Parliament wanted to know what the Netherlands and the European Union must do if other major originators of emissions, like the US and China, did not cooperate with a new climate agreement. This was a major dilemma, because only a globally ambitious climate policy can produce enough of an effect. At the same time, a level playing field was desirable from an economic perspective.

## Dutch climate policy from an international perspective

In preparation for the post-Kyoto protocol, the Dutch cabinet conducted additional interdepartmental policy research (IBO) in 2006 on future international climate policy. The policies focused on reducing greenhouse gasses (mitigation) as well as on adjusting to climate change (adaptation). That same year, environmental minister Jacqueline Cramer (2007-2010) presented her policy agenda 'Clean and Efficient', which formulated ambitious new policy goals. An example that fits the adaptation line is the establishment of the second Delta Commission – the first Delta Commission was established after the disastrous inundations of 1953.

*Future International Climate Policy*
The IBO workgroup 'Future International Climate Policy' was made up of representatives of different ministries, the Netherlands Environmental Assessment Agency (MNP), the Netherlands Bureau for Economic Policy Analysis (CPB), and two members with solid knowledge of climate problems. According to the IBO workgroup, only an internationally coordinated approach offered a good chance to limit Earth warming. The European Union had to take the lead here and pull along major emission producers like the US, Japan, Russia and emerging economies (IBO, 2006).

The cabinet endorsed the advice of the IBO workgroup. Values and starting points like stewardship, international solidarity, enlightened self-interest and 'the polluter pays' formed the connecting thread in the cabinet's reaction. The cabinet listed several building stones for an international climate policy: 1. Temperatures may rise no more than two degrees; 2. Annex-1 countries, including the US, must take the lead, but an expansion to emerging economies is necessary; 3. A global emissions market must be set up; 4. The transfer from technology to developing countries and the adaptation in developing countries must be supported by the rich countries; 5. Further deforestation should be prevented and emissions from aviation and maritime transportation must be tackled. The Netherlands will become involved in this process in an international context (Tweede Kamer 2007-2008a).

*Clean and Efficient*
Dutch climate policy was following the stipulations of the Kyoto protocol and the ensuing agreements in the European Union. In the work program 'Clean and Efficient: New energy for the climate' of September 2007 the cabinet described the ambitions of the Netherlands (Ministerie VROM et al. 2007):

- Reducing emissions of greenhouse gasses by 30% in 2020 compared to 1990.
- Doubling the tempo of energy savings from 1% to 2% per year.
- Increasing the share of sustainable energy in 2020 from 2% to 20% of the total energy use.

There was input to counteract climate change through a real change in production and consumption. To that end, agreements and conventions were made with various sectors, provinces and municipalities. The second pillar was international climate diplomacy, given that the Netherlands itself only emits 0.5% of the total amount of $CO_2$. The third pillar was the simulation of innovation in order to attain as many results as soon as possible – for example, innovation in the fields of water management and energy. In terms of energy, the government aimed for a transition to sustainable energy management in order to further limit $CO_2$ emissions. The transition policy was included in the fourth National Environmental Plan and was shaped in the Energy Transition program. Water management policy aimed at strengthening the 'weak links' in the coast and at having extra space for rivers to catch high flow volumes. This further reduced the risks for the Netherlands. In the long term, more innovative situations would be needed.

*Delta Commission*
In September 2007 the second Delta Commission was established, to be led by Cees Veerman. This commission was asked to develop a long-term vision of the way in which the Netherlands could stay safe from high waters until the end of the 21st century despite the expected climate change (Deltacommissie 2008). Another goal of the Delta Commission was to convey a sense of urgency. The naming of the second Delta Commission, which refers to the inundation disaster from 1953, already appeals to this. In 2008 the Delta Commission published the report *Working together with water*. The commission stated that future water management policies will have to deal with uncertainties and called for early anticipation of higher water levels and investing in order to be ahead of the uncertainties, while preserving the necessary flexibility. In its advice the commission took extreme scenarios into account: a rise of sea levels of 0.65 to 1.30 meters towards the year 2100, and 2 to 4 meters by 2200. The cabinet adopted the most important conclusions and considered policies. The Delta Commission had to process a great deal of criticism from the media. Critics reproached the Commission of exaggerated climate alarmism. The reality value of this sort of future projections was put into doubt, and there was fear that acting upon them would cost society too much money.

## Difficult implementation of Kyoto

Implementation of the Dutch climate policy as established in *Clean and Efficient* was difficult. The Kyoto protocol demanded that the Netherlands reduce its greenhouse-gas emissions by 6% by 2012 compared to 1990. As mentioned previously, the Netherlands was realising about half of its Kyoto goals abroad. At home, the Netherlands did not want to emit more than 220 Mton greenhouse gasses per year in the 2008-2012 period. For this 'domestic task', target values were set for $CO_2$ savings in the construction, agriculture, traffic and transportation, and industry and energy sectors, and for the other greenhouse gasses. In early 2008 an urgent debate took place after minister Cramer let Parliament know that $CO_2$ emissions in the Netherlands would increase by 3% during the cabinet period. This would be compensated by the purchase of $CO_2$ abroad, but conflicted with the ideas behind *Clean and Efficient*. Social and environmental organisations were demanding climate legislation, but the minister remained loyal to her policy. The recession seems to be helping the Netherlands somewhat. According to *Milieubalans 2009* the Netherlands will very probably meet its Kyoto obligations. Partly due to the recession the average yearly emissions in the 2008-2012 period will lie at about 2% to 11% under the levels of the baseline year 1990 of the Kyoto protocol. Because of this, the government will need about half of the foreign-purchased emission rights to meet the Kyoto obligations.

## Political reactions to the fourth IPCC rapport

In November 2007 a new IPCC report appeared, assessment report AR4. According to this document, scientific certainty about anthropogenic influence on the climate is increasing. Global warming also seems to be happening at a faster pace than previously thought. This scientific message was introduced directly into the political debate. GroenLinks (GreenLeft) called upon the ministers of Housing, Spatial Planning and the Environment and of Development Assistance to make more radical choices in the execution of climate policy and strengthen their international plea for a UN adaptation fund for developing countries. On the eve of the 2007 climate conference in Bali, GroenLinks called upon Minister Cramer to make out a case internationally for solid agreements. GroenLinks wanted a $CO_2$ emissions reduction from rich countries of 25-40% by 2020, which scientists claimed is necessary to prevent temperatures from rising by more than two degrees. Extensive new research was showing that climate change can become manifest in more extreme ways than mentioned in AR4. At the request of GroenLinks, PvdA minister Jacqueline Cramer allowed research to be conducted into such extreme scenarios. The PVV, by contrast, asked the environmental minister to postpone drastic climate policies until there was more certainty about any climate changes (Aanhangsel van de Handelingen TK 2007-2008). Quoting science, minister Cramer answered that according to AR4 the scientific evidence for climate change has become stronger again. The PVV made a motion requesting the cabinet not to become more involved than other major world players, given that global climate policy only benefits from a joint approach and the Netherlands doesn't have to take the lead within the EU (Tweede Kamer 2007-2008b).

## Political climate debate preceding the Copenhagen climate summit

Before the Copenhagen climate summit was held in December 2009 (COP 15), politicians as well as scientists made themselves heard. Shortly before the summit, Climategate caused quite a commotion; this was followed by a parliamentary debate about the role and legitimacy of the IPCC and the fourth assessment report.

*Alarming and sceptic voices from the scientific community*

Shortly before the climate summit, in November 2009, the investigation about extreme scenarios ordered by the minister in 2007 came out. The PBL (Netherland Environmental Assessment Agency), KNMI and WUR analysed the scientific literature about climate change from 2006 up to 2009. The 2007 AR4 of the IPCC presented an assessment up to 2006, thus the latest scientific insights were not processed into that document. The report of, among others, the PBL, concluded that AR4 presented the scientific insights properly and still forms a solid basis for decision-making. There were however indications that climate change is going faster than indicated by the IPCC and could also have more serious consequences (PBL, KNMI, WUR 2009). That conclusion had been drawn earlier that year. In March 2009 a scientific congress took place of more than 2000 climate scientists and economists, who got the message out that worldwide emissions appeared to be worse than the scenarios in AR4 showed. Scientists foresaw a temperature rise of more than two degrees. These two degrees could cause large-scale disruptions even during this century, therefore doing nothing was not a realistic option: measures must be taken at a global level, for the short and the long term. Scientists presented their conclusions to the Danish prime minister Rasmussen, host of the climate summit in December 2009 (NRC Handelsblad 2009). In this way, scientists exerted moral pressure on politicians to enter into a Copenhagen Accord. At the same time, climate sceptics were holding a congress in New York: 800 scientists and other actors met to discuss whether there is a climate problem at all.

*Polarisation in the political climate debate*

There was polarisation in the Dutch political debate. In the parliamentary debate shortly before Copenhagen (Tweede Kamer 2009-2010a; Tweede Kamer 2009-2010b) the progressive parties, partly based on recent scientific information, made alarming pronouncements and pleaded for a strong Dutch input in climate negotiations. They called upon the moral principle of intra- and intergenerational justice. Samsom of the PvdA stated: 'This [signing of the climate convention] is about much more than just the

environment. It is about the question of whether we are willing to share our future chances honestly with each other, about whether everyone counts, regardless of where on the planet you were born' (Tweede Kamer 2009-2010b p. 3296). Vendrik of GroenLinks stated: 'The climate debate is too often reduced to a technocratic swamp, in which things seem to turn exclusively around complicated reduction percentages, goals and charts, while it should be about people. Climate change is par excellence a social issue: how do we distribute the environmental space on Earth fairly over the generations and among the people here and in developing countries?' (Tweede Kamer 2009-2010b, p. 3303). GroenLinks pleaded for an intensification of Dutch climate policy up to 40% $CO_2$ emission reduction in 2020, but found no supporting minority for this. For the first time in the 40-year parliamentary history the climate-sceptic side was brought forward solidly and consistently by the PVV. The PVV denies the existence of a climate problem, and is against signing climate conventions and implementing climate policy at the expense of taxpayers. The party posed various interpellations about the need for a climate convention (Aanhangsel van de Handelingen TK 2009-2010a; Aanhangsel van de Handelingen TK 2009-2010b). A motion of the party not to spill tax money on the climate problem was not supported by the other parties. Environmental minister Cramer indicated explicitly that the cabinet bases itself on the information coming from the IPCC and not on what it considers a small minority of scientists who disagree with the IPCC.

*Parliamentary debate about Climategate before Copenhagen*
Climategate caused intense commotion on the eve on Copenhagen. E-mail correspondence of climate scientists of the Climate Research Unit of the University of East Anglia in Great Britain were hacked and made available on a website accessible to the public. That correspondence showed, according to the sceptics, that scientific data supporting global warming was dealt with selectively and that certain studies that relativise the climate problem were deliberately left out of the IPCC report (see Chapter 3). Climate science was heavily criticised in Parliament.

The Verdonk Group (Proud Netherlands) posed written questions about Climategate and asked about the likelihood of a temperature drop in the last ten years and the possible policy implications if that turned out to be true (Aanhangsel van de Handelingen 2009-2010). The VVD asked the minister to conduct an investigation into Climategate (Aanhangsel van de Handelingen 2009-2010c). Samsom of the PvdA reacted furiously on the doubts to the integrity of climate science, so close before Copenhagen: 'Sure, while dozens of satellites and thousands of weather stations record the temperature on Earth and the data is placed on websites accessible to everyone, *Proud Netherlands* (a small right-wing party) suspects a conspiracy of a small group of scientists to keep this data a secret' (Tweede Kamer 2009-2010b). According to PvdA minister Cramer there is no reason whatsoever to doubt the reliability of current climate science and the IPCC. Before launching an investigation, when addressing her climate research group she wanted to wait for the inquiry that the University of East Anglia itself was going to conduct into the public accusations in relation to Climategate (Tweede Kamer 2009-2010). The IPCC also launched its own investigation into the content of the hacked emails.

Box 2.1. Official preparation for COP 15

**How did the Dutch input for the climate negotiations in Copenhagen come about?**
The Dutch starting point for the negotiations in Copenhagen is the previously mentioned two-degree goal, which has been central to the climate policies of the European Union since 1996 already and was ratified in 2005 by the heads of government (Van Vuuren et al., 2006). This goal can be traced back to the scientific discussion in the 1990s about the growing climate-related risks of a rising average world temperature (see Chapter 3).

Within the Netherlands the national position to be taken transpires mainly through the interdepartmental Kyoto Protocol Task Group, where representatives of ministries and the

negotiators have a seat. The Netherlands Environmental Assessment Agency (PBL) also participates. Within the negotiations in the context of the Climate Convention, Europe has assumed a joint standpoint, hence member states have to first get to agree on the issues. Right before Copenhagen various formal and informal international ministerial consultation rounds took place, in and outside an EU context. In October 2009 the European Environmental Council decided about the input for COP 15 in Copenhagen. Just like the Netherlands, the EU aimed for a goal of 80% fewer $CO_2$ emissions by 2050. For 2020 the target goals were 20% fewer emissions and 30% if other countries participated too.
This is slightly less ambitious than the Dutch reduction goals of 30%. The EU also wanted aviation to produce 10% fewer emissions by 2020 than in 2005. For maritime transportation a 20% reduction was settled on. The EU also established rules to safeguard that land use and forestry contribute on a permanent basis to emission reductions. In the week before Copenhagen last-minute round-table talks took place of the permanent environmental Parliamentary Commission with scientists, sceptics, representatives of social organisations and the business community, in order to bring their latest insight and message to COP 15.

### Difficult climate summit in Copenhagen

Things were extremely difficult at the COP 15 in Copenhagen. There is a final text, but it is not endorsed by all the participating countries and it is not legally binding either. The idea was to make agreements about the degree of $CO_2$ emissions reductions by each of the 196 participating countries during the second budget period of the Climate Convention (2012-2020). That was not possible. Not even a worldwide ambition level was agreed upon for 2020. In the end, nothing concrete was accorded about deforestation either. Copenhagen shifted all these point to COP 16, which will be held in Mexico later this year. Still, a few important items were settled in Copenhagen. The goal of keeping global warming within two degrees was accepted. China and India also allowed their efforts to reduce greenhouse gasses to be measured in a controllable manner. Finally, financial pledges were made to support climate policy in development countries (20 billion dollars in 2010-2012), and the Kyoto protocol remains effective.

### Climate science further under political fire

When a series of (alleged) errors in AR4 came to light in January 2010, the Dutch debate about the integrity of the IPCC continued after the failure of COP 15. The report states that the Himalayan glaciers will have melted by 2035. It should have read 2350. The mistaken year seems to come from a report of the World Wide Fund for Nature and cannot be traced back to a scientific publication. More errors were discovered in parts of the report that use non-peer-reviewed literature (see Chapter 3). Because domestic and international climate policies are based on the scientific input of the IPCC, in late January the parliamentary debate on this issue was not only about the IPCC, but also climate policies came under fire and doubts about the legitimacy of such policies were raised.

The VVD wanted to temporarily suspend decision-making about new climate policy until further investigation took place into the IPCC. This also applied to water management as proposed in the context of the report of the Delta Commission. The PVV was heavily opposed, claiming that the IPCC is made up of fraudulent and manipulative scoundrels, crooks and profiteers that are tearing at taxpayers' money, and should be eliminated.

D66 (Democrats 66) and the ChristenUnie (Christian Union) appealed to the need for the no-regrets climate policy to point to future problems with security of energy if oil supplies become depleted and security of supply because of our dependence on oil-producing countries. The ChristenUnie pointed out that the legitimacy of climate policy should not only be based on science, but that the additional discussions 'also rest on principles of stewardship, justice and fair sharing' (Handelingen TK 2009-2010c,

p. 4544). Samsom of the PvdA acknowledged blame (see quote at the beginning of this section), stating that ‘politics has ran away with science’. Because politics has ‘drawn scientists into allied and opposing camps’, we ‘ourselves have undermined the neutrality of that science we are now so loudly criticising’ (Handelingen TK 2009-2010c, p. 4541). According to Samsom, this politicisation of science leads to sceptical parties being excluded from climate science. He made a widely supported motion to have the PBL conduct research into the faults in the IPCC report and IPCC procedures.

Environmental minister Cramer was quite outraged about the faults in the IPCC report and stated that one should be able to count blindly on science and that not another single fault should be accepted. She did nuance her position in the daily NRC Handelsblad after many scientists were all over her in public discussions in the media, given that science consists of trial and error and faults are part of the scientific process (Cramer 2010).

## 2.7 Conclusion

In this chapter we asked ourselves how political parties in Parliament dealt with the scientific uncertainties surrounding climate change in the last 40 years. We especially looked at which interaction takes place between science and politics, which substantiation grounds are presented in the debate in order to take policy measures even in a context of uncertainty about the severity and scope of a problem, on which political considerations climate policy is based, and to what degree alarming and sceptical voices get a place in the parliamentary debate.

In the first phase (1970s) the climate problem was signalled by several parliamentarians. Based on various alarming voices from the science field, during this period a number of interpellations were posed about the greenhouse effect. Only in phase 2 (1980s) did the greenhouse effect get a place on the policy agenda. In the political debate the $CO_2$ problem was recognised and played a political role in the energy discussion and the choice between coal-fired power plants and nuclear plants. At the same time, it was said that scientific substantiation of this phenomenon was still too weak. There was also consensus about the starting point at which such an international problem should also be tackled at an international level. Without an international agreement there would only be support for no-regret measures, such as energy savings, which do not affect the international competitive position of the Netherlands.

In the third phase (1987-1994) this context changed dramatically. With the foundation of the IPCC climate science was ascribed a political role. This gave climate science a uniform voice towards national and international policymakers. The conclusion of the first IPCC report from 1990, that continued emissions of anthropogenic greenhouse gases would lead to global warming, created a new political context. In 1992 this report formed the scientific basis for setting up a Climate Convention and also created national and international political support for it. Based on the precautionary principle, the first IPCC report, in combination with the international approach, offered sufficient foundations to formulate and implement climate policy, for Dutch politics too. Because of the scientific uncertainties policies had aimed so far at measures that were needed anyhow for other policy goals, like energy certainty. From the perspective of the precautionary principle, the IPCC report offered a sufficient basis for climate policy that goes further than no-regret measures.

In phase 4 and partially in phase 5, the combination of the precautionary principle and IPCC reports caused interpellations about scientific knowledge and uncertainties related to the climate problem in the political debate to be sidetracked. In other words, the IPCC reports are deployed to depoliticise the political debate. Questions were repeatedly asked in Parliament about scientific information and scientific uncertainties in relation to the climate problem. Such questions come from the entire political spectrum. In phase 4 (1995-2005) Parliament organised the Temporary Commission for Climate Policy, which investigated existing scientific knowledge. This does not take away from the fact that in the ensuing

parliamentary debate the notion of scientific uncertainty plays a central role again. The minister answered that scientific uncertainties surely exist, but that policies are based on the reports of the IPCC and the precautionary principle. These dynamics repeated themselves nearly identically to the parliamentary climate investigation in 2004.

Phase 5 (2006–present) shows a re-politicisation of the political climate debate. This is firstly because climate adaptation has gotten a more solid place in the political discussion, and is illustrated most strongly by the discussion surrounding the report of the second Delta Commission. This is not about $CO_2$ reduction from an international perspective, but about dike enforcement from the standpoint of national safety. It is thus about the question of what climate change means for the way in which the Netherlands defends its coast. We also saw the political debate becoming polarised in the course of the Copenhagen climate summit. A dynamic just like that of phase 4 seems to be developing. On the one hand, GroenLinks bases itself on recent alarming choices and even extreme scenarios, and pleas for higher $CO_2$ reduction goals. The PVV, by contrast, denies the existence of a climate problem. With Climategate looming, the environmental minister stated that the cabinet bases itself on information that comes from the IPCC. Once again, the discussion about new scientific knowledge and climate-sceptic voices was written off via the IPCC channel. The UN Climate summit in Copenhagen failed, and after the summit Climategate only escalated. This flared up the discussion about scientific uncertainties surrounding climate change, especially the role of the IPCC. For the first time in the 40-year debate about the climate problem an explicit debate took place in the Dutch Parliament about the political role of climate science and the importance of sceptic scientific voices. The politicisation of climate science and the scientification of politics – in which politics hides behind the reports of the IPCC – has itself become a subject of political debate.

# Intermezzo 1 The interaction between climate science and politics

*Jeroen P. van der Sluijs*

**Acceptable climate change: one or two degrees?**

*Villach-Bellagio climate norms from 1987: one to two degrees*

An international debate about what a realistic upper limit is for acceptable climate change has been going on since the 1980s already. At the workshops of Villach and Bellagio in 1987 the international Advisory Group on Greenhouse Gases (AGGG, the precursor to the IPCC) proposed ecological climate norms for the first time (Rijsberman et al., 1990; Jäger, 1990). So as not to endanger ecosystems and agricultural systems, upper limits would be set to the admissible world average temperature rise. Because forests have a maximum speed at which they can migrate with shifting climate zones, upper limits are also needed for the speed at which the climate changes. To protect coastal ecosystems (such as mangrove forests and salt marshes) as well as coral reefs and coral atolls, boundaries are needed for maximal allowable rises of sea levels and the maximal allowable tempo for such rises.

As maximal allowable temperature the AGGG suggested 0.1°C per decade, with a maximum of 1.0 or 2.0°C total temperature rise compared to pre-industrial levels. A maximum tempo of rises in sea levels of 20 to 50 mm per decade was also proposed. As maximum for a total rise in sea levels, a limit of 0.2 to 0.5 meters above 1990s levels was proposed. These boundaries are known as the 'Villach-Bellagio norms' and are based on an analysis of the vulnerability of ecosystems using paleontological data. The argumentation used was that a greater temperature rise or a higher rising tempo can, separately and in combination, trigger fast, unpredictable and non-linear changes that can cause great damage to ecosystems. AGGG based the absolute upper limit of 2.0°C on preventing disintegration of the West Antarctic ice sheet. After all, when 125,000 years ago it was 2 to 2.5°C warmer, this ice sheet melted and sea levels were 5 to 7 meters higher than they are now.

*Villach-Bellagio climate norms as basis for 2-degree policy*

The Villach-Bellagio norms have played an important role in international climate policy since 1987. Article 2 of the Climate Convention states that the ultimate goal of the convention is to stabilise the concentrations of greenhouse gasses at a level 'that would prevent dangerous anthropogenic interference with the climate'. By now, at the Copenhagen climate conference of December 2009 a two-degree goal was accepted as starting point for the climate convention.

Dutch and European policy goals are also related to the 1987 Villach-Bellagio norms. The Dutch aim, as expressed in the Second White Paper on Climate Change from 1995, is to reduce emissions by 1 to 2% per year in industrialised countries after the year 2000, and relates among other things to the upper limit of 0.1°C per decade for temperature rises and a maximum acceptable

total worldwide warming of 2°C. The EU too chose in its Sixth Environmental Action Programme (EC, 2001) for an upper limit of 2°C compared to pre-industrial temperatures as long-term goal (and thus 1.3°C above the current temperature).

A very relevant question for policymakers is: At which level does the level of atmospheric greenhouse gasses have to be stabilised in order to keep the temperature rises under a specific upper limit that was chosen as target? For this reason, in its assessments the IPCC keeps presenting calculations that indicate which development of greenhouse-gas emissions are necessary to attain a series of possible stabilisation goals. Such calculations were carried out for stabilisation levels of under 450 ppm (particles per million on a volume basis), 550 ppm, 650 ppm, 750 ppm and 1000 ppm.

$CO_2$ is not the only greenhouse gas that man emits. Other greenhouse gases such as methane, nitrous oxide, sulphur hexafluoride, CFK's and PFK's also contribute to the warming. For the sake of convenience, concentrations of other gasses have been converted into $CO_2$ equivalents. In the discussion about stabilisation levels the reader must keep watching whether the figures for the stabilisation level refer to all greenhouse gasses together (converted into $CO_2$ equivalents) or only to $CO_2$. For example, for its Sixth Environmental Action Programme the EU (EC, 2001) chose a stabilisation level of 550 ppm for $CO_2$. In December 2004 it reviewed its interpretation of this goal by stating that the goal of 550 ppm applies to all greenhouse gasses together (expressed in $CO_2$ equivalents) and not to $CO_2$ only. For $CO_2$ this implies a stabilisation level of 450 ppm. According to analyses of the IPCC this corresponds with a global emissions reduction of greenhouse-gas emissions of at least 70% compared to 1990.

*Ongoing scientific discussion*

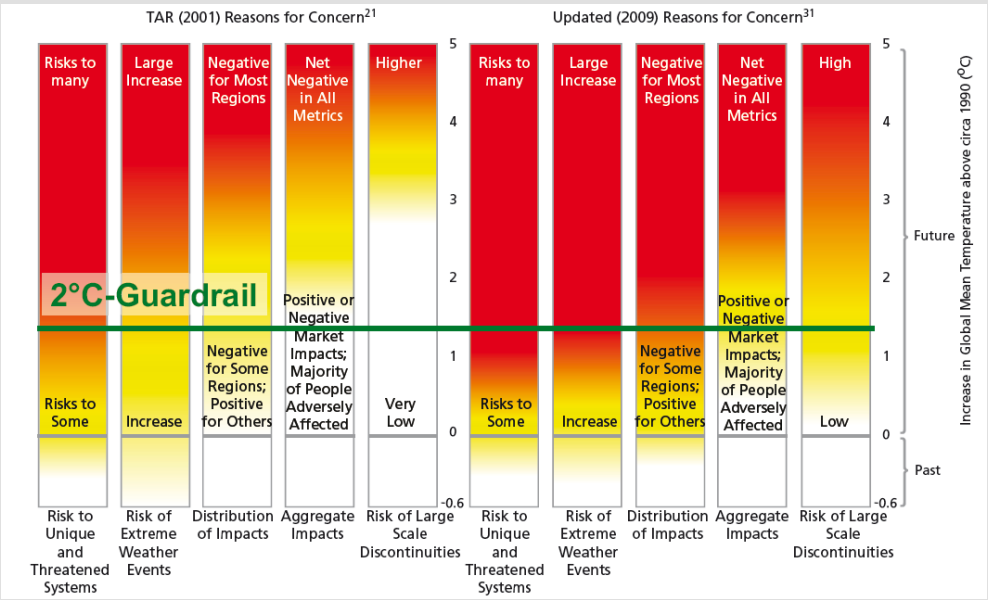



Figure 2.2 Left is the *burning ember* diagram from the third IPCC assessment report IPCC (2001); right is the updated diagram of Smith et al. (2009).

In the third IPCC assessment report of 2001 the diagram shown above was presented, which based on five risk indicators illustrates at which temperature rise severe and disruptive consequences can occur. The severity of the risk is shown with an orange colour running from light to dark. This is known as the *burning ember* diagram. It shows that starting from a warming of two degrees or more, climate change becomes a problem that is very difficult to control and severe consequences are expected for the entire chain. Recently (Smith et al. 2009) an update was made of this analysis based on research that has since become available. This update paints an even more pessimistic picture, indicating that severe effects are expected already at lower warming levels, therefore we should probably aim towards a goal of 1 degree. James Hansen, director of NASA Goddard Space Center, concludes on the basis of paleontological climate research that the warming (above the already realised warming of almost 0.6°C) should be limited to a maximum of 1°C in order to prevent large-scale collapse of the ice sheet and the corresponding extreme rise in sea levels. Such scientific insights also reopen the political discussion about the socially desired stabilisation levels for greenhouse gasses. In recent years an increasing number of scientific voices are saying that we should go back to 350 ppm or even to the pre-industrial level of 280 ppm, so that, for example, acidification of marine ecosystems doesn't get out of hand. According to a recent study by McNeil and Matear (2008), there is a tipping point in the Southern Ocean of 450 ppm after which acidification leads to disastrous consequences for its entire maritime ecosystem. Availing themselves of new insights about slow-working feedback processes in the climate, Hansen et al. (2008) set a stabilisation goal for a maximum warming of 1 degree at 350 ppm for $CO_2$. They consider the current $CO_2$ concentration of 385 ppm as too high.

# 3 The politicisation of climate science

*Jeroen P. van der Sluijs, Rinie van Est*

*Scientists can no longer say 'I know the results of the calculation but I won't tell you and I will just sway to the people from the front steps.' Science stands in the middle of society and lives in a glass house, and the whole world looks in.*

(Robbert Dijkgraaf 2010, president of the Royal Netherlands Academy of Arts and Sciences, KNAW)

## 3.1 Introduction

When the stakes are high in political decisions that are based on scientific studies, the scientific debate becomes politicised (Jasanoff et al. 1995, Jasanoff & Wynne 1998, Irwin 2001). Sometimes societal players deliberately deploy certain tactics to turn scientific results in their favour, to bring a favourable study to the fore, or to get rid of inconvenient knowledge. Peter Gleick (2007) distinguishes a number of categories of tactics that are deployed to such ends for political motives, but which scientifically speaking are improper or misleading, or which abuse the scientific process for spurious goals. The main tactics are: appealing to emotions; making personal (*ad hominem*) attacks; deliberately mischaracterising an inconvenient argument and then wiping the floor with it; inappropriate generalisation; misuse of facts and uncertainties; false appeal to authority; hidden value judgements; scientific misconduct, such as selectively leaving out inconvenient measurement results or packing advisory boards (see also Michaels 2005).

The climate issue is a textbook example of this. For years now climate sceptics, especially in the United States, have been accused of deploying such tactics with the political motivation of preventing the government from implementing climate policies (McCright & Dunlap 2003). Recently, Hoggan exposed the strategy of lobbyists for the oil and coal industry in the United States and Canada, linking their close connections with some of the climate sceptics in the US (Hoggan 2009).[1] Last year the Intergovernmental Panel on Climate Change (IPCC) also came increasingly under political fire. In November 2009 unidentified persons hacked into the e-mail correspondence of prominent climate researchers of the University of East Anglia and put it on the internet (Climategate). Because of their tone and content, as well as the discussions that started in early 2010 about found and alleged faults in parts of the most recent IPCC report, questions have risen about the scientific integrity, scrupulousness and political independence of the IPCC. The question was brought up of whether the IPCC had organised the production of its reports well, and to what degree these scientific reports are politically tainted. Could their presentation of the knowledge be working in favour of the policy preferences of the involved researchers? Fifty-five Dutch scientists wrote an open letter to the Dutch Parliament indicating how science can contribute to improve the IPCC process,[2] claiming that the IPCC should be more upright in quickly and openly recognising and correcting faults. At the same time, they emphasised that the faults do not take away from the main conclusion that humans are very likely changing climate, with considerable consequences for the future.

[1] See also www.desmogblog.com.
[2] See www.sense.nl/openletter.

Politicians demanded an evaluation of the work of the IPCC. To this end, the Netherlands Environmental Assessment Agency (PBL) started an investigation that focuses chiefly on errors in the 2007 IPCC report. The PBL also launched a website where those interested can report errors they find in this report. The Royal Netherlands Academy of Arts and Sciences (KNAW) established a commission to oversee the quality of the PBL investigation. At an international level, the UN Climate Science Panel asked the InterAcademy Council (IAC) to evaluate the IPCC procedures that led to the fourth assessment report from 2007. This evaluation is led by KNAW president Robbert Dijkgraaf with his colleague Lu Yongxiang, president of the Chinese Academy of Sciences.[3]

## Policy-oriented climate science within a political context

This chapter aims at describing and understanding the role of policy-oriented climate science from a political context. We take a look at the Dutch knowledge infrastructure around climate change but direct our analysis mainly at the IPCC. At an international level the IPCC has a pivotal role in the policymaking process, because its reports form the scientific basis for international climate negotiations. In the previous chapter we saw that the IPCC reports also play a central political role in the Dutch parliamentary climate debate. The IPCC was founded by the UN. We will describe how international politics have defined and organised the role that the IPCC plays in bridging over the interface between climate science and international climate politics. We will then discuss two important elements.

First we will examine how the IPCC is expected, according to its political objectives, to deal with scientific knowledge, uncertainties and possible dissent. We will examine which policy vision dictates the IPCC's dealing with scientific uncertainties. To guide our analysis we distinguish three policy strategies to approach scientific uncertainties (see Box 3.1). The key question here is whether uncertainties are seen as a temporary lack of knowledge, as a problematic lack of unequivocalness, or as a fact of life – something that unavoidably plays a role in complex and politically sensitive topics.

Secondly, we discuss how the writing and reviewing process of the IPCC works and how this leads to certifying, as it were, new knowledge as robust scientific foundations to build climate policies. This takes place however in a context of major scientific uncertainties, continuously advancing insights and ongoing scientific debate. For this reason, we will also discuss the scientific debate extensively: what are people in agreement over, scientifically speaking, and which aspects of the climate issue is there still a dispute about? How does the IPCC communicate about scientific knowledge and uncertainties, and how does the scientific dispute get a place in policy advice?

Box 3.1. Three policy strategies to deal with scientific uncertainties

At the interface of science and policy one can look at scientific uncertainties in three different ways (Van der Sluijs 2006). Each way leads to a different approach to uncertainties and each has its own drawbacks.

*Approach 1: Uncertainty as lack of knowledge*

One can first see uncertainty as a shortcoming in knowledge, where uncertainty is experienced as a temporary problem. The approach is to push back the uncertainty, among other things by creating increasingly complex models. As long as this is unsuccessful, the uncertainty is expressed numerically, for example a distribution around an average. This approach runs into the limitation that by far not all uncertainties can be expressed quantitatively in a reliable way. What's more, in

[3] See www.ipcc.ch/pdf/press/pr-1003210-UN.pdf.

practice uncertainties do not become reduced with more research: the problem appears to become ever more complex. The drawback of this approach is that there is a semblance of certainty because the numbers coming from the increasingly complex models suggest that there is more knowledge than is actually the case.

*Approach 2: Uncertainty as lack of unequivocalness*
The second vision sees uncertainty as a problematic lack of unequivocalness. One scientist says this, the other says that. It is unclear who is right. The solution has been a comparative and independent evaluation of research results, aimed at building scientific consensus via multidisciplinary expert panels. This approach is geared towards generating robust findings. The drawback of this paradigm is that issues over which there is no consensus remain underexposed, whereas it is precisely this dissent which tends to be extremely relevant to policymaking.

*Approach 3: Uncertainty as a fact of life*
One can see uncertainty as a mere fact of life, something which unavoidably plays a role in complex and politically sensitive topics. We accept the fact that uncertainty is not temporary but permanent, and recognise that not all uncertainties can be expressed quantitatively. Such an approach demands a culture that is open to uncertainty and that recognises that there are many things that science cannot yet provide an answer for. Ignorance and the influence of values are focused on here. Techniques applied to deal with it are knowledge quality assessment and risk management, including knowledge production, as deliberative or participative social processes.

Robustness is sought here primarily in policy strategy and not in the knowledge base: which policy is useful regardless of which of the diverging scientific interpretations of the knowledge is correct.

The drawback of this approach is that uncertainty and minority interpretations are so much in the spotlight that we forget how much we do know about these risks and which items actually enjoy broad consensus.

## 3.2 Policy-oriented climate science

*"The role of the IPCC is to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation. 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."*[4]

Man has been studying the climate for centuries. The fact that naturally occurring atmospheric greenhouse gases such as $CO_2$ play a role in the infrared balance of the Earth and thus in the climate has been known since work of Joseph Fourrier (1768-1830) (Van der Sluijs 1997). The first few centuries of climate research focused on explaining weather fluctuations in the geological past, like the ice ages. Scientific research into climate change due to human actions is however a relatively new research area.

[4] www.ipcc-wg1.unibe.ch/procedures/PrinciplesProceduresGoverningIPCC.pdf.

In 1908 Alfred Lotka issued the first scientific warning, foreseeing far-reaching climatologic impacts if the large-scale use of coal continued (Pilson 2006). Chapter 2 showed that it wasn't until the 1980s that politicians and policymakers started needing more scientific knowledge about climate change. This also created the demand for policy-oriented climate science.

The Earth with its oceans, continents and islands, atmosphere, biosphere, ice masses and cycles of water, carbon, nitrogen and countless other substances, forms an extremely complex system in which numerous interactions are at work. Many of its partial systems and underlying processes are still poorly understood. Exploring the consequences of human influences on that system and by extension the climate is therefore possible to a limited extent only. Still, enough is known to give reason for concern, and it is precisely for that reason that policymakers greatly need to have good comprehensive scientific assessments of the climate issue (Van der Sluijs & Turkenburg 2006). Because of the limited knowledge base, scientific assessments will unavoidably use expert judgements and subjective probability judgements. There is also a large number of climate scientists whose voices are not heard outside the climate field and who prefer to be involved exclusively with scientific research. These researchers do not feel at ease when answering policy questions and tend to be rather reticent in giving interim conclusions in a scientific field they still consider to be in its infancy. They reproach their peers who are involved in it that they are seduced by politicians to make pronouncements on questions about which knowledge has not led to clear conclusions so far (Van der Sluijs 1997).

Section 3.2.1 describes the central role of the IPCC in providing scientific knowledge about climate change to the international policymaking community. In section 3.2.2 we discuss the research institutes in the Netherlands that provide policymakers with climate-related information.

### 3.2.1 IPCC: main scientific supplier for international policies

In the late 1980s there were many scientific studies about causes and consequences of climate change which partially contradicted each other and whose exact relevance in terms of policy was not clear. To arrive at international agreements about climate policy, policymakers needed a carefully weighed overview of the state of knowledge in the field of climate change. In 1988 the Intergovernmental Panel on Climate Change (IPCC) was established as an independent scientific panel by the United Nations Environment Programme (UNEP) together with the World Meteorological Organization (WMO). The IPCC is an intergovernmental agency and is open to all member states of the United Nations and the WMO. Government representatives participate in the IPCC review procedures and in the plenary meetings where the program of activities is determined and reports prepared, and where the IPCC staff and its chairman are elected.

The role of the IPCC is formally established, as the quote in the beginning of this section indicates. Its mandate comprises mapping out the scientific basis for climate change, and its task includes listing socio-economic factors that are relevant for the implementation of specific policies. This involves, for example, exploring the consequences for man, nature and the economy of different possible quantitative long-term end goals of the Framework Convention. Within its mandate the IPCC can investigate what the consequences are of, say, 1, 2, 3, 4, 5 or 6 degrees of warming worldwide, but may not make pronouncements about which of those possible end goals of the Framework Convention is desirable. The latter is the domain of politics.

The IPCC itself does not do new research, but inventories research published in scientific journals and other scientific studies. This process, in which scientific knowledge is analysed by experts and adapted in order to inform the policymaking process, is known as an assessment. The knowledge comes mostly from a large number of specialised fields. In an assessment this information is gathered, analysed, structured, combined, interpreted and summarised. This knowledge is then presented in such a way that

it becomes as understandable, accessible, relevant and useful as possible for anyone who is involved in the policymaking process but is not an expert himself.

By mapping out scientific consensus, the IPCC fulfils a central political function in certifying robust knowledge that can serve as a foundation for the social and political debate. In international as well as Dutch climate policies, IPCC reports are accepted as the most important scientific basis for policymaking. Every 5 or 6 years the IPCC publishes an overview of the state of knowledge. In 1990 the IPCC brought out its first assessment report, which was followed by supplements in 1992 and 1994. In 1995 the IPCC brought out its Second Assessment Report (SAR). Since the SAR, IPCC reports have been accepted by the Conference of Parties (COP, the 192 countries that signed the Framework Convention) as scientific starting points to implement the Framework Convention. In 2001 the third assessment report was published and in 2007 the fourth, generally known as AR4.

These reports consist of three partial reports. Partial report I covers the physical science basis (climate system and causes), report II discusses impacts, adaptation and vulnerability, and report III looks at mitigation (possibilities to tackle the causes). Each partial report has a technical summary as well as a summary for policymakers. There is also a synthesis report that summarises the findings of the three partial reports in general lines. Scientists and government representatives negotiate the content of the summaries for policymakers line by line, where government representatives decide about approval and scientific authors have a veto right of sorts. The fact that all participating governments formally accept the reports of the IPCC and determine policy summaries together with scientists ensures that these reports can also count on wide support from governments and policymakers and are considered as an authoritative source (Petersen 2006).

### 3.2.2 Dutch infrastructure for climate policy

There are more than 80 research groups and institutes working on climate-related research in the Netherlands. In addition to numerous university-affiliated research groups and knowledge institutes like the Royal Netherlands Meteorological Institute (KNMI), the Netherlands Environmental Assessment Agency (PBL) and Deltares, there are also research institutes like the Energy research Centre of the Netherlands (ECN) and TNO. Dutch climate science plays a multifaceted role in domestic and international climate policies.

In the first place, numerous Dutch scientists contribute to the five-yearly reports of the Intergovernmental Panel on Climate Change, as (co-)author or reviewer of one of the many chapters of the reports. There are also many other Dutch contributions to scores of other IPCC publications, like the special reports about e.g. emission scenarios of $CO_2$ capture and storage, and methodology reports like the IPCC Guidelines for National Greenhouse Gas Inventories for countries that signed the Kyoto protocol. Secondly, it is knowledge centres like the KNMI, PBL and Deltares which feed knowledge into the Dutch ministries. Thirdly, there are two policy-oriented research programs that gather knowledge about climate adaptation policies for the Netherlands, and there is research being conducted at universities.

#### Knowledge centres for climate policy

In feeding knowledge into ministries, knowledge centres KNMI, PBL and Deltares play a chief role in bringing together knowledge for policy purposes. To make the uncertainties visible, the KNMI has presented a number of climate scenarios. KNMI climate scenarios are relevant, plausible and internally consistent representations of what the future could look like. They are used by countless government

agencies and organisations to design climate policy. The most recent scenarios date from 2006 and were supplemented in 2009.[5]

The PBL informs the government and the Parliament about the consequences of climate change for the Netherlands, the degree to which the set climate goals will or won't be attained, the effectiveness of intended policy options, trends in Dutch emissions of greenhouse gasses, etc. Deltares is a knowledge and research institute specialised in water and deltas. It came into existence on January 1st, 2008 when four partners bundled together their expertise and experience: WL - Delft Hydraulics, GeoDelft, the TNO Ground and Ground Water unit, and parts of the Ministry of Waterways and Public Works.

The Netherlands also has the Platform Communication on Climate Change (PCCC), a cooperation between PBL, KNMI, NWO (Netherlands Organisation for Scientific Research), WUR (Wageningen University & Research Centre), UU (Utrecht University), ECN, VU (Vrije Universiteit) Amsterdam and Deltares. Via the website www.klimaatportaal.nl the PCCC makes knowledge about climate change accessible to all groups in society that are interested, and aims at offering a balanced and scientifically sound overview of the current state of affairs. Every year the PCCC publishes a booklet, *De Staat van het Klimaat* (The State of the Climate), which offers a wide accessible overview of the current level of scientific understanding.

*National updates of climate knowledge*
For AR4 the IPCC could include the scientific production of six years. In the period ending August 2006, a total of 14871 articles appeared in scientific journals with 'climate change' in the title or the abstract, compared to 19,322 articles between August 2006 and 1 February 2010.[6] This shows that the number of scientific studies that the IPCC must synthesise is increasing exponentially: in 3.5 years more new studies became available than in the six preceding years. This is further illustrated in Figure 3.1.

The next IPCC report (AR5) will not appear before 2013. The Dutch political scene recognises the slowness of the IPCC process. This led to the PBL/KNMI study *News in Climate Science and Exploring Boundaries* (Meyer et al. 2009), which appeared shortly before the climate summit in Copenhagen. This study presented the state of knowledge since the publication of AR4. It also explores extreme scenarios with a focus on possible impacts and relevance for the Netherlands. The report may have been subjected to peer review according to the standard procedures of the PBL and KNMI, but not with the same transparency and traceability as is common within the IPCC. To conduct a peer review IPCC-style would severely infringe upon the speed with which such a knowledge update can be produced.

[5] See: www.knmi.nl/klimaatscenarios.
[6] Search in Web of Science on 1 February 2010 for Topic=["climate change"]. Of the hits for the year 2006 it is assumed that two-thirds fall in the AR4 period and one third afterwards.

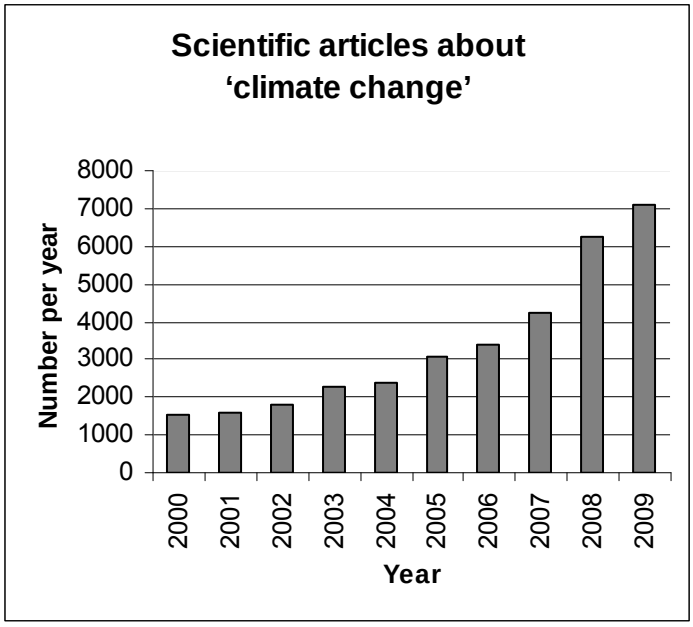



Figure 3.1 Number of scientific articles per year with 'climate change' as subject. Source: ISI Web of Science search per year with Topic=("climate change"), database version 1-2-2010.

## National research programs 'Climate changes Spatial Planning' and 'Knowledge for Climate'

All these knowledge institutes work together in two large research programs, Climate changes Spatial Planning and Knowledge for Climate, The research program Climate changes Spatial Planning maps out the consequences of climate change and develops ways to deal with it. The program looks mainly at how the Netherlands can adapt to climate change via spatial (re)design, and supports the decision-making process about the future spatial design of our country. The research results are offered to government agencies, social institutes and knowledge institutes.

Knowledge for Climate is a demand-oriented program that focuses mainly on knowledge and the organisation of knowledge in order to make the Netherlands climate-resistant. The program aims at developing strategies for adaptation around nine hotspots: Schiphol Mainport; Haaglanden region; Rotterdam region; major rivers; south-west Netherlands Delta; shallow waters and peat meadow areas; dry rural areas; Wadden Sea; and internationally (densely populated deltas that are facing comparable challenges due to climate change). In this way, the program aspires to turn the Dutch vulnerability into an opportunity. The knowledge and experience that arise by making the Netherlands more climate-resistant offer chances to improve the business climate and strengthen the export position in the field of climate and delta technology. (For more information about Climate changes Spatial Planning and Knowledge for climate, visit www.klimaatonderzoek.nl.)

## University research

Research in all fourteen Dutch universities is conducted via three money sources. The first comprises all the research within the fixed structure of the universities. The second source is the financing mainly of PhD students and post-doc positions from the NWO programs. Some important NWO programs around the climate are Vulnerability, adaptation and mitigation; Energy research; Climate variability; Land-ocean interactions in the coastal zone; Biodiversity in relation to global change, Gamma-research for the environment, surroundings and nature; and the Netherlands Partnership for a Sustainable Earth. There are also several NWO programs in the field of sustainable technologies such as the Sustainable hydrogen program. The remaining financed research in universities falls under the third money source.

This includes contributions to major European cooperation projects within the seventh framework program of the EU such as Adaptation and Mitigation Strategies (ADAM), as well as large-scale nationwide demand-oriented research programs.

## 3.3 Dealing with scientific uncertainties and dissent

In recent years polarisation and politicisation can be observed, especially in the public debate over the climate problem, in which a group of scientists is very critical of the pronouncements of the IPCC. These scientists profile and organise themselves as 'climate sceptics'. The political polarisation within climate science was well illustrated in March 2009, when the International Alliance of Research Universities held a large scientific congress in Copenhagen, *Climate Change: Global Risks, Challenges and Decisions*, with more than 2000 participants. The goal was to bring together the latest developments in climate research since AR4. At the same moment, climate sceptics held a counter-congress in New York, *Global Warming, was it ever really a crisis?*, in which nearly 800 scientists, journalists and other interested parties participated. The initiator of this congress was the American Heartland Institute, which we come back to later. While the university scientists were assessing the new studies as even more alarming than AR4 in Copenhagen (Richardson et al. 2009), the message from New York was that the climate problem was being grossly overestimated, therefore government interventions could not be justified.[7] This is where the insights of climate sceptics differ from those of mainstream climate scientists and the IPCC over the main IPCC conclusion about climate change. Among the issues of contention was the question of whether Earth has become warmer in the past century and whether man has played an important role in that process.

This section offers a look at the degree of consensus within climate science about the answer to the question presented above. Next, we describe how policymakers and scientists deal with uncertainties in practice. The political body set up the IPCC based on a consensus model, with the task of informing it about robust scientific knowledge. We describe the consensus model on which the IPCC is based and the space that there is within IPCC reports to sensitise policymakers to scientific uncertainties and dissent. We then describe the main messages that the four assessment reports have brought forward, and end with an inspection of the climate sceptics' criticism of these reports.

### Degree of consensus within climate science

Oreskes (2004, 2007) investigated the correspondence between climate scientists in scientific publications for the period between 1993 and 2003. She searched for the key word 'global climate change' in Web of Science and found 924 articles whose abstracts she analysed. She classified the publications into six categories: explicit confirmation of the IPCC consensus position; evaluation of climatologic impacts; mitigations options; methods; paleontological climate analysis; and rejection of the IPCC consensus position. Of all papers, 75% was about the first three categories and subscribed to the IPCC consensus implicitly or explicitly, and 25% were about method or paleontological climate research without taking a position with regard to the role of man in climate change. None of the publications rejected the IPCC consensus position; Oreskes also determined that none of the publications presented data that conflicted with this position. In criticisms of the Oreskes study, we find that Peiser (2005) claims that her approach exaggerated the degree of consensus, and Pielke considers she does not do enough justice to the diversity of scientific visions on the climate issue.

In a recent study (Doran & Kendall Zimmermann 2009), the degree of consensus in science is investigated by a survey among a wide group of scientists. Of the 10257 addressed scientists, 3146

[7] www.heartland.org/events/NewYork09/proceedings.html.

answered the questions. To the first question, 'When compared with pre-1800s levels, do you think that mean global temperatures have generally risen, fallen, or remained relatively constant?', 90% answered that temperatures on earth had risen. The second question, 'Do you think human activity is a significant contributing factor in changing mean global temperatures?', got a positive answer from 82% of respondents. When scientists were classified according to degree of expertise it appeared that a higher percentage answered 'yes' the more specialised they were in the field of climate change. Those scientists who recently published more than half of their studies in scientific journals on the climate topic scored the highest: 97.4% of the respondents in that group answered yes to the second question. Non-climatologists who themselves did not publish about the climate in scientific journals scored the lowest, with 76% of them seeing a human role in climate change. To compare: in an opinion survey among the American public only 58% answered this question positively. The consensus is thus very high, mainly among specialists who have published a lot of research about climate change.

Within mainstream climate science the scientific discussions are not so much about the question of whether man influences the climate but about uncertainties within the climate system. There are thus ranging debates about the relative importance of different factors that contribute to climate change at a specific moment in time, about the exact climatologic processes in the distant past, and about the best way to stimulate clouds in climate models. The intermezzo 'Scientific controversies about causes and consequences of climate change' provides an extensive overview of these scientific debate topics.

In general lines, the essence of the main insights of the consecutive IPCC reports and its predecessors of the past 30 years has not changed (see also Clark & Jäger 1997). There is wide agreement among climate scientists about the following items:

- The composition of the atmosphere, especially its concentrations of natural greenhouse gasses, plays a key role in the temperature on the Earth surface. Without an atmosphere it would be 33 degrees colder on Earth. The largest part of that difference is due to the natural greenhouse effect coming mainly from water vapour, $CO_2$ and several other trace gasses like methane and nitrous oxide.
- The observed increase of concentrations of greenhouse gasses in the atmosphere which has been taking place since the beginning of the industrial revolution can alter atmospheric and oceanic heat balances in such a way that it causes the climate to change;
- This rise in greenhouse gasses is very probably caused primarily by the increasing use of fossil fuels and by large-scale deforestation;
- When $CO_2$ concentrations double compared to pre-industrial levels, the average Earth surface temperature worldwide will increase by about 1.5 to 4.5°C. Scenario studies anticipate that in case of unchanged policies, such a doubling will occur in the course of the 21st century;
- The tempo and degree of climate change can be influenced to a large extent by technically feasible emission-reduction measures for these gasses.

## IPCC consensus model as political strategy

In the introductory section we distinguished three policy strategies to deal with scientific uncertainties (see Box 3.1). The first approach sees uncertainty as a temporary lack of knowledge, the second approach sees is as a problematic lack of unequivocalness. The third approach accepts uncertainties as a fact of life, something that inevitably plays a role in complex and politically sensitive topics. This vision pushes openness about uncertainties and dialogue as a solution strategy to the foreground.

International politics established the IPCC mainly starting from the second vision about dealing with scientific uncertainties: creating a clear knowledge base on which international climate policy can be

based. The scientific reporting of the IPCC bases itself on the studies published, chiefly in peer-reviewed scientific journals. In this way, an attempt is made to get a sense of all the separate studies and to see what picture comes forward. IPCC reports aim to identify the state of knowledge while enjoying wide scientific support. This goal fosters developing consensus in the editorial teams. Exercising assessment in consensus is problematic though. For example, as a result of the IPCC consensus model weak signals from the scientific community get a less prominent spot in the reports than they deserve based on their policy relevance (see also Van der Sluijs 2010). This is the case with tipping points: they can lead to severe non-linear impacts, but given the state of knowledge and the many uncertainties, univocal scientific consensus about the severity and scope of many of these tipping points cannot yet be reached. Still, policymakers tend to experience this particular uncertainty as relevant in terms of policy: when designing a policy strategy you better have thought beforehand about extreme scenarios that cannot be ruled out but have an unknown chance of happening than be completely surprised if they occur unexpectedly at a later time (see also EEA, 2001). The consensus approach also deprives us of a full view of the plurality of scientific opinions within and between the various scientific disciplines that study the climate problem. In the intermezzo 'Scientific controversies about causes and consequences of climate change' we sketch several of these points of continuing dispute. The consensus approach also limits the political field of action on which players can present different scientific studies to substantiate their positions. For this reason, Pielke (2007) pleads for experts in the interface of science and policy to present themselves more as '*honest broker(s) of policy alternatives'* between pluralistic science and our pluralistic democratic society.

The recent IPCC reports also contain elements from the first and third approaches. Increasingly, in addition to a quantified uncertainty range around the present figures (approach 1) we find a qualitative indication of the level of scientific understanding for each of the figures (approach 3). An example of this can be seen in Figure 2.1 in Intermezzo 2 'Scientific controversies about causes and consequences of climate change', in which the IPCC presented a quantified uncertainty margin in the second column for each factor that has altered the temperature balance of the Earth, and in the last column an indication for the level of scientific understanding for each of those factors. The IPCC's own guideline prescribes that any diverging scientific visions on certain aspects should be reported in the chapters that discuss those aspects. This does get done. However, in the policymakers' summaries, the technical summaries and the synthesis report of AR4 dissent is no longer discussed and only issues over which there is consensus get mentioned. Uncertainties are discussed though: the synthesis report of AR4 concludes with a chapter 'Robust findings, key uncertainties' that clearly indicate what robust conclusions there are and which aspects are still uncertain. The word 'uncertainties' is also mentioned countless times in policymakers' summaries. Yet policymakers' summaries and synthesis reports do not provide insights into where in science is there dissent and what positions are taken in this respect, whereas that information is indeed policy-relevant. To get a good picture of it, one has to read the entire AR4.

### Main message from the IPCC to the political arena

The first IPCC assessment report (1990) is mainly of a signalling nature, and it placed the climate problem high up on the agenda. In this way the report indicated that there were still many scientific uncertainties, especially over whether the expected anthropogenic effect on the climate could already be observed and which part of the perceived temperature increase could be attributed to man. The expected warming through the measured increase of greenhouse gasses was actually smaller than natural variations in climate: climate is never constant, it fluctuates around an average. This problem is known as the signal-to-noise ratio when detecting a signal. The expected signal was so weak that it got lost in the noise. The concern is mainly about the future. For continued emissions of greenhouse gasses the IPCC scenario studies from 1990 anticipated that atmospheric greenhouse-gas concentrations would become so high so quickly that human influence on the climate would soon far exceed natural variability.
The second assessment report (1995) concluded that 'the balance of evidence suggests a discernible human influence on global climate' (IPCC 1996, Summary for Policymakers: 4). The use of new detection techniques such as the fingerprint method played an important role here: the various causes of

climate change, such as the sun, greenhouse gasses and carbon emissions from volcanoes, show another typical vertical warming pattern at different atmospheric altitudes. The third assessment report (2001a) concluded even more peremptorily: 'There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities' (IPCC 2001a, Summary for Policymakers: 10). In the most recent assessment report, AR4, the conclusion is even more decisive:

*'Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations. This is an advance since the TAR's conclusion that 'most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations'. Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns.'* (IPCC 2007a Summary for Policymakers: 10).

## Climate-sceptic opposing voices

As mentioned, there is a group of scientists who are critical of the main message of the IPCC. A report was published in the US titled *US Senate minority report: More than 700 international scientists dissent over man-made global warming claims* (Inhofe, 2009). As an indication that there is no consensus among scientists about climate change caused by human actions, this minority report mentions, among other things, a survey among Canadian scientists, 68% of whom does not agree with the proposition that climate science is a 'settled' issue. This is not a surprising result, given the predicament. There are, after all, countless uncertainties, scientists disagree on all kinds of issues, and space remains for more research and new discoveries.

In Canada, 10 scientists published their own policymakers' summaries of AR4 under the auspices of the Fraser Institute, called the *Independent summary for policymakers* (McKitrick et al., 2007). The Fraser Institute promotes individual prosperity and the free market, and is opposed to all forms of government intervention.

*Heartland Institute in the United States*

The somewhat comparable American Heartland Institute (www.heartland.org) published two reports about climate change with the provocatively chosen subtitle *Report of the Nongovernmental International Panel on Climate Change (NIPCC)* (Singer 2008; Idso & Singer 2009). According to its own website, the Heartland Institute is a non-profit organisation that puts its energy towards a free market, deregulation and privatisation of public facilities, and is against all forms of government intervention and bureaucracy. It can be seen as the opposite pole of an organisation such as the United Nations, which the IPCC is partially under. The report from 2008, edited by the American climate scientist Fred Singer, is titled *Nature, not human activity rules the climate*. It is based on a contribution of 25 scientists of very contrasting disciplines, including the Dutch economist Hans Labohm and the Dutch retired professor of chemical processes technology Dick Thoenes. Thirty-nine scientists contributed to the report *Climate change reconsidered* from 2009.

The Heartland reports posit that the actual warming is lower than the IPCC concludes, and substantiates this conclusion with a different weighing of data sources (satellite measurements compared to ground measurements) and a different interpretation of some of the same satellite measurements. These reports also state that human influence on the climate is negligible because a certain part of the expected fingerprint based on models was not clearly observable in a specific measurement set. The Heartland Institute states that global warming in the twentieth century is not exceptional and that comparable warming in the geological past was not accompanied by catastrophes. Their reports go into an extensive discussion about shortcomings of simulation models used in climate research, and affirm that stabilising, natural reactions are being strongly underestimated. The Heartland Institute embraces the hypothesis that interaction between solar activity and cosmic radiation constitutes a more important explanation for the observed warming than the emission of greenhouse gasses caused by man. It also expounds the

advantages of warming and higher $CO_2$ concentrations for agriculture and nature through e.g. the $CO_2$ fertilisation effect: plants grow more if there is more $CO_2$, and they are more frugal with water if the stomas have to open less often to 'breathe in' the same amount of carbon dioxide.

Unlike the IPCC reports (see next section), the Heartland reports are not based on a very wide spectrum of available scientific studies. The reports present mainly studies that relativise or contradict the main conclusions of the IPCC. That may be a useful contribution to the scientific debate over climate change, but does put the reports of both institutes in entirely different categories. The Heartland reports should be understood as a form of counterexpertise. The controversy between Heartland and IPCC also shows that the ideological field of tension between free market and government intervention – after all, IPCC reports are part of the legitimation of climate-influencing government policies – is increasingly intruding into the domain of science.

## 3.4 Certification of scientific knowledge for climate science

For an issue such as climate science, in which a great deal is at stake for society, it is considered very important for policies to be based on reliable, meticulous, balanced and independent science. The IPCC has formally established practices, procedures and guidelines that aim at safeguarding this standard. This section describes the procedures and practices of the IPCC, the way in which its scientific review process is set up, and how the IPCC deals with grey sources, which do not come from peer-reviewed scientific articles. We conclude with the criticism that AR4 has received in the last year.

### IPCC procedures and practices

The entirety of the IPCC's procedures and practices, including the peer review process, is formally established in a guideline.[8] Peer review is the common procedure for quality monitoring of scientific work in which peers – fellow scientists – assess each other's studies and texts critically and comment on it. Rule 16 of the guideline says that the procedure must be evaluated every five years and revised where necessary. In the course of the nearly 20-year existence of the IPCC, the review procedure has indeed been regularly revised. It has learned from criticism to and internal evaluations of its procedures during subsequent assessment reports. After the second assessment report, for example, it was decided to appoint special review editors to improve the accuracy and transparency of the way in which reviewers' comments are processed. Since then, all the steps can be found per chapter in the IPCC website: the first order draft, the review comments of experts to that first version, the revised version or second order draft with the processed comments, the review comments of experts to the revised version, and the review comments of government representatives to the revised version.

Many people were involved in the production of the fourth assessment report (AR4) from 2007. The three partial reports of AR4 are written by nearly 44 editorial teams, with a total of 450 main authors. Those authors were selected on the basis of their expertise, with involvement of all 194 participating countries. As contributing authors, another 800 scientists have contributed with texts to the chapters from their own field. The entire process of the IPCC is supported by four Technical Supports Units (TSUs), each with 5 to 10 employees. There was a TSU in the Netherlands until recently, at the PBL, but it has now moved to the Potsdam Institute for Climate Impact Research in Germany. Around 2,500 reviewers gave close to 90,000 commentary points to the total of 44 chapters of the three workgroup reports. For each separate commentary point the main authors used arguments to indicate how that comment was processed. Review editors ensure that each comment point is treated and processed straightforwardly and correctly.

[8] See www.ipcc-wg1.unibe.ch/procedures/PrinciplesProceduresGoverningIPCC.pdf .

As conclusion to the procedure, they sign a declaration that they have verified and agree with the results. The review editors report to the chairman.

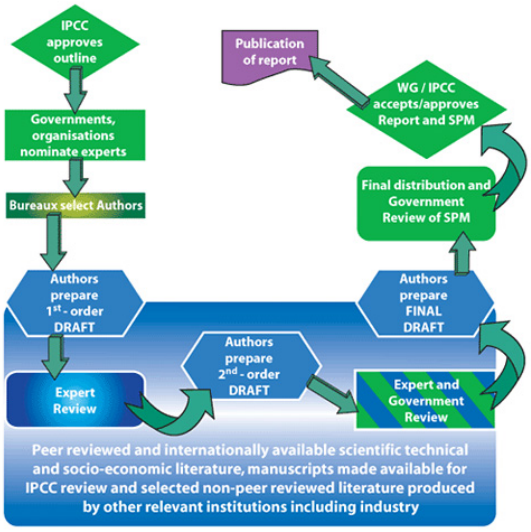



Figure 3.2. The writing process of AR4 depicted in a scheme (source: www.ipcc.ch).

## Open review procedure

The review procedure of the IPCC (see Figure 3.2) differs from that of scientific journals. In a scientific article the review forms the basis for a decision by the journal's editors as to whether a manuscript has sufficient scientific quality and originality to be eligible for publication. With the IPCC it is different: here it is already known *before* the review process that chapters submitted for review will be published in the report. The review round serves only to give feedback in order to increase the quality of the content of the texts in the chapter.

Another difference with the review procedure of scientific journals is the open character of the review process of the IPCC. According to its own guidelines (IPCC Procedures 1999), the following experts are eligible to be reviewers: 1) Experts who have significant expertise and/or publications in particular areas covered by the Report; 2) Experts nominated by governments as Coordinating Lead Authors, Lead Authors, contributing authors or expert reviewers as included in lists maintained by the IPCC Secretariat; and 3) expert reviewers nominated by 'appropriate organisations'. Reacting to criticism that especially experts in the field of climate were being deployed, after a second (1996) and even more after a third assessment report (2001) the IPCC decided to avoid any form of exclusion by offering increasingly wider possibilities so that non-scientists and experts from entirely separate disciplines could also serve as reviewers. In practice, the IPCC does this exercising great latitude with the term 'appropriate organisations' from its own guideline – a term not further specified – in order to guarantee a peer review that is as open as possible and avoid exclusion: any organisation that wants to nominate reviewers is enabled to do so. As a result, non-scientists too can comment on the draft texts. Researchers who are sceptical about the climate problem, like Hans Labohm (originally an economist), are reviewers for the IPCC (Petersen 2006).

## Dealing with grey sources

The procedure guidelines of the IPCC prescribe how editorial teams must deal with grey sources and unpublished work. Most of the nearly 18,000 source references in AR4 are about peer-reviewed scientific publications. The rest refers to what is known as grey literature. The guidelines explain that some relevant knowledge for the IPCC is only available in grey literature. This applies mainly to knowledge and experience in various economic sectors with respect to emission-limiting measures, sectors' spots that are vulnerable to climate change and adaptation possibilities. This knowledge is often included in reports

of research institutes, reports of workshops and congresses, and industry publications. Such grey sources have not undergone the peer review that is common for scientific journals. The IPCC guideline prescribes that grey sources must be examined critically and that each editorial team must check for quality and validity before a finding from a grey source is included in an IPCC report. The guideline also prescribes that the source should be fully traceable and that when using unpublished sources a copy should be submitted to the IPCC secretariat so that it is available to third parties. All sources – peer-reviewed and grey – should be included in a reference list at the end of the chapter. This procedure followed for AR4 is more thorough than is common in the interface of science and policy. Transparency and traceability are also well-protected. Up to a year ago this procedure was still seen by many as a textbook example of political and scientific correctness. Recent discussion about established and alleged faults in AR4 have shown that the IPCC procedures to safeguard scientific quality are not watertight.

### Political criticism of the IPCC

In the last year the IPCC and AR4 have been under increasing political fire. Some faults have been brought to light in the AR4 partial report about regional impacts. One of them concerns the incorrect claim that if the current warming tempo continues, the glaciers of the Himalayas will very likely have melted away completely by the year 2035. That year came from a report of the World Wide Fund for Nature (WWF) from 2005, based on an article by a science journalist in *New Scientist* from 1999 (Pearce 1999), who in turn got it from a wrongly represented interview with, among others, an Indian and a Russian glaciologist in an Indian publication from 1999. Riding on the carrier wave of the Climategate affair, exposure of this mistaken year about the Himalaya glaciers on page 493 of the chapter on Asia in the report of workgroup II was explosive news. When criticism pointed to the fact that the year came from a World Wide Fund for Nature report, the discussion expanded to the question of the use of grey literature sources.

In addition, some climate sceptics saw the use of a WWF report to support a claim of scientific knowledge as an indication that the IPCC is not an independent scientific panel but an alarmist lobbying group. Such a conclusion, based on the currently known facts, is unfounded. In a report with about 18,000 references to sources, references to a WWF report are made on about 15 places, and then only in the partial reports about impacts and solutions (workgroups II and III). In the partial report about the scientific basis of the climate problem (workgroup I) there isn't any reference to WWF publications: about 97% of the sources of the report from workgroup I are peer-reviewed publications from scientific journals. None of the data from the WWF reports made the summary for policymakers or the synthesis report either.

## 3.5 Conclusion

At the interface of science and policy, the IPCC has played a central political role since the early 1990s. The IPCC brings together scientific knowledge periodically and interprets it for the international policymaking process within the Framework Convention. The scientific knowledge gathered and processed by the IPCC plays a primary role in the legitimation of domestic and international policy aimed at reducing greenhouse-gas emissions. In turn, the long-term policy goals of the Framework Convention have become leading for the financing, organisation and any questions surrounding a large portion of climate science. It is because of the central political role of the IPCC that precisely around the climate summit in Copenhagen (COP 15) the scientific debate flared up and became polarised. Exactly the same thing happened around the decisive climate summit in Kyoto in 1997 (Van der Sluijs 1998). The central political role of science is the most important moving force behind the politicisation of policy-oriented climate science. This partly explains why faults in a three-year-old scientific report are front-page news these days.

## Emphasis on IPCC procedures, too little attention paid to political role of IPCC

The societal debate about the IPCC and climate science thus gives cause for reflection. Within the current national and international discussion about the IPCC there is relatively little attention being paid to the political role of the IPCC. This requires societal reflection on the role that the IPCC has been ascribed by the international political community in the interaction between climate science and climate policy.

In the current discussion the emphasis lies primarily on evaluating the procedures of the IPCC during the production of the fourth assessment report. In the Netherlands, for example, the Netherlands Environmental Assessment Agency (PBL) started an investigation to this end under the auspices of a KNAW commission. At an international level the UN Climate Science Panel asked the InterAcademy Council (IAC) to evaluate IPCC procedures. Especially from a policy perspective, guaranteeing the scientific reliability of the IPCC report is indeed extremely important. For this reason, in this chapter we present how the scientific review process of the IPCC is structured and how the IPCC deals with grey sources. The upcoming evaluations that the political arena will start will probably do this more extensively and thoroughly. Nonetheless, on the basis of our analysis we can already formulate several points of improvement for IPCC procedures and practices (see Box 3.2).
In addition to attention for the procedures, societal reflection on the political role of the IPCC is also highly needed – specifically about the question of how the IPCC deals with scientific uncertainties and how it communicates with political bodies about it. To guarantee the policy relevance of the IPCC, politicians have opted for a consensus approach when dealing with scientific uncertainties, as we have shown. In other words, the IPCC is an institute framed by international politics which had set up its procedures and practices from a specific vision on how politics deals with scientific uncertainties.

Table 3.1 Overview of strengths and weaknesses of three policy strategies to deal with scientific uncertainties (based on Van der Sluijs 2006).

| Politically dealing with uncertainties | Vision of uncertainties | Strength | Drawback |
|---|---|---|---|
| Approach 1: More scientific research | Uncertainty as lack of knowledge | Searching for scientific certainties | Creating illusory certainty |
| Approach 2: Build scientific consensus | Uncertainty as lack of unequivocalness | Exposing consensus | Underexposing dissent |
| Approach 3: Openness about uncertainties | Uncertainty as fact of life | Exposing dissent | Underexposing consensus |

The current tendency to improve IPCC procedures via external evaluations fits with the current consensus approach: people are looking for ways to continue with the existing practices and legitimise them politically. It is also important to reflect on the strengths and weaknesses of the current consensus approach of the IPCC. We will do this in the remainder of this concluding section, using the three distinguishing strategies to deal which scientific uncertainties that were presented in the introductory section (see Box 3.1). In Table 3.1 we summarise the strengths and weaknesses of the three policy strategies.

## Plea for more openness about scientific uncertainties and dissent

As mentioned, the political goal of the IPCC is to create a clear knowledge base. In this way the IPCC follows in fact the second approach, whose strength is to shed light on scientific consensus. Such consensus can play a constructive role in legitimating policy. The disadvantage of the consensus approach is however that it underexposes scientific uncertainties and dissent, thus making the chosen policy – which, after all, wagers on consensus – vulnerable to scientific errors. The consensus approach cannot get along well with parts of the knowledge base where the state of scientific knowledge is still

premature and univocal conclusions cannot be established along objective lines. The consensus approach also takes away a full perspective of the plurality of scientific views within and between the different scientific disciplines in relation to the climate problem. The consensus approach thus limits the political playing field in which players can present different scientific studies to substantiate their positions.

This can be partially solved by building elements from the third approach into IPCC practices: more openness for dissent in IPCC reports (see last point in Box 3.2). With very complex issues like climate change, uncertainties, interpretation options and possible surprises play a major role. To notice newly upcoming themes and weaknesses on time in everyday thinking, it is important not to reject diverging opinions immediately but to actually pay specific attention to them (cf. EEA 2001; Van der Sluijs 2007). Climate sceptics and scientists who think differently than the mainstream on certain points can fulfil a counterexpertise function in the scientific and political debate about climate change (cf. Turkenburg & Van Wijk 1991; Van Soest & Gimbrère 2006). An option to this end is to include a dissent chapter in the synthesis report of the IPCC which contains a sketch of minority scientific views and points of ongoing scientific dispute. The summary for policymakers could also have a section about dissent. Both dissent contributions could constitute a first step to give critical voices a more visible place in AR5 than they had in AR4 in terms of wide agreement. By exercising more openness about scientific uncertainties and dissent, policymakers get a more complete picture of climate science. Instead of choosing the optimal policy based on the widest scientific consensus interpretation, they can design robust and flexible policy strategies that take into account uncertainty and plurality in science. Robust strategies are packages of policy measures that are useful regardless of which of the competing scientific interpretations may be right or the direction in which the uncertainties are going. Flexible strategies are those that can be quickly adjusted to advancing scientific insights, in which locking-in and irrevocability of implemented policy trajectories can be prevented. Such policy strategies are less vulnerable to uncertainty and to the question of whether the IPCC has identified the problems correctly and faultlessly (Dessai & Van der Sluijs 2007).

As shown in Table 3.1, the third approach also has a clear drawback: an overexposure of dissent and uncertainty, which in practice often seems to undermine the basis for political policymaking because measures are postponed in order to wait for an increased certainty which does not arrive. Approach 3 requires science to be more open about uncertainties, boundaries of knowledge and pluriformity within science. From politicians and policymakers this approach demands that they be more aware of the limitations of science and the nature of the uncertainties surrounding climate change. It is however of great importance that politicians do not hide endlessly behind those scientific uncertainties but take their own political responsibility.

### Plea for a more integrated role of climate-sceptic scientists

A plea to give a more visible place to voices from, among others, climate-sceptic scientists, also demands a slightly different role from climate sceptics. Climate-sceptic scientists nowadays follow chiefly the third approach: they want more attention for scientific uncertainties. To that end, some of them have currently organised themselves separately and publish their own reports, e.g. under the banner of the Heartland Institute. These reports present mainly those studies that relativise or contradict the main conclusion of the IPCC. As mentioned, this is a potentially useful form of counterexpertise.

The way in which climate sceptics relate to the scientific debate could strongly improve though. A difficult point is that there is a broad spectrum of climate scepticism (which also applies, by the way, to climate activism), varying from criticism to and alternative interpretations of data that are scientifically sound to obvious urban legends. In a more extensive overview of sceptical visions it is often difficult to determine which arguments are or aren't useful. On top of that, arguments are sometimes repeated for years on end, even when the errors have been pinpointed and sometimes even recognised by the corresponding sceptic. This is frustrating for mainstream and sceptic climate scientists alike. Mainstream scientists can

get tired of having to keep reacting to the same, by now settled point of scepticism. And climate sceptics often say that they are ignored when climate scientists no longer react to their arguments. In short: the high scientific standards that climate scientists rightly demand from the IPCC apply to them too.

Box 3.2. Four recommendations to improve IPCC practices and procedures.

The IPCC works according to a transparent procedure with an extensive review process. Climate-sceptic scientists also play a role here. The process is not perfect, as is clear from, among other things, the discussions around Climategate and the errors in the fourth assessment report. Lessons can thus be drawn to improve practices and procedures in order to safeguard accuracy, balance and independence. This is about dealing with faults and with grey literature better, and about clarifying the scientific status of different parts of the report.

A perfect procedure cannot guarantee that reports are faultless either. Consistent application can decrease the chance of faults though. We can distil four recommendations from this chapter: 1. There is a need for a procedure to correct errors in IPCC reports which are discovered after publication. 2. The process of dealing with grey literature should be improved. In relation to this, 3. The scientific status of the various parts of the IPCC report should be communicated better, and 4. Scientific dissent should acquire a more central place in the reports.

**Improve on how to deal with faults**
It seems desirable for there to be a procedure to correct errors in IPCC reports which are discovered after publication. For example, an ongoing errata list could be maintained on the IPCC website where ascertained faults in the report are set right. A sharp distinction must be made here between faults within the representation of past knowledge and advancing knowledge. Advancing knowledge belongs in the next subsequent assessment report and not in an erratum. A clear distinction must also be made between faults and differing scientific visions.

**Improve on how to deal with grey literature**
Complying with the guideline for the use of grey sources should be safeguarded better. For instance, some members of the editorial team could be given the task of inventorying which data from the grey sources are used in the chapter, scrutinising them more critically, and where possible replacing them with data from peer-reviewed sources. In the text it should also be immediately clear which data come from grey sources, so that material can be examined more critically by reviewers and source provenance is clearer for readers. The reference list could be split into peer-reviewed and grey sources. One could also add to the guideline that for all sources that have a DOI (*Digital object identifier*, a reference system currently used by nearly all scientific journals and which ensures permanent traceability of the source), it should be mentioned.

**Clarify scientific status of various part of the IPCC report**
For the interaction between science and politics it is important to clarify the difference in the scientific status of the three partial reports and the summary for policymakers. The partial report of workgroup I describes the scientific basis and establishes the foundations for the other two practice-oriented reports.

For workgroup I, grey sources are referred to only in highly exceptional cases: in practice, there is a 'no, unless' strategy. It would be good if this current practice was defined procedurally. For workgroups II (impacts, adaptation and vulnerability) and III (mitigating) it is actually not possible to work without grey literature.

**Give dissent a more central place**

It seems advisable for the IPCC to include a dissent chapter in the synthesis report of its next assessment report (AR5), which would include a sketch of scientific minority views about climate and points of ongoing scientific dispute. A comparable section about dissent in the summary for policymakers would also be desirable. This would be a good way to give a more visible place in AR5 than they now have in AR4 to voices from the scientific field that are currently unable to count on wide agreement. This would include claims that the problem is less severe as well as warnings that the problem is more severe than the picture that arises from the wide consensus side.

# Intermezzo 2 Scientific controversies about causes and consequences of climate changes

*Jeroen P. van der Sluijs*

There are important disputes going on among climate scientists regarding some aspects of the climate problem. These discussions take place mainly at official scientific stages: in their journals, congresses, workshops. In this study we have looked primarily at scientific journals. Without pretending to offer a complete picture, in this Intermezzo we describe the following controversies in the scientific community:

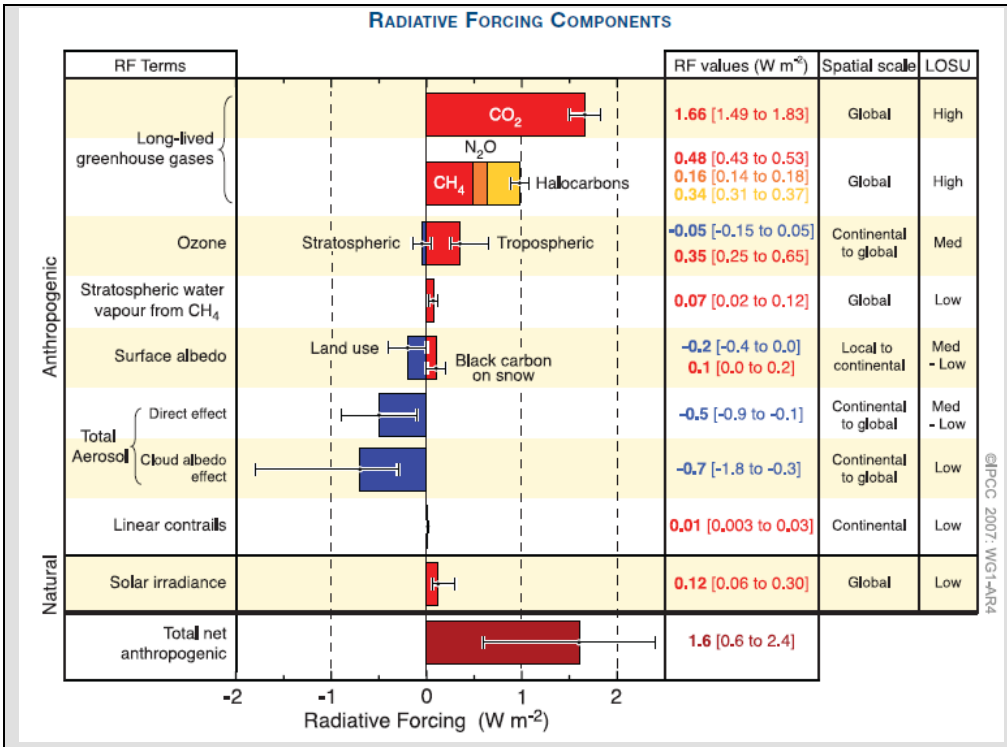
**About causes:**
- the role of man compared to the role of the sun when explaining observed warming patterns;
- the question of the degree to which recent warming is exceptional compared with climate fluctuations in the past 2000 years (the 'hockey stick controversy');
- the different stories about $CO_2$ in the geological past as brought forward by analysis of air bubbles trapped in polar ice and counts of stomatal density of fossil plant leaves.

**About consequences:**
- climate sensitivity expressed in the temperature increase that follows a doubling of atmospheric carbon dioxide concentrations;
- strengths and weaknesses of climate investigations with simulation models.

## 1. Controversies about causes

### 1.1 The role of man compared to the role of the sun

The fourth assessment report discussed the role of the sun extensively. An important Figure from the report is shown below: the current scope of the contribution of each of the factors that influence climate, expressed in the change of the radiation balance of the Earth compared to pre-industrial balances. This is called radiative forcing and is expressed in watts per square meter of Earth surface.




Intermezzo 2. Figure 1. Global average radiative forcing and uncertainty margins in 2005 for the various anthropogenic and natural causes of climate change. The last column shows the knowledge level.

What is noticeable in the Figure is that the magnitude of the radiative forcing due to changes in solar intensity is small compared to the role of greenhouse gasses, but also that the knowledge level (last column) is low. Because of this, the estimate about the share of solar intensity has a limited reliability. The IPCC nonetheless concludes that it is very unlikely that the role of the sun is substantially larger than what the figure depicts. Various scientists, including the Dutch astronomer Prof. De Jager, consider that the IPCC is underestimating the role of the sun and that more research is needed to understand this role properly. De Jager does not mean that the current contribution (as seen in Figure 2.1) is per definition underestimated, but that the sun can behave very whimsically and that it could hit us with major surprises in the future (see also De Jager et al. 2006; Meyer 2009). He also believes that there is an indirect effect of the sunspot cycle on the climate via solar winds (see below), which have not been included in Figure 2.1.

The Dutch paleoclimatologist Bas van Geel has analysed, among other things, peat sediments. He compared indications for changes in water levels in peat layers with fluctuations in the $^{14}C$ isotope. The $^{14}C$ isotope is a measuring rod for solar activity because $^{14}C$ occurs in the atmosphere under the influence of cosmic radiation. When solar winds are low, the Earth is less protected from cosmic radiation. Plants absorb $^{14}C$ during photosynthesis, and this isotope can be found back in peat. Van Geel discovered that in the last 6000 years wet and dry periods have quickly alternated. During episodes of decreasing solar activity (recognisable because of high amounts of $^{14}C$ in the peat), he kept finding traces of a wetter and probably colder climate. This indicates that in the past the sun was an important explanatory factor for climate fluctuations (Van Geel 1996; Blauw et al. 2004; Mauquoy et al. 2008).

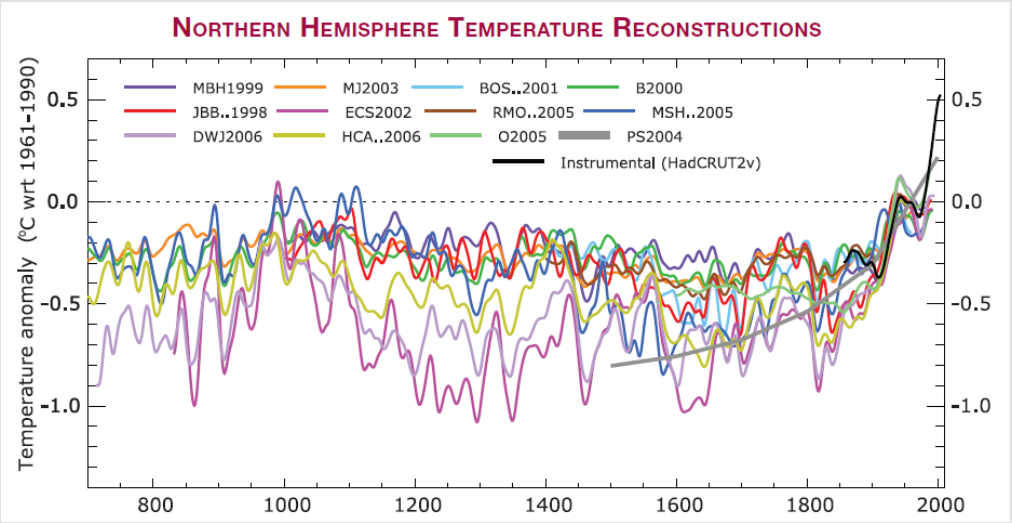
A group of Danish physicists (Svensmark & Christensen, 1997) developed a theory that posits that cosmic radiation modulated by solar winds influences clouds. Water vapour could condensate along the ionisation tracks that the cosmic radiation brings about in the atmosphere, thus forming clouds. This changes the cloud cover, which in turn influences the amount of solar radiation that can reach the Earth surface. By now many researchers have delved into this possible mechanism for the link between sunspots and the climate, but measurement series do not register the postulated effect on the clouds – hence no 11-year cycle can be spotted in the cloud cover as measured by satellites. Scientists have also sought for signs of an observable cloud formation during episodes of high cosmic radiation. The results of different studies vary considerably, from no effect to a 7% change in liquid cloud water, about one week after the most intense episodes. On the basis of this theory, an immediately and not a delayed effect is expected. None of the existing studies show a trend in the measured cosmic radiation that corresponds with the observed warming, thus the Danish theory cannot (yet?) be substantiated clearly through observations and measurements. Natural variation in cosmic radiation is large, which makes it doubtful whether a possible signal from a solar influence can be detected measurably.

The various studies that have become available since AR4 (fourth IPCC assessment report) confirm the order of magnitude of the role of the sun as estimated and depicted in Figure 2.1 (Van Dorland et al., 2009), and show no link between solar activity and clouds (Kulmala et al. 2009, Pittock 2009).

### 1.2 The hockey stick controversy

The hockey stick controversy is about the question of how abnormal the directly measured rise in average temperatures in the northern hemisphere in the last century is compared to temperature fluctuations on Earth in the last 2000 years, as reconstructed from indirect measurements.

Systematically gathered series of temperatures measured with thermometers in the northern hemisphere have only been available for about 160 years. Temperature series from before 1850 have been reconstructed from historical series that provide indirect information about the temperature (proxy data). The most common measurement series are tree rings, isotope ratios in ice core drillings and coral reefs, drilling in the sediments of ocean and lake floors, glacier lengths, and drilling cores in rocks and permafrost.
In the late 1990s, Michael Mann and colleagues published the first temperature reconstruction of the last millennium. Due to the typical shape of the graphic, it got the name ‘hockey stick’. There was a great deal of controversy around the hockey stick. Some saw in it the ultimate proof that man is warming the Earth, others had scores of questions about the reliability of proxy data. Since then, more such reconstructions have been published, based on other measurement series. AR4 includes 12 of those climate reconstructions together in a graphic, compared with temperatures measured directly with thermometers since 1850 (Figure 2.2).




Intermezzo 2. Figure 2. Reconstructions of the variations in temperature in the northern hemisphere during the last 1300 years, based on different measurement series of proxy data. The series measured since 1850 directly with thermometers is depicted with the black line. The vertical axis shows the deviation of the yearly temperature from the 30-year average of 1961-1990 (IPCC 2007).

The picture that comes forward from the 12 reconstructions is remarkably consistent for the warming of the last century, with one noticeable exception: the tree-ring reconstruction of the group of Briffa shows a trend after 1960 of decreased tree-ring thickness that would come back in the graphic as a temperature drop since 1960 of about 0.2°C in the BOS-2001 line in the graphic, but this measurement series has only been included in the graphic until 1960.
At first glance it seems surprising that the tree rings would have been decreasing in thickness since 1960/1970 while direct thermometer measurements show a warming. Tree-ring thickness is influenced by several factors. One possible explanation for the discrepancy is the acidification that started around that time and which we know influences the growth of trees negatively. In many versions of the hockey stick graphic, including that of AR4, the Briffa reconstruction after 1960 has been left out because, among other reasons, the acidification signal in the tree ring thickness is thought to make the temperature signal unreliable (Briffa et al. 1998).

Critics of the hockey stick analysis, like Canadian statistician McIntyre, read between the lines of the hacked e-mails of Prof. Phil Jones of the University of East Anglia that the Briffa reconstruction from tree rings after 1960s was left out partly out of political considerations. McIntyre speculates that the intentional omission would make the message of the graphic less alarming. This cannot really be concluded from the literal text of the e-mails in question.
Another ongoing point of dispute about the hockey stick graphic concerns the warm period in the Middle Ages, roughly between the years 900 and 1300 – in connection with the question of whether current warming is unique compared to natural climate fluctuations. Was this medieval period warmer than the warm period of recent decades or not, and was this warm period a regional or a global phenomenon? Temperature reconstructions from proxy data rest on so many assumptions and are surrounded by so many uncertainties that they still leave room for all these interpretations.

In 2006 the American National Academy of Sciences published a report of a workgroup of independent scientists especially appointed for this purpose in which the hockey stick discussion is

scrutinised in detail. The commission came to the conclusion that the warming of about 0.6 degrees measured in the last century with thermometers is indeed consistent with the temperature reconstructions from numerous proxy data, and that it can be deduced with great reliability that the warming of recent decades is exceptional compared to the last 400 years.

They assessed the data over the period spanning the years 900 to 1600 as less reliable, and reconstruction from before the year 900 as having very little reliability (NAS 2006).

### 1.3 Stomas versus air bubbles in ice

Part of the knowledge about the role of $CO_2$ in Earth's climate is based on the measured composition of air bubbles contained in the ice of the South Pole. The most important measurement is that of the Vostok ice core drilling. By drilling more than 4 kilometres deep into the ice, researchers could look up to 800,000 years back in time. The ice mass grows each year because of snowfall. In the process, air from the atmosphere becomes trapped in the ice. Isotope measurements allow scientists to determine the age of the ice in each position of the drilling core. Based on other isotope measurements, reconstruction of temperatures during the formation of the ice is fairly reliable. A time series can be produced that gives information about the composition of the atmosphere in the geological past and the corresponding temperatures. The natural ice age cycles, which correspond with the Milanković cycles (variations in the position of the sun with respect to Earth using three variations), are clearly observable. The picture that comes forward is that $CO_2$ concentrations in the last 660,000 have fluctuated between around 180 ppm (particles per million) during the ice ages and 280 ppm during interglacial periods. For the last 1000 years, ice core drillings show very constant $CO_2$ concentrations of 280 ppm.

In recent years new paleontological studies have become available which aim at reconstructing the pre-industrial atmosphere on the basis of other data. An important development is the systematic counting of stomas on fossil plant leaves. The more $CO_2$ is in the air, the fewer stomas plants make. Paleo-ecologists of Utrecht University have published a reconstruction of the composition of the atmosphere between the years 1000 and 1500, based on stomatal frequency counts of fossil leaves in southern Limburg (Van Hoof et al., 2008). This reconstruction shows that natural variability in atmospheric $CO_2$ concentrations was greater than the ice core reconstructions show. The difference between the highest and lowest values in the examined period amounted to 34 ppm, three times as much as the 12 ppm variation on the ice core reconstruction of that same period. This shed doubts on the IPCC's conclusion that $CO_2$ played no role in fluctuations of the pre-industrial climate of the last 1000 years.

The new finding can also mean that a slightly smaller or actually a larger portion of the observed increase in atmospheric $CO_2$ concentrations in the last century was caused by humans than thought up to now – after all, the uncertainty regarding pre-industrial concentrations appears to be three times bigger. Reconstruction of pre-industrial $CO_2$ concentrations can also be used to improve estimates of climate sensitivity.

# 2. Controversies about consequences

## 2.1 Climate sensitivity

One of the greatest uncertainties in climate projections based on climate models concerns the so-called climate sensitivity, a measure of the average global increase of the equilibrium temperature on the Earth surface that results from a doubling of atmospheric $CO_2$ concentrations compared to pre-industrial levels (from 280 ppm to 560 ppm). Calculations with single-column radiation models of the atmosphere show that such a doubling will cause globally an average initial rise in the warmth radiation balance of the Earth's surface of about 3.7 W/m$^2$. Without any feedback mechanisms, one can accurately calculate that this will be accompanied by a global average warming of about 1°C.

In reality, this initial warming leads in turn to numerous changes in the climate system, some of which enhance the already triggered warming (positive feedback), while others dampen the warming (negative feedback). An important positive feedback occurs with the decreasing reflection capacity (or albedo, literally 'whiteness') of the Earth surface: the reflection of sunlight by ice and snow has a cooling effect, which becomes weaker as the ice and snow surface shrinks. There is also water vapour feedback: at higher temperatures more water evaporates, and a warmer atmosphere can contain more water vapour – a strong greenhouse gas – so warming increases again. Yet more positive feedback is caused by redistribution of warmth in the atmosphere caused by warming: high in the atmosphere (in the stratosphere) it becomes colder, but below (in the troposphere) it actually gets warmer. This is known as tilting of the vertical temperature gradient, with the tropopause as pivotal point.The role of clouds is more complicated and is not yet completely understood. Because of their water content, clouds contribute to radiative forcing, but at the same time because of their whiteness (reflection of sunlight) have a cooling effect. Which of these two opposite effects weighs the most depends on many factors, such as the average drop size in the cloud, drop density, optical thickness, altitude of the nimbostratus and degree of coverage. The net result can produce a positive or a negative result per cloud, which results in a positive (more warming) or negative (warming-inhibiting) net feedback of clouds (Bony et al. 2006).

The greatest differences in the results of different climate models can be traced back to the way in which the role of clouds is modelled. There are roughly two different methods by which cloud formation is modelled. In one method it happens as a function of relative air humidity, and is known as the RH (relative humidity) scheme. It rests on the assumption that clouds are formed when water vapour concentrations exceed a threshold value which varies with temperature and atmospheric pressure. The CLW (cloud liquid water) scheme is an attempt to describe the physics of cloud formation. These physics are not yet known with accuracy though, hence there is no scientific reason to chose the CLW scheme over the RH scheme. Knowledge about cloud formation is insufficient to this end.

The physical ensemble approach is a promising newcomer. It makes a large number of model simulations in which for each model run different values are assumed for the relevant model parameters, sampled from their uncertainty ranges (Murphy et al. 2004). When this is done not with one but with different models, we speak of a multimodel ensemble. This approach provides the most complete insight into the uncertainty range within which climate sensitivity could lie.

Based on numerous model studies, observations and reconstructions from paleontological data, AR4 estimates that climate sensitivity probably lies in around 2 to 4.5°C, with 3°C as best estimate. The IPCC considers a value lower than 1.5°C very unlikely. Values above 4.5°C cannot be ruled out, but lend themselves less to be reconciled acceptably with the already observed warming.

The American climatologist Richard Lindzen (2001) states that in the atmosphere above the tropics there is strong negative feedback, due to which according to his estimates climate sensitivity lies ten times lower than the best estimate of AR4. According to Lindzen, climate sensitivity only amounts to 0.3°C. The atmosphere in the tropical zone, according to his theory, reacts with more intense episodes of very heavy rainfall, in which a lot of water disappears from the atmosphere in a short period. After such mega-rains, the atmosphere in those spots temporarily contains very little of the greenhouse gas water vapour, which allows Earth's surface to radiate a lot of its warmth radiation to space unencumbered. He describes this as a self-regulating cooling 'iris' that opens up often when it gets warm, in this way strongly counteracting the warming process.

The theory of Lindzen is controversial and is contradicted by different observations. The group of Lin (Atmospheric Sciences Research, NASA) used the Lindzen model and fed it with observations from other satellites (Lin et al. 2002). The calculations of Lin resulted in slightly positive feedback, thus in fact a higher climate sensitivity than the IPCC's best estimate. From Lin's study it appears that the Lindzen model is very sensitive to small changes in the used data and assumptions. It is noteworthy that Lindzen himself does not report on this sensitivity. Among the requirements of good scientific practice are that, when publishing the results of a model studied, scientists must also publish the results of a sensitivity analysis of the used model.

Research into climate fluctuations during the last million years indicates that climate sensitivity can in fact be twice as high as the best estimate in AR4: not 3°C, but 6°C (Hansen et al. 2008). This difference is due mainly to feedback that keeps happening decades or hundreds of years later, like that of the land ice albedo. The time scale adopted to determine climate sensitivity it thus of great importance. Slow feedback mechanisms have not been processed properly into the climate models yet, among other reasons because they rarely span more than 100 years. Another recent study (Chylek et al. 2007) bases itself on data gathered by 14 satellites and on observations of the dust content in the atmosphere from 1985 to 2005. That study showed that climate sensitivity is actually twice as small as the best estimate in AR4. For a more comprehensive discussion of the implications of slow feedback processes, we refer readers to the PBL report *News in climate science and exploring boundaries* (Meyer 2009).

### 2.2 Strengths and weaknesses of climate investigations with simulation models

The most advanced yet most complicated climate models are known as atmosphere-ocean coupled general circulation models (GCM's). They simulate the interaction between atmosphere, ocean, land surface and sea ice. Nearly all meteorological knowledge meets here. The Earth-atmosphere-ocean system is subdivided in the model into layers and grid cells. The resolution of this grid for the current GCM's lies around 150 km, while the atmosphere is subdivided vertically into about 19 layers. Using meteorological and thermodynamic fundamental equations, for every variable – such as wind, temperature and humidity – a time development is calculated at each grid cell for each

layer, taking into account the interactions with all the surrounding grid cells. Current GCM's include many processes and feedback mechanisms.

In GCM's several processes are parameterised – in other words, they are not calculated on the basis of the laws of physics but are quantified with a highly simplified calculation scheme. This is done because the spatial scale on which the processes occur is smaller than the resolution of the grid in which the model has subdivided the Earth-atmosphere system. For example, if the model calculates with grid cells of 100 by 100 kilometres and the process takes place on a much smaller spatial scale, as is the case with cloud formation, there is no other option. This problem cannot be solved by calculating with a finer grid either, as one would have to deal with the limitations of the calculation powers of supercomputers. Furthermore, a finer grid would create the need for increasingly detailed measurement data in order to feed it to and calibrate the models, otherwise parameterisation would raise questions about the data's reliability. The equations are, after all, no longer directly based on the laws of physics but on a much simplified, large-scale description of the underlying natural process, which is afterwards calibrated with imperfect and incomplete measurement series. Processes that have been parameterised in climate models are: radiation processes, boundary layer fluxes, convection, cloud formation, evaporation, ground hydrology (because of the potential evaporation) and oceanic interaction.

Important limitations of climate models are currently:
- fundamental limitations of the predictability of complex systems;
- the modelling of cloud cover and optical properties (including the aerosol effect);
- modelling of water vapour feedback processes (all process that transport water vertically);
- the (unavoidable) use of parameterisations;
- the limited quality and length of available measurement series and indirect data (proxy data), which complicate the calibration and validation of the models;
- insufficient inclusion of many feedback mechanisms that act via the biosphere (Van der Sluijs 1997);
- insufficient inclusion of slow-working feedback mechanisms (Hansen 2008);
- the limited possibilities for the validation of models of open systems like the Earth and of the assumptions on which they are based (Oreskes 1994).

Another problem is that the reproducibility and independent testability of model simulation is limited in practice because the large models cannot just be transferred to the computer of another research institute. If another research group wanted to test the experiment independently, it must have the same supercomputer and corresponding software. This requires gigantic investments, which limit testability. The alternative of buying computing time on the same supercomputer on which the original simulation experiment was done is also an expensive prospect.

Further, there is a more general criticism of the use of computer simulation models as substantiation for climate policy. Many models are, according to critics, overparameterised and can give a wide spectrum of results with justifiable initial values and parameter settings. This engenders the risk that researchers can keep fiddling with the model until a desirable result comes out (Hornberger & Spear 1981; Saltelli 2008). Through systematic uncertainty analysis and sensitivity

analysis of the models, instead of one single arbitrary result, the entire *range* of possible model results can be mapped out and described. This could largely obviate that point of criticism.

In addition, it is good practice to use not just one, but as many different models as possible and to compare the results. Within the IPCC this has been common practice for a long time. AR4 too makes use of this multimodel approach, in which results from models developed by different groups of scientists are averaged. In this way, researchers try to neutralise any systematic error of models. A problem is that these models have not been developed independently from each other and, for example, parts of them use the same source code, as a result of which eventual systematic errors may not get neutralised after all.

In the World Climate Research Programme (WCRP) a project has been running since 1989 in which climate models and their results are systematically compared.
Explanations are also sought for differences in results. Nearly all atmosphere-ocean coupled general circulation models are involved here.[9]

This is a form of quality control that leads to continuous improvements of the models.
In a recent report of the *US Climate Change Science Program* (Bader et al. 2008) an extensive analysis was made of strengths and weaknesses of the current generation of climate models. For seasonal cycles and large-scale variations in climate the models correspond well with the established observations (correspondence is about 95%). The correspondences between models and observations are slightly less good (about 50 to 60%) for the precipitation pattern, with the largest deviation in the Amazon region and elsewhere in the tropics.

In the terrain of jet streams[10] and storms in middle latitudes (between 40° and 65°, in northern and southern latitudes), most models do well. Modelled ocean circulation is also corresponding increasingly well with the observations.

The observed southward displacement of the storm track and the jet stream in the southern hemisphere is also reasonably well simulated in the models. The cause is twofold: there is the intensified greenhouse effect and there is the depleted ozone layer, which has a local cooling effect in the stratosphere. For trends in climate extremes the current models are also consistent with the observations, especially the increase of extreme precipitation events as well as severe drought. When the current models are fed with the best estimates about the contributions of greenhouse gasses, volcanic dust, variations in solar radiation and anthropogenic aerosol emissions from the last century, the climate simulated with those models shows large similarities with observed reality. One should keep in mind that the models are calibrated to those same observations. For this reason, strictly speaking they do not yet have a predictive value for the climate system in terms of how it would behave under new conditions, namely higher greenhouse-gas concentrations.

[9] See www-pcmdi.llnl.gov/about/index.php and www-pcmdi.llnl.gov/ipcc/diagnostic_subprojects.php.
[10] Jet streams are permanent strong, meandering air currents at higher altitudes of the troposphere, with wind speeds of 100 to 400 km per hour.

# 4 Climate politics and science in the media

*Monique Riphagen, Davy van Doren, Jeroen P. van der Sluijs, Jurgen Ganzevles, Rinie van Est, Arjan Wardekker*

## 4.1 Introduction

The media – old and new – play an important role in political and societal discussions. They report on the political debate, reflecting it, and offer a platform for the societal debate. Opinion pages in newspapers and newsmagazines aim to present a wide spectrum of different stimulating societal opinions, thus fostering the societal debate and clarifying differences of opinion.

But the media also inform the political debate. News reports can trigger parliamentarians to pose questions to the minister in charge or place topics on the political agenda. In a more indirect manner, media attention can put pressure on politicians to place topics on the agenda through grassroots support. The media reflects not only on the political and societal debate, but also influences it to a degree.

Shortly before the Copenhagen climate summit (December 2009) the Climategate affair became of public interest and appeared in the media. After Copenhagen news came out about Himalayagate – the real or alleged faults in the fourth IPCC report (see Chapter 3). The news in the media about these possible climate science scandals gave rise to heated debates in Parliament.

The present chapter describes how the Dutch written media has reported about the topic of climate change in the last four years. This comprises the period from 2006 up to 2009, which we identified in Chapter 2 as phase 5: implementation of the Climate Convention, Copenhagen phase. We analyse articles about climate change from four Dutch newspapers (*Algemeen Dagblad*, *NRC Handelsblad*, *de Telegraaf* and *de Volkskrant*) and two weekly newsmagazines (*Elsevier* and *Vrij Nederland*). We examined what types of events these media give attention to. Do they report mainly about scientific or politically-related events? Do they report more about national or international events? We also map out from what perspective they report on climate change. Do they bring out mainly alarming voices or rather sceptical ones?
In this chapter we show that the Dutch media pays balanced attention to the climate debate. What is noticeable is that it is primarily an international discussion. There is a strong emphasis on the international political discussion about the climate convention. The Dutch political debate remains largely out of the picture. Climate is seen as a technical-scientific issue and not as a political issue – this appears to reflect the depoliticisation of this Dutch debate.

**Method**

*Selection of articles*

For the media analysis in this chapter six sources were selected, four newspapers and two newsmagazines. Written, paid media was chosen because they have a full archive via the online newspaper databank LexisNexis (www.lexisnexis.com) for the chosen period. These four newspapers and two newsmagazines represent together such different target groups that they reach an average of the population. The four chosen newspapers are *Algemeen Dagblad*, *de Telegraaf*, *NRC Handelsblad* and *de Volkskrant*. The newsmagazines are *Elsevier* and *Vrij Nederland*. The chosen newspapers and newsmagazines form a reflection of different voices in society. The selection period runs from January 2006 to December 2009. Starting in 2006 attention to climate change increased, and enough articles appeared to conduct a useful analysis.

In LexisNexis we sought first of all which search terms produced the most hits. The applied search term 'opwarming' (warming) resulted in a total of 1875 articles, 1277 of which ended up being analysed; the other articles did not hold any relation with climate or climate change (for example, 'athletes *warming* up before training' or '*warming* up the soup'. Table 4.1 provides an overview of the numbers of analysed articles per newspaper or newsmagazine.

*Analysis of the articles*

The articles were analysed qualitatively as well as quantitatively. For each individual article a number of variables was established. These variables are described in Table 4.2. This analysis is partly based on a subjective interpretation of the nature and tenor of each article. In most cases, articles could be classified simply on the basis of the categorisation and classification used. For a number of analysed articles this was less self-evident and a choice had to be made.

The article in such cases was not categorised into different classes, because this would make the weighing per article uneven. An uneven weighing can lead to false interpretations of data and a distorted representation of the research results.

Table 4.1 Overview of used media

| ***Type of medium*** | ***Newspaper*** | | | | ***Newsmagazine*** | |
|---|---|---|---|---|---|---|
| Medium | Algemeen Dagblad | NRC Handelsblad | Telegraaf | Volkskrant | Elsevier | Vrij Nederland |
| Number of articles | 174 | 379 | 248 | 417 | 39 | 20 |
| **Total** | **1218** | | | | **59** | |

Table 4.2 Description of examined variables

| *Variable* | *Description of variable* |
|---|---|
| Date | Date of publication |
| Type of medium | Newspaper or newsmagazine |
| Medium | Name of newspaper or newsmagazine |
| Section | Section within the medium in which the article appears |
| Title | Title of the article |
| Author | Author of the article |
| Source | The sources listed or used in the article |
| Topic of article | Most important topic on which the article is based |
| Conclusion of article | Most important conclusion of the article |
| Category | The type of topic that is discussed in the article. See Table 1 of the Appendix for a further description of the used categories. |
| Tenor | General tenor of the article. See Table 8 for a further description of how the tenor per article type was determined. |

## 4.2 Dynamics of media attention

In this section we will search for the dynamics of media attention in the field of climate change. How many articles were published in the 2006-2009 period, and how does the attention in the written press relate to events in society such as international climate summits, parliamentary debates and the appearance of scientific reports?

Figure 4.1 shows per month the number of published articles in the newspapers and newsmagazines we analysed. This figure also offers insight into whether the reporting is of an alarming or a sceptical nature, or whether it is undetermined (for an analysis of this, see section 4.3).

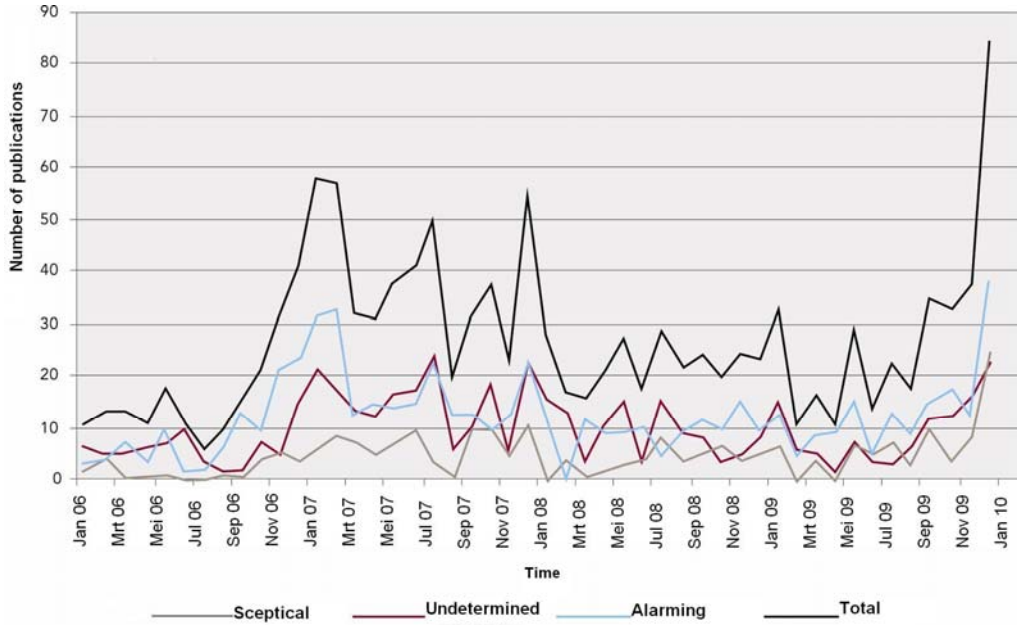



Figure 4.1 Number of articles that appeared in the Algemeen Dagblad, NRC Handelsblad, de Telegraaf, de Volkskrant, Elsevier and Vrij Nederland in the period between January 2006 and December 2009

Figure 4.1 shows some peaks in the media attention. News reports with an undetermined and alarming tenor follow the total line and show a similar pattern of peaks and lows. The sceptical line follows the same pattern but lies slightly lower – thus fewer articles were found with a sceptical view.

Which events determine these dynamics and generate the most media attention? In the examined period we first see a major peak between October 2006 and February 2007. Various international events are responsible for this. In October 2006 the documentary *An Inconvenient Truth* by former American Vice-President Al Gore generated a lot of media attention. Next, in November the report of the British economist Nicholas Stern appeared in which he calculated for the British government what the potential financial consequences of climate change are. These events appear to be occurring not entirely coincidentally on the eve of the climate summit, COP 12, in November 2006 in Nairobi. In the Netherlands the KNMI announced in a report that the last fall was the warmest ever in the Netherlands. In December 2006 national as well as international events were reported on. Former President Clinton came to Rotterdam to promote the Clinton Climate Initiative. At an international level the media reported on the IPCC announcement that the fourth assessment report (AR4) would be published in April 2007.

The following noticeable peak occurred in June and July 2007. In June the G8 held a summit in Germany with climate as its central theme. In July *Live Earth*, a worldwide concert with climate change as theme, took place. In July 2007 the documentary *The Great Global Swindle* came out. This climate-sceptical production was a reaction to the climate-alarmist documentary of Al Gore, *An Inconvenient Truth*.

In December 2007 there was another peak in media attention, especially regarding COP 13, the UN climate conference in Bali. In the Netherlands the documentary *Meat the Truth*, made by Marianne Thieme from the Party for the Animals, came out, focusing on the major effect of meat consumption and production on climate change.

In 2008 we see some smaller peaks. At an international level no major events took place except for COP 14 in Poznan, which can also be seen in Figure 4.1 (in December 2008). At a national level two events took place that were written about several times. In August 2008 the KNMI published a report about the consequences of climate change, and in September a report from the Delta Commission came out. Both events generated some media attention but did not cause a large peak.

In 2009 too things remained relatively calm. This was however the prelude to a boost of media reports in late 2009 about the UN climate summit in Copenhagen (COP 15). In the month preceding COP 15 there was Climategate, the (alleged) scandal surrounding the hacked e-mails of climate scientists (see Chapter 3). This received extensive coverage. In December 2009 the media was overflowing with Copenhagen.

This overview shows that the most noticeable peaks were from news reports about international events of a political nature. Especially the climate conferences (COPs 12, 13, 14 and 15) appear to be determinant for the dynamics of media attention. Preceding and surrounding these conferences many media events took place – *An Inconvenient Truth* before COP 12 in Nairobi, *Live Earth* five months before COP 13. Reports also come out regularly before international summit conferences that present the scientific state of affairs regarding climate change. Such media events appear to want to generate attention for as well as give input to these international climate summits. In this way the dynamics of media attention to climate change reflect the dynamics of international climate politics, including all the problems and uncertainties that go together with an international political context.

## 4.3 Substantive analysis of media attention

To be able to say more about the content of the examined articles, they were classified into five different categories: problem, cause, consequence, policy and solution. The ‘problem’ category is generally about the climate problem and about events and opinion polls in relation to climate change. The ‘cause’ category examines various processes that underlie climate change. The ‘consequence’ category describes the consequences of climate change for man, nature and the economy. The ‘policy’ category’ includes news reporting about agreements, debates and negotiations related to general climate problems and climate policy, reduction of $CO_2$, and energy and transportation policies to be implemented (see Table 1 of the Appendix). The ‘solution’ category contains articles about solutions for counteracting climate change or its consequences. Figure 4.2 shows the relative distribution of the articles over these categories.

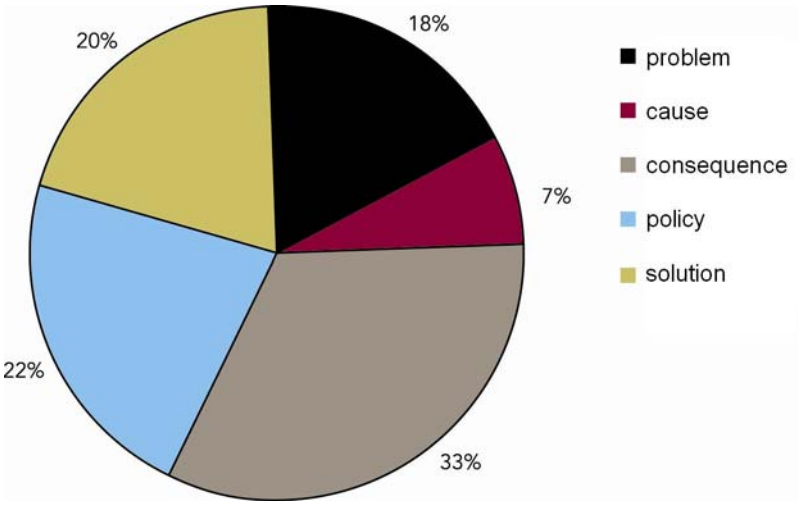



Figure 4.2 Distribution of the examined articles over five different categories.

Relatively little attention is paid to the causes of climate change, the domain of climate science. Only 7% of news reporting is about that. It could be that we have already passed the phase of problem-signalling and the ensuing analysis of the causes. It could also be that scientific articles about the causes of the climate problem are considered as less newsworthy. There are hardly any writings about the causes of climate change from a sceptical perspective.

Most of what is written in the newspapers and newsmagazines is about the consequences of climate change, with 33% of the examined articles discussing the possible consequences of a warming planet. Possible solutions (20%) and policies to be implemented (22%) are discussed a lot.

Searching for solutions and the creation and implementation of (climate) policies is part of what politics is about. Before the creation of climate policies, political considerations and choices are made. News reporting about climate policy reflects this political debate. The policy category appears to be the most divided. Figure 4.3 shows that nearly as many articles with a sceptic as with an alarming tone regarding climate policy are published.

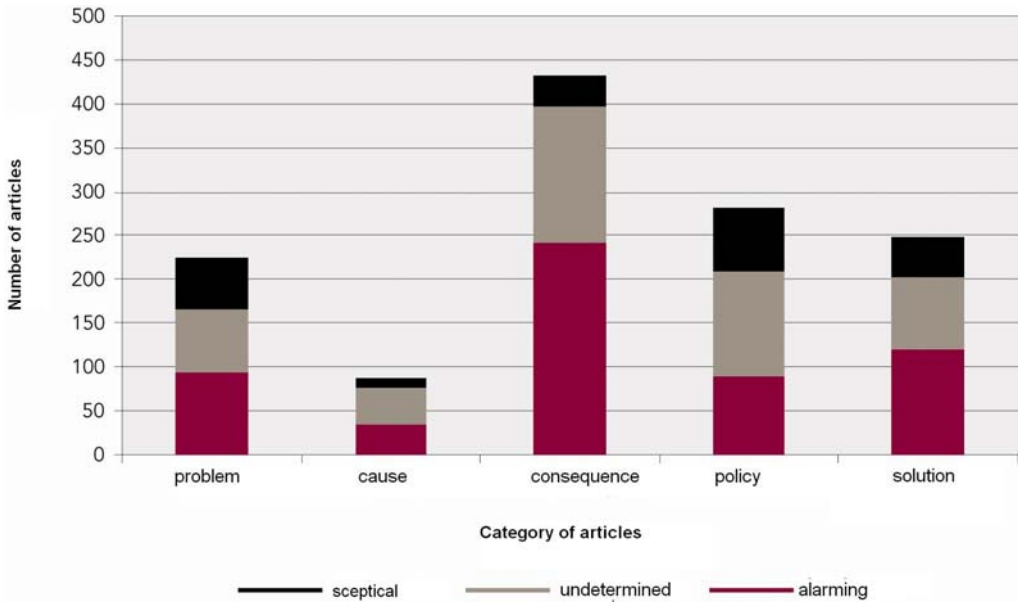



Figure 4.3 Distribution of the examined articles over five different categories.

## 4.4 Sources of media reporting about climate change

To gain more insight into the sources on which the four newspapers base their reporting, we analysed them for all the articles. First of all, we wanted more insight into the type of source that was used. Does it come mainly from science, from politics or from interest groups? An overview of this distribution is shown in Figures 4.4a, 4.4b and 4.4c. We made a distinction between international and national sources. In the unknown and other categories it was not possible to make this distinction. Give that this category makes up 23% of the total sources, this percentage was also used in Figures 4.4b and 4.4c.

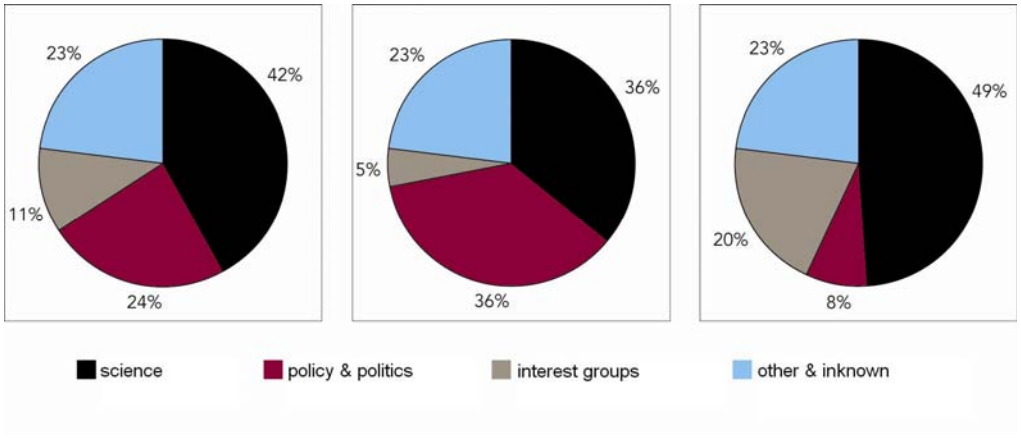



Figure 4.4a Distribution of total number of sources over science, policy & politics, interest groups, and other & unknown.

Figure 4.4b Distribution of total number of international sources over science, policy & politics, interest groups, and other & unknown.

Figure 4.4c Distribution of total number of national sources over science, policy & politics, interest groups, and other & unknown.

Almost half of the total sources appear to come from science. Much is also drawn from the policy & politics category. A relatively minimal portion of the information comes from interest groups. Among

interest groups are representatives from the business community as well as environmental organisations like Greenpeace and the World Wide Fund for Nature. These NGOs thus contribute to a limited degree to the debate in the media. Finally, there is a large category of 'other & unknown', which includes sources that do not fit in the other categories and articles whose sources are not clear. Examples of other sources are religious leaders making pronouncements about the climate problem or a mountain guide announcing that he has observed the glaciers receding. Compared with the international sources, many national sources come from the scientific field. A relatively small percentage of sources comes from Dutch policy & politics. By contrast, more national interest groups are mentioned that international interest groups.

Although a large part of the sources come from science, they do not produce large peaks in news reporting, as we saw in the previous section. Figure 4.1 shows that those scientific publications which lead to peaks are reports that serve a policy goal, for instance of the KNMI or the IPCC. Publications in the prominent journals *Science* and *Nature* are also mentioned repeatedly. Do the mentioned sources come mainly from policy-oriented climate science? Or is a lot drawn from the corner of general climate science or other scientific disciplines such as economics, psychology and biology? We split these different scientific categories in Figures 4.5a, 4.5b and 4.5c.

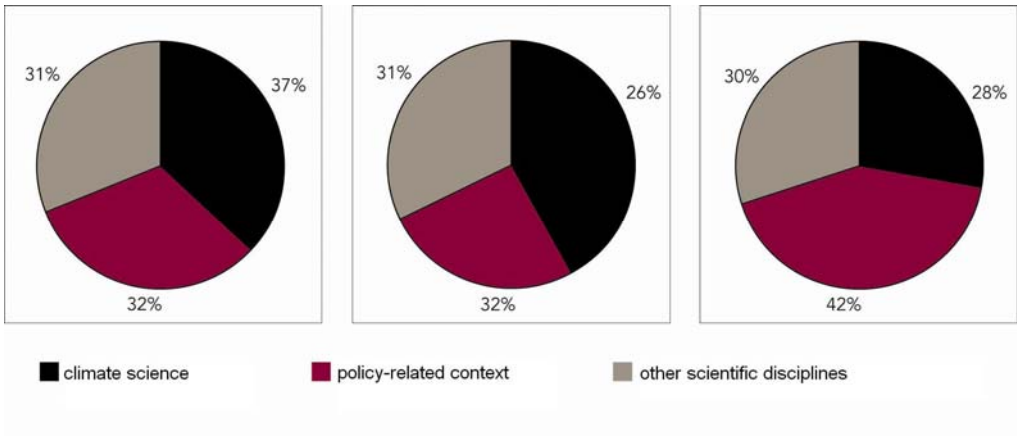



Figure 4.5a Distribution of the total number of sources over climate science, climate science in a policy context, and other scientific disciplines.

Figure 4.5b Distribution of the total number of international sources over climate science, climate science in a policy context, and other scientific disciplines.

Figure 4.5c Distribution of the total number of national sources over climate science, climate science in a policy context, and other scientific disciplines.

The distribution over the three types of science we used is fairly even. Slightly more use is made of academic climate scientists or scientific publications, such as articles in the scientific journals *Nature* and *Science*. Sources from climate science that have come about in a policy context, like the IPCC's AR4, and sources from other scientific corners, are used practically as often. Examples from this last category are the Danish economist Bjørn Lomborg and biologists who point to the extinction of species, possibly as a consequence of climate change. The media thus use a wide range of scientific sources and present the scientific debate fully. We do see differences between the use of international and Dutch sources. Relatively more international sources from general climate science are used than national sources. A relatively large part of the national sources come from climate science in a policy context. International sources come relatively more often from general climate science.

Table 4.3 lists the aforementioned categories, split into international and national sources in absolute numbers. International climate science is clearly mentioned more often in the media than national climate

science. Articles based on policy-oriented climate science pay about the same amount of attention to international as to national reports. The fact that this ratio is different than that of articles based on fundamental climate science probably reflects the large share of demand-oriented climate research programs in the Netherlands (see also Chapter 3). It is also noticeable that international policy & politics score much higher than national policy & politics. Wherever interest groups are the source of the news reporting in the media, these tend to be national interest groups.

Table 4.3. Overview of the numbers of newspaper sources coming from the different types of science, policy & politics, and other categories.

| Type of source | National | International | Total |
|---|---|---|---|
| **General climate science** | **45** | **117** | **162** |
| **Policy-oriented climate science** | **69** | **73** | **142** |
| **Other science** | **48** | **90** | **138** |
| **Policy & politics** | **40** | **279** | **319** |
| **Interest groups** | **103** | **40** | **143** |
| **Other** | | | **315** |
| Total | | | 1218 |

## 4.5 The tone of the climate debate in newspapers and newsmagazines

Climate alarmists warn that there is a severe climate problem and urgent, drastic measures are necessary. Climate sceptics, on the contrary, doubt the existence or the severity of global warming and usually argue against far-reaching climate policy or find climate policy not necessary at all. In the United States, climate-sceptic voices get a relatively large amount of media attention because of the journalistic principle of hearing both sides of an argument (Boykoff & Boykoff 2004). The result is a 'balance as bias': the small minority of sceptic climate scientists get as much space as their non-sceptical colleagues. In this section we look at whether this is also the case in the Dutch written media. We describe how many alarming and sceptical voices regarding climate change can be found in these media. We also indicate what the ratio is between alarming and sceptical voices, for different newspapers and newsmagazines.

### No 'balance as bias'

Table 1 of the Appendix shows for each category when an article is classified as alarming, undetermined or sceptical. Note that 'sceptical', e.g. for the 'solutions' categories, means something different than for the 'problem' category. Pronouncements such as 'the proposed solutions are poor or unnecessary methods to counteract climate change' and 'this solution does not work' evidence scepticism towards the first category. A claim such as 'action must be undertaken to tackle the climate problem' or 'the problem does not justify government interventions' is sceptical with respect to the problem.

Figure 4.6 shows that the Dutch situation is not comparable to that in the US either. Slightly less than half (45%) of the articles is of an alarming nature, 37% is undetermined and 18% has a sceptical tenor. Hence the picture that is formed in the various media we analysed is not purely alarming or sceptical in its totality. The Dutch media thus shows no balance as bias.

But does this also apply to the various separate newspapers and newsmagazines? And to what degree do newspapers and newsmagazines differ from each other in their reporting about alarming or sceptical voices? Figure 4.7 shows little difference between the four examined newspapers. In all the newspapers,

between 44% and 51% of the analysed articles was alarming, between 33% and 39% undetermined, and between 14% and 19% had a sceptical tenor. Among newsmagazines the ratio is different though. From the analysed articles in Vrij Nederland, 35% had an alarming tenor, 60% were undetermined and only 5% had a sceptical tone. The analysed articles in Elsevier were of a chiefly sceptical nature (54%), and only 13% were alarming. Compared with Elsevier, Vrij Nederland does not opine much yet reports rather neutrally about the climate problem.

The placement of an article in the different sections of newspapers and newsmagazines will depend on its content. Relatively speaking, most alarming articles in the newspapers are placed in the Netherlands/international section and the book section. The largest number of sceptical articles are placed in the opinion & debate section (see Figure 1 of the Appendix). In newsmagazines too the most sceptical articles are placed in the opinion & debate section (Figure 2 of the Appendix).

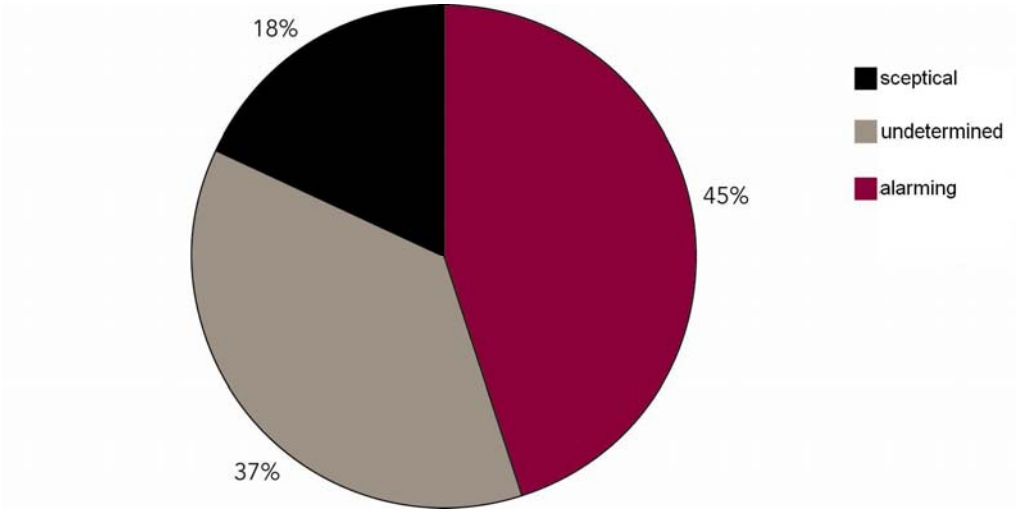



Figure 4.6 Distribution of tenor of the message across all analysed articles.

We may conclude that the climate debate in the Netherlands is conducted in a fairly nuanced fashion in the various examined newspapers. Dutch newspapers present the sceptical voices without there being a balance as bias. The two newsmagazines do take a clear political position in the climate debate, with Vrij Nederland reporting more from an undetermined angle than the newspapers. This is probably not that surprising, given that stimulating debate and presenting opinions is their function. The newsmagazine Elsevier does that merely from a social conservative and economically liberal vision. Vrij Nederland has always had a more progressive character.

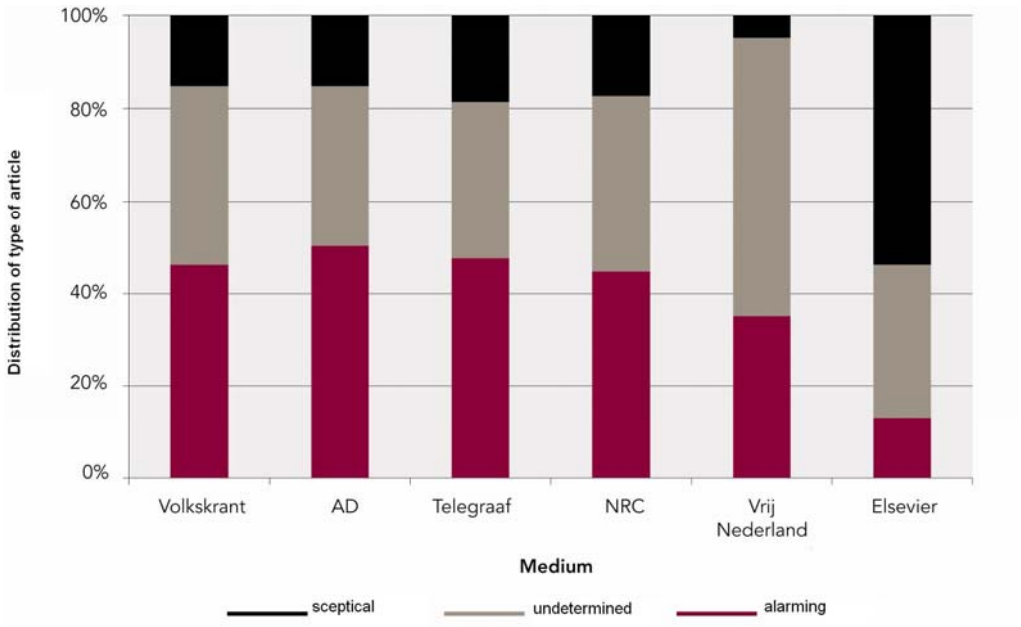



Figure 4.7 Relative distribution of the tenors of the examined articles per medium.

## 4.6 Conclusion

Looking at how the Dutch written and editorial media have reported on the topic of climate change over the last four years, clear peaks and lows are noticeable. If we split the number of articles from that time according to their alarming, sceptical or undetermined tenor, the peaks and lows in all three lines follow roughly the same pattern. These dynamics seems thus not to be determined by sceptical versus alarming causes, but much more by events around which sceptical and alarming voices can be heard that are subsequently found in the media. The strongest signal in the time series of media attention can be clearly traced back to international climate negotiations in a UN context. The succession of the conferences of treaty parties (in the examined period COP 12 in Nairobi, COP 13 in Bali, COP 14 in Poznan and COP 15 in Copenhagen) dictates the peaks in media attention. Most other events that got a lot of media attention tend not to be of a coincidental nature – they are usually issues such as the publication of reports or documentaries, or media-oriented events that are clearly timed to take place right before a climate summit. Behind such media events there seems to be an attempt to generate attention for these international climate summits and a desire to give input to them.

If we look at the content of the news reporting, we see that it primarily involves consequences, policies and solutions. There is less attention for problem analyses, and the least attention goes to the causes of climate change. The most important sources news reporting makes use of are science (slightly less than half) and policy & politics (about one quarter). Interest groups constitute the source in only about 10% of the news. Although a large portion of the sources come from science, these sources do not account for large peaks in reporting, with the exception of scientific reports that serve a policy goal, like the reports from the IPCC and KNMI. For reports coming from scientific sources, distribution among disciplines is fairly even. If we examine differences in attention between Dutch and international sources, we see that international sources take a lead in climate science. This applies even more to policy & politics. The press pays very little attention to Dutch climate politics – this is not the case with interest groups. National sources appear most often only among interest groups. With respect to the balance between sceptical, alarming and undetermined tenors in newspaper news reporting, we see a rather nuanced picture. The Algemeen Dagblad, NRC Handelsblad, de Telegraaf and de Volkskrant do not seem to differ

much from each other in their placement of articles with an alarming, undetermined or sceptical tenor. There is no deceptive balance in these newspapers, compared to the US, where media studies have found a balance as bias around climate change. The debate between alarming and sceptical journalists takes place mainly on the opinion pages of the newspapers. In contrast to the newspapers, the newsmagazines Vrij Nederland and Elsevier do take an explicit position in the climate debate. Vrij Nederland reports more alarmingly than sceptically about the climate problem. Elsevier reports chiefly from a sceptical perspective. It is understandable for newsmagazines to report in a politicised fashion about climate change, given their opinion function and political leanings.

In short: we may conclude that the written and editorial press informs the Dutch public in a comprehensive and balanced manner about climate change and the societal and political debate surrounding it. The Dutch media pay attention to the political debate and the scientific debate, and their news reporting about climate science can be called nuanced. The attention towards the political process focuses mainly on the international debate that unfolds primarily around UN climate summits. News coverage on the Dutch political debate about climate change remains far behind. This lack of media attention for the national political discussion seems to be reflecting the depoliticisation of the Dutch political debate about climate change.

# Intermezzo 3 Scientific consensus and dissent with regard to solutions

*Jeroen P. van der Sluijs*

There is wide consensus about the fact that stabilisation of greenhouse-gas concentrations requires drastic emission reductions at or below 550ppm $CO_2$ equivalents: this means worldwide at least a 50% and possibly 80% emission reduction by 2050 compared to 1990. Because developing countries need space for the growth of their economies, this entails that industrialised countries must reduce their emissions by more that 80%, up to 100% or more (negative emissions). Important options to cut back emissions are improvement of energy efficiency (which includes improvement of materials efficiency) and a large-scale deployment of renewable energy sources such as the sun, wind, hydro power, geo-thermal energy and biomass.

All scenario studies show that even at a maximal deployment of what is attainable through these options in the short and medium term, the required emission reductions cannot be attained and a third major option thus becomes necessary. For this reason, nearly all scenario studies foresee an indispensable role for $CO_2$ capture and storage in the period leading up to 2050 (IEA 2008). It is expected that only after 2050 will sustainable energy technology have developed so far that we can manage entirely without fossil fuels.

Other researchers tend to put nuclear energy on the forefront as a temporary, partial solution. This option does not enjoy wide support in many countries though, because of issues surrounding nuclear energy such as nuclear waste, proliferation of nuclear weapons, reactor safety, depletion of uranium supplies and accounting for external costs (SER 2008; Craye et al. 2009). Besides, mining and processing of nuclear fuel is also accompanied by $CO_2$ emissions. These emissions are now limited, but could increase as uranium resources become further depleted and extraction of this mineral becomes more difficult.
The controversies about solutions in the Dutch scientific and political communities intensify mainly around the issue of the safety of large-scale $CO_2$ storage, the possible role of nuclear energy, the degree to which wind energy fits the Dutch landscape (‘pollution of the horizon’), and the question of under what conditions can biomass be accepted as a sustainable solution. Considerations that play a role in the last question are the consequences for biodiversity, using up space, possible competition with food production and nature, and the energy balance of the entire chain.

Solution proposals of an entirely different nature rest on what is known as geoengineering (Meyer et al. 2009). An example of this is emergency cooling of the Earth by bringing artificially cooling aerosols into the atmosphere. These proposals are controversial; they will not be discussed in the present report.

In addition to emission reductions there are also options for increasing sequestration of $CO_2$ in forests and soils in what are known as sinks. Under the Kyoto protocol (see Chapter 2), carbon that

is stored additionally in sinks (e.g. due to large-scale reforestation) may count for meeting the agreed reduction targets. This solution is controversial because it is technically difficult to establish clearly how much carbon is being captured, and because it is difficult to guarantee that this carbon will stay out of the atmosphere for a long period. After all, no one can guarantee that a forest that is planted now will remain a forest for hundreds of years. It is also hard to establish clearly whether the capture of $CO_2$ is additional.

In the course of preparations for the climate summit in Copenhagen a heated discussion raged about a new mechanism that would be allowed to count: REDD (Reducing Emissions from Deforestation and Degradation). This is about counting emissions that are prevented by combating deforestation that otherwise would occur. Deforestation is an important cause of $CO_2$ emissions, via various mechanisms. By burning forests flat to create agricultural land, and by using wood which at the end of its life cycle ends up being burned or decomposed, carbon dioxide re-enters the atmosphere. After deforestation, the organic material that has accumulated in the ground for millennia oxidises in a short time, causing even more $CO_2$ to be released than the amount that was captured in the trees themselves. Because the forest ceases to exist, there is no more $CO_2$ captured in biomass and organic matter in the ground. This loss of a $CO_2$ sink can also be considered as a source. According to AR4, 17% of the yearly increase in atmospheric $CO_2$ concentrations can be ascribed to deforestation.

Several controversial issues surround REDD. Is combating deforestation really additional, or would the deforestation have really taken place without the alleged preventive measure? How do you monitor deforestation? How do you measure the prevented deforestation in a credible and reliable manner? Aren't the emissions just being shifted? Such leakage occurs when a logging company leaves a country whose trees are protected by REDD but increases logging in countries that do not yet participate in REDD. In that case there are no net emission reductions, whereas the REDD-participating country does receive emission rights.

Another point within the REDD mechanism which is still being fully debated is the role of the recovery of degraded ecosystems. This involves, among other things, carbon dioxide that is released from recently drained peat areas, especially in southeast Asia. After drainage the peat begins to oxidise, and this is accompanied by large $CO_2$ emissions from the soil. By raising water levels again, a large amount of $CO_2$ emissions can be prevented.

Besides mitigation (reducing the emissions), there are other discussions about adaptation to climate change. By now there is wide agreement about the inevitability of adaptation. There is no alternative: even if successful mitigation halts climate change at some point, the climate will continue to warm for decades. The slow warmth absorption and release (thermal inertia) of the oceans guarantee this delayed effect. Because the countless uncertainties make the scope of climate change unpredictable, much of the discussion intensifies around the question of how to deal with uncertainties in adaptation policies (see also Dessai & Van der Sluijs 2007).

# 5 A democratic approach to the climate problem

*Rinie van Est, Jeroen P. van der Sluijs, Frans W.A. Brom*

The preceding chapters offered different perspectives on the complex interaction in the area of climate change between science, policies and politics, and society in the Netherlands. We mapped out the scientification of the Dutch political climate debate, and showed how Dutch politics have dealt in the last four decades with scientific uncertainty and pluralism in the field of climate change. We also looked at the politicisation of policy-oriented climate science, examining in particular the political role of the IPCC and the way in which it is expected by international politics to deal with scientific consensus and dissent. We also described how the Dutch written media has reported in the last four years about the political climate debate (in an alarming and sceptical style) and the scientific debate (with its knowledge and uncertainties). We saw that scientific uncertainties and dissent are not only a scientific given but also reflect different political visions and interests (Sarewitz 2004). On the basis of these gained insights, in this final chapter we will search for new ways to look at the interface between climate policy and science, and perhaps enrich it.

We will start with a reflection on how the interplay between politics and policy-oriented climate science is organised at the moment. Next, we will discuss the current crisis in the political and scientific climate debate. Finally, we offer an additional perspective for looking at the interaction between climate politics and climate science, and a way to improve it from a pluralistic democratic perspective.

## 5.1 The ‘success’ of the linear interaction model

The current political organisation of the interface between climate politics and science took shape in the late 1980s and early 1990s. In Chapter 2 we called this phase (1987–1994) period 3: ‘precautionary domestic/international political decision making’. Before this period a no-regret policy was pursued in the Netherlands motivated by lack of scientific knowledge and absence of international climate policies. This changed radically in phase 3. Since then, how politics has dealt with scientific uncertainties has been determined by the precautionary principle and the consensus approach of the IPCC. For a long time, this combination resulted in a broad political consensus in the Netherlands in the field of climate policy.

### Precautionary principle and consensus approach of the IPCC

In the mid 1980s the precautionary principle was introduced into international environmental policy in order to deal with the persistent uncertainties surrounding environmental problems (UNESCO COMEST 2005). In the Rio de Janeiro Declaration at the UN Summit on Environment and Development, this principle was accepted by UN member states as starting point for international environmental policy (UN 1992). In 2000 this also became a leading principle within EU environmental policies (EU 2000). The precautionary principle entails that in order to intervene to limit a risk no full scientific knowledge of that risk is needed, it suffices for there to be reasonable scientific indications that there will be a problem if there is *no* intervention. To assess such indications in the field of climate change, the UN founded the IPCC in 1988. The political goal of the IPCC was to create a clear knowledge basis for the development and legitimation of international climate policy.

When dealing with scientific uncertainties regarding climate change, the UN opted for a consensus approach. Its strength lies in shedding light on consensus in science. International political actions were

thus made dependent on the scientific answer (of the IPCC) to questions such as to what degree climate is warming as a consequence of human actions, or how much reduction of greenhouse gasses emissions is needed to keep climate change within politically-determined acceptable boundaries. The first IPCC report from 1990 indicated that it is likely that continued emissions of anthropogenic greenhouse gases would lead to global warming. On the basis of this knowledge, the UN Framework Convention on Climate Change was signed in Rio de Janeiro in 1992. Article 3.3 of that convention states the leading character of the precautionary principle: *'The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost.'* The second, third and fourth IPCC reports showed increasing scientific evidence – from 'likely' to 'very likely' – that not intervening would result in *'threats of serious or irreversible damage'*.

### Success of the linear interaction model

The interaction model between politics and science that was set up by national and international political bodies to deal with scientific uncertainties is also known as the linear or technocratic model (Pellizzoni 2001). The assumption behind it is that more scientific research will lead to more reliable knowledge and less uncertainty. That knowledge forms a solid basis for political agreement and decision-making and thus for meaningful action. In this model the political debate has become practically unnecessary because policy emanates almost by itself from scientific knowledge. A reduction of scientific uncertainty and dissent through a legitimate process that determines consensus over the current knowledge – identified by Kitcher (2001) as 'certification' – is central to this interaction model. There is a sound awareness that because of the complexity of the climate system scientific uncertainties will always exist. At the same time, in this process one seeks robust knowledge over which scientists are in wide agreement. In the Netherlands, the scientific basis produced by the IPCC has strongly contributed in the last two decades to a broader political consensus and hence to the legitimation of climate policy. One could say that the linear model has 'worked' for a long time.

## 5.2 Crisis in the climate debate? What crisis?

By now there is also a discussion in the Dutch political arena and scientific community as well as in general society about the interaction between politics and science. The direct catalyser was Climategate and a number of faults that were discovered in the fourth IPCC report. Because of this, confidence in the IPCC – as the incorruptible and legitimate supplier of the knowledge base of climate policy it should be – is at stake. Because the IPCC consensus plays such a central role in the legitimation of the linear model for dealing with the climate problem, this model has come under pressure.

Our study shows that criticism of the IPCC goes further than criticism about its procedures and practices. One needs to take a critical look at the current linear interaction model between climate politics and climate science. This model may have well resulted in political consensus about climate policy, but in its wake climate politics in the Netherlands have scientified, and domestic and international science has become politicised. We begin with politics and climate science, then look at how the political arena has reacted to the criticism to the fourth IPCC report. The Dutch government defends the linear model by criticising the IPCC and demanding an evaluation of IPCC procedures. We end this section by identifying two fundamental limitations of the current linear model.

### Depoliticisation of the political climate debate

An analysis of the parliamentary climate debate over the last twenty years shows that the Dutch Parliament repeatedly asked questions regarding scientific information and uncertainties surrounding the climate problem. Such questions came from the entire political spectrum. The calibrated answer of the

government is that scientific uncertainties surely exist, but that policies are based on the IPCC reports and the precautionary principle. In this way, the IPCC reports put politicians in a position to hide behind science with an aura of irrefutability in order to defend far-reaching choices in climate policy. It is precisely for this reason that the recently found errors in the climate report have come down so hard on the political arena.

## Politicisation of the scientific climate debate

In a sense, the political body has assigned the IPCC the role of instrument for the production of incontrovertible authority (a sort of certainty machine for univocal problem analysis) as well as of arbiter for settling political controversies about the right policy goals and the best ways to achieve them. Apparently, politicians deem science capable of calculating objectively, reliably and validly what the right climate policy is and how (with which optimal combination of options) is must be implemented. As a direct consequence, the political conflict about climate change and the underlying ideological conflicts (e.g. about free markets versus government intervention) are now deeply embedded in the field of climate science itself. To put it bluntly: if you want to exert influence on policy choices, given this division of roles it is most effective to do it through science. (Think of policy choices such as: What is the best stabilisation level or reduction goal? Can this be optimally realised with nuclear energy, wind energy or underground $CO_2$ storage?) After all, science has always been given pre-eminence to make such calculations. This has contributed to a strong polarisation and politicisation of the scientific debate.

## Political attack on and defence of the linear model

In the discussion following Climategate and the discovery of errors in the climate report the linear model was harshly attacked, but also strongly defended and upheld. Especially the PVV (Party for Freedom) dismissed the IPCC as an activity driven by left-wing politics. Climate science was also blamed for having profited from the political demand for more scientific certainty. The government defended the linear model. Politicians criticised the IPCC and demanded an evaluation of its procedures. Scientists made excuses for the faults of the IPCC report, repeatedly adding in the same breath that those faults did not diminish the main message of the IPCC, which is that due to human actions the climate will very likely change with possible far-reaching future consequences.

The actions of Jacqueline Cramer, Minister for Environment and Spatial Planning, illustrate the reaction of the government. She called the climate report's incorrect year for the disappearance of the Himalayan glaciers worrisome. The government should be able to sail blindly on the climate panel, she states (NRC Handelsblad, 27 January 2010). In an opinion column of the NRC Handelsblad, Cramer explained: 'We base our climate policy on scientific insights … We build our climate policy on that solid scientific foundation.´ (Cramer 2010). Here the minister positioned the IPCC as an instrument to create a scientific foundation of irrefutable authority. In the same opinion column, she writes: 'People want to understand the reasoning behind environmental measures … to this end, politicians and scientists will have to ensure that people can have a realistic picture of the consequences of climate change. This picture of the state of things should be based on independent research and verifiable data'. In other words: citizens must understand the 'why' of the government climate policies, and the establishment of that 'why' is seen by the Minister as the sole domain of the IPCC. For example: the minister has to answer to angry citizens in Barendrecht, who want to know why carbon dioxide must be stored underground in their town. Politicians turn its justification for action over to science. The IPCC automatically becomes the lightning rod for any dissatisfaction about far-reaching government interventions to save the climate (see also Pilkey & Pilkey, 2007). Such a scenario can only work if climate science has a spotless image though. To polish up the blemished blazon of the IPCC again, national and international political bodies ordered an independent evaluation of its procedures and practices.

## Two fundamental limitations of the linear model

Because politicians in the Netherlands and elsewhere have embraced the linear model, climate science has ended up at the heart of the political conflict – that is, the scientific climate debate has become an

important arena for political battles. As a result, diverging political visions seek justification of their position in the scientific debate. In the process, supporters of climate policies use the IPCC reports to depoliticise and thus monopolise the climate debate. They claim that the IPCC report has a preferential position in the political debate. On the other hand, opponents try to reopen the political debate by magnifying uncertainties and imperfections in climate science. This explains why in climate-sceptical blogs such as climategate.nl and klimatosoof.nl the arrow points nowadays mainly at science and not at politics. The proposal to evaluate the political procedures and practices of the IPCC also fits into this picture. The expectation behind it is that the current controversy can be settled by perfecting policy-oriented climate science. People are thus seeing scientific uncertainty as the main cause for the lack of solid justification of policy and solid support for it. This is the exact central core of the technocratic linear model for politically dealing with scientific uncertainties.

Given the storm of criticism, mending the technocratic model by evaluating the IPCC is a logical and good step. A good picture of the state of affairs in climate science is an important precondition for domestic and international climate policy. Still, more is needed. The current approach has two basic limitations: a scientific and a political one. First of all, because of the complexity of the climate system major uncertainties will always remain in the knowledge base. Certainty about future climate change is an unattainable ideal, as is a faultless IPCC report. Secondly, scientific uncertainty and dissent are not an exclusively scientific phenomenon, and this is acknowledged too little. They are also a manifestation of political division and a context in which science is conducted and strategically used in order to settle a political conflict about interests and values. For almost any political vision a scientific study can be found that supports its values position (Sarewitz 2004). Hence more or faultless science is not conducive towards eliminating political value conflicts.

The challenge for politicians is to develop different criteria or principles to justify policy choices in a context of an inherently uncertain knowledge base. The precautionary principle too fails to offer politicians enough of a hold to justify policy choices because it does not make the call for clear and univocal science subside, even if attaining such knowledge is clearly impossible due to the nature of the issue.

## 5.3 Towards a more democratic perspective

An important question raised by the recent fuss is whether this debate about the interaction between politics and science means the end of the linear model. Or, more constructively formulated: how can we improve on the interaction between politics and science in the climate field from a democratic perspective? We have already concluded that ‘purification’ of policy-oriented climate science, especially in the form of evaluation of the IPCC, is useful yet insufficient. Such purification focuses primarily on restoring the linear model and doesn’t have enough of an eye for its basic limitations.

In this section we take a look from the perspective of democratic deliberations (also known as the deliberative model in social-science literature) at the interaction between politics and science when it comes to dealing with scientific uncertainties. Our goal is not to replace current technocratic methods of dealing with uncertainties – what we hope is to widen and enrich the current debate by sketching an added perspective. The current technocratic model assumes a political consensus based on scientific consensus. Scientific uncertainty is considered here as a lack of unequivocalness (see Box 3.1). The basic weakness of this model is that dissent is underexposed in both science and politics. The weakness of the closed technocratic model is precisely the strength of the more open deliberative model.

Searching for robust policy choices that do justice to the diversity and uncertainty within this knowledge is what constitutes the core idea behind the deliberative approach. Whereas the linear technocratic model places the problem definition in the hands of scientific experts and aims for political unity, in the

previous extensive dialogue between science and policy there has in fact been appreciation for the existence of diverging views. Such a new approach could inspire the current debate.

This section starts out from a deliberative vision searching for ways to make the scientific exercise less political and scientify politics less, so that there is more space for a discussion about politics and moral values. Here it is also important to ask how, in a context of permanently uncertain knowledge, can policy choices be justified more democratically than is the case in the technocratic model. The connecting thread is not so much the total demarcation between science and politics, but a clarification and strengthening of each's own role in politics and science.

## Depoliticisation of science

The linear model has fostered the politicisation of climate science. More pluralism in climate science and better communication about it offer opportunities to depoliticise science. It is also important to limit the influence of policymakers on the scientific process to a minimum.

*Stimulate and facilitate pluralism in science*

With respect to the IPCC, a plea for more pluralism means that in addition to uncertainties and dissent, and to communication about it, attention is also paid to other types of scientific paradigms. It is important to enter into a dialogue with scientific dissidents and offer them space within the scientific agenda, including research financing. Climate sceptics can even play a positive role in this process. They still regularly throw arguments into the political battlefield which are, scientifically speaking, long outdated (For examples, see klimaatportaal.nl.). In doing so, they undermine their own legitimacy and credibility in the political and scientific debate. It would behove the political debate if climate sceptics exercised more self-regulation and did some house-cleaning. That requires a clear distinction between scientifically tenable criticism that has withstood the test of peer review and, on the other hand, speculative and rhetorical arguments that aren't (yet) or are no longer based on published scientific work. In this way, valid climate-sceptical voices can also claim a clearer and more constructive role in the scientific discourse.

*Prevent excessive dependence of science on policy*

The IPCC is a hybrid forum that includes scientists as well as policymakers. The scientific status of the three parts of the IPCC report – part I: the physical science basis; part II: impacts, adaptation and vulnerability; part III: mitigation – differs. In addition, the scientific report itself and policymakers' summaries are often incorrectly mixed up. For the interaction between science and politics it is important to clarify the difference in scientific status of the three partial reports and the policy summary. It makes sense to publish partial report I (knowledge about the climate system and its causes) as a separate scientific report that covers basic knowledge about the climate system. Policymakers do not need to play a role in the materialisation of that partial report. Application-oriented partial reports II and III, where input from the practical side of policymaking is necessary, can be based consistently on the scientific foundations from partial report I.

## Politicisation of the climate debate

Within the linear model the IPCC has taken a central role in the political debate. It is important for the political arena to free itself from this self-created scientific hold and for more political latitude and liveliness to re-enter the climate debate. To this end, primacy in that debate should return to politics and the climate debate must be expanded.

*Primacy back in politics*

The practices of the IPCC in the last two decades have strongly contributed to the depoliticisation of the climate problem, resulting in a broad consensus. Such a consensus facilitates policymaking but risks constricting the related political debate. As the pronouncements of the IPCC become stronger, the space for political debate becomes more reduced. In the political debate science should play an important yet

limited role. The danger lies in scientific knowledge replacing the ethical and political discourse. Democracy morphs then into technocracy – the dictatorship of science.

Politics are about clarifying political values and societal visions and choices, and can therefore never hide behind scientific knowledge. It is important that politics no longer dismiss science as a certainty machine. New scientific knowledge produces new insights, but also more perspective into that which we don't yet know. It is therefore very questionable whether scientific uncertainty in the climate arena can be reduced at all. Politicians should also be aware of the fact that scientific paradigms can change.

The basic assumption behind the linear model – that reducing scientific uncertainty is necessary to justify climate policy – does not wash either. Scientific uncertainties play a role in many terrains, and in most policy terrains these uncertainties are accepted as unavoidable. It would be better to just say goodbye to the illusion of certainty. This gives policy its primacy back, and climate science becomes depoliticised. Hence it is important for the public and political debate to clarify which political values and visions are at stake. From a deliberative vision it is those values which should give direction to science – in place of the other way around, which is what commonly occurs these days.

*Expanding the political debate*
In the political debate, the way in which a problem is defined is crucial, as it determines what can and may be talked about, what interests are at play and what policy options can be brought to the table. The political debate on climate change is dominated by the question of whether the $CO_2$ emissions of industrialised society threaten the future of our planet. Climate science plays the central role in answering this very complex question, because this specific question cannot be answered by direct observation, in a societal debate, or even using common sense. Science must indicate what possible consequences could loom upon us if we fail to intervene. In this way, climate science ensures the moral justification for the current policy of $CO_2$ reduction. This has two political consequences: first, science legitimates or rationalises the moral position of the green parties, causing its own set of frictions, and secondly it narrows the political debate down to the question of what is the percentage of $CO_2$ that we want to reduce.

There are two ways to expand the current political climate debate. In addition to doomsday predictions and exercising precaution, more desirable political scenarios for the future and the world could get a clearer spot in the climate debate, turning it into a search for societally attractive development perspectives. The transition into a sustainable society is one that beckons ecologically as well as economically speaking. A vision that is possible here fits that of a bio-based economy. Reducing our dependence on fossil fuels is interesting not only from an environmental angle but also in terms of bringing down economic vulnerability (e.g. running out of raw materials), innovation and new business impetus. Too much emphasis in the climate debate has come to lie on scientific substantiation or proof of the end of the world. Scientific knowledge can be well deployed towards depicting and developing beckoning future scenarios.

It is encouraging to see that the Dutch political climate has widely expanded in the last five years thanks to an increased focus on climate adaptation. Before that, climate policy was mainly about mitigation: preventing a climate change of more than 2 degrees by reducing greenhouse emissions. Adaptation has gotten increased attention in recent years, expanding and cranking up the political discussion about climate change. An example is the discussion on the report of the second Delta Commission. Expanding the climate discussion with adaptation is relevant because the abstract discussion about climate change on a worldwide scale acquired a more national significance, giving a more central role to local societal, social and ecological vulnerabilities (Sarewitz & Pielke 2000). Such a perspective on climate and the environment fits more with direct experiences and problems of citizens. Experiences like these also have the emotional and moral power to lead to action and can therefore also contribute to more involvement of citizens towards mitigation.

## 5.4 Epilogue

In this report we placed the interaction between politics and the scientific climate debate under a magnifying glass. This interaction is currently being shaped from a linear technocratic model in which political consensus processes based on scientific consensus processes are central. We have discussed the strength of this model, as well as its success in Dutch politics during the last two decades. It is interesting to note that the linear model never worked in the United States, where until recently the political climate debate was completely stuck (Sarewitz & Pielke 2000). More climatological research and the consensus reports of the IPCC did not lead to less political conflict there. This example illustrates that the linear model does not work in all circumstances. It is precisely in a situation of political polarisation and major scientific uncertainties that the linear model comes under pressure. We have shown that this model has a blind spot with respect to dealing with politics and scientific dissent. A more deliberative approach appears to offer relief in this sense. The additional perspective proposes a number of interesting trigger points to strengthen the interaction between climate politics and climate science. We do hope that this added perspective will shed light on the climate debate and enrich it.

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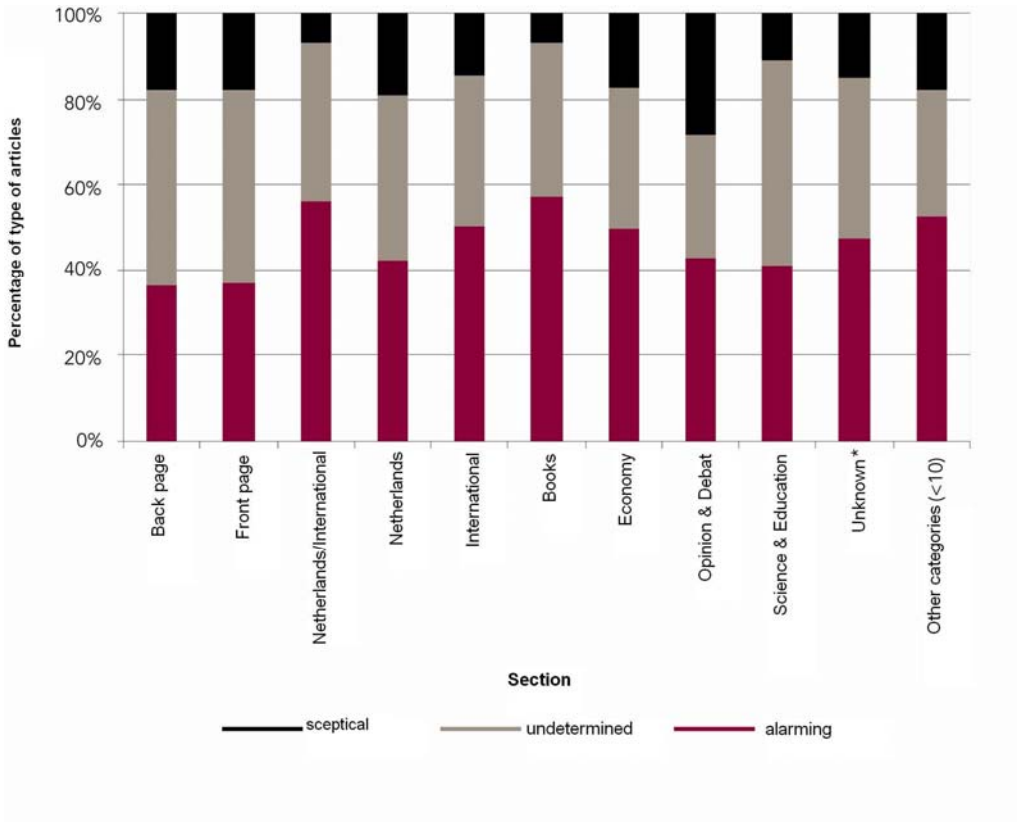
# APPENDIX

Table 1. Overview of applied definitions for labelling the tenor of the message of each article.

| | ***Alarming*** | ***Undetermined*** | ***Sceptic*** |
|---|---|---|---|
| **Problem** | Drastic and/or urgent action must be undertaken to tackle the climate problem. | Disagreement/lack of clarity/no pronouncements about action to be taken with respect to climate change. | No action should be undertaken to tackle the climate problem, or the problem does not justify government interventions. |
| **Cause** | Human actions are the main cause of current climate change. | Disagreement/lack of clarity/no opinion about the cause of climate change. | Natural processes/cosmic activity are the most important causes of climate change. |
| **Consequence** | The consequences of climate change are severe. | There is still a lack of clarity about the consequences of climate change; the consequences are not serious. | There are no unacceptable consequences of climate change and/or we can adapt to them. |
| **Policy** | Urgent action is needed. | Action is (urgently) needed, but there is disagreement about how and the degree to which this should happen. | The proposed or necessary policy leads to nothing or is not implemented. |
| **Solution** | Proposed solutions are good/necessary approach to counteract climate change. | Proposed solutions are potential approaches to counteract climate change; there is still disagreement about the preferred approach. | Proposed solutions are not good/necessary methods to counteract climate change/solutions don't work. |




**Distribution of types of arguments in different newspaper sections.**

Figure 1. Relative distribution of published articles in analysed newspapers, classified by tenor.

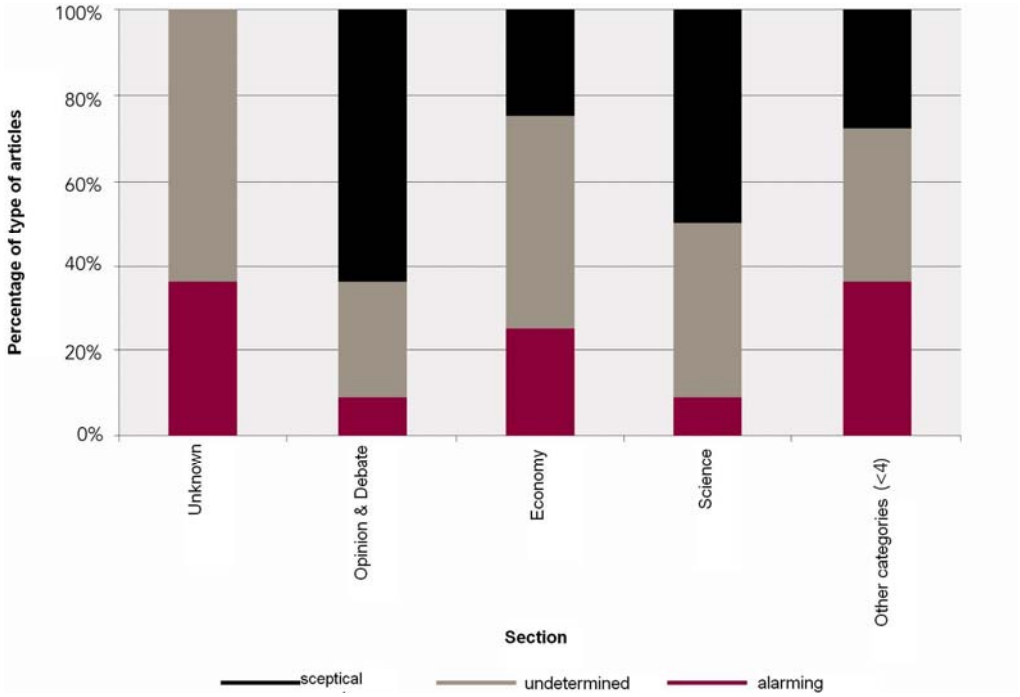



Figure 2. Relative distribution of published articles in analysed newsmagazines, classified by tenor.

Table 2. Overview of events in the period January 2006 - December 2009 that were reported more than once in the media. (* = because of reporting halfway through or at the end of a month, publications on an event are sometimes extended into the next month; ** = including extensions in January and February 2007).

| Time period | | Number* | Topic |
|---|---|---|---|
| 2006 | January | 3 | Article (Nature): About the emission of methane by trees. |
| | February | 1 | Book (High Tide): Mark Lynas writes about the impacts of climate change. |
| | March | 6 | Book (De menselijke maat (*The human scale*): Salomon Kroonenberg writes relativising on the climate discussion. |
| | | 7 | Article (Science): About the consequences of the melting of the Greenland ice sheet. |
| | May | 3 | Study (IUCN): About the consequences of climate change for biodiversity. |
| | | 1 | Documentary (An Inconvenient Truth): About the causes and impacts of climate change. |
| | | 5 | Study (KNMI): presentation of four new climate scenarios for the Netherlands. |
| | August | 2 | EU: new cars still emit too much $CO_2$. |
| | September | 2 | Article (Nature): Methane emissions from Siberian soils larger than expected. |
| | October | 10 | Documentary (An Inconvenient Truth): Came out in the Netherlands. |
| | November | 13 | Report (Stern): British economist calculates potential economic consequences of climate change. |
| | | 3 | COP 12 (UN Climate Summit, Nairobi): World leaders discuss the climate problems' causes, consequences and solutions. |
| | December | 3 | Report (KNMI): Last fall was the warmest ever in the Netherlands. |
| | | 5 | Initiative (Clinton): Alliance of 40 cities, including Rotterdam, will take the lead within the CCI in counteracting climate change. |
| | | 3 | Initiative (Dutch businesses): The most important Dutch companies demand government action towards counteracting climate change. |
| | | 25** | IPCC Report: Announcement of fourth assessment report (AR4). |
| 2007 | January | 7 | Policy (EU): The EU demands stricter rules for $CO_2$ emissions. |
| | February | 3 | Discussion: Hans Labohm doubts human influence on climate change. |
| | March | 5 | EU summit (Brussels) World leaders discuss the climate problems' causes, consequences and solutions. |
| | April | 15 | IPCC report: Fourth assessment report is published (AR4). |
| | May | 4 | Study (KNMI): New models predict a changing Dutch climate. |
| | June | 13 | Climate summit (Heiligendamm, Germany): World leaders discuss new legislation for $CO_2$ emissions. |
| | July | 11 | Initiative (Live Earth): Concert for climate change. |
| | | 4 | Initiative (Vis à Vis): Theatre show for climate change. |
| | | 8 | Documentary (The Global Swindle): Sceptical documentary about the causes and consequences of climate change. |
| | August | 2 | Climate summit (VS): President Bush announces a summit to discuss $CO_2$ emissions. |
| | | 2 | Initiative (TNT): With the initiative 'Planet Me', Peter Bakker wants to become the first $CO_2$-neutral transportation company in the world. |
| | September | 5 | Book (Cool It!): Danish statistician Bjørn Lomborg talks about the cost effectiveness of climate policy. |

| | | | |
|---|---|---|---|
| | | 3 | Climate Summit (US): Summit to discuss the approach to $CO_2$ emissions. |
| | October | 7 | Prize (Nobel prize): Al Gore wins the Nobel prize for peace with his documentary 'An Inconvenient Truth'. |
| | November | 4 | Report (IEA): Report about the future use of energy and energy sources. |
| | December | 11 | COP 13 (UN Climate Summit, Bali): World leaders discuss climate change. |
| | | 2 | Documentary (Meat the Truth): Marianne Thieme tells about the effect of meat consumption on the climate. |
| **2008** | January | 3 | Article (Nature): About the causes of the melting of the North Pole. |
| | April | 3 | Climate Summit (Bangkok): World leaders discuss climate change. |
| | May | 3 | Summit (Ilulissat, Greenland): About the potential exploitation of a melting North Pole. |
| | July | 4 | Climate Summit (Tokyo, Japan): World leaders discuss climate change. |
| | August | 13 | Report (KNMI): About the consequences of climate change. |
| | September | 4 | Report (Delta Committee): About the consequences of climate change for the Netherlands. |
| | December | 7 | COP 14 (UN Climate Summit, Poznan): World leaders discuss climate change. |
| **2009** | January | 3 | Research (Australia): About the effects of climate change on coral reefs. |
| | | 4 | Report (KNMI): About the contribution of decreased mist to global warming. |
| | February | 1 | Book (The Deniers): Sceptic book about climate change. |
| | March | 3 | Book (De Klimaatoorlogen (*The Climate Wars*)): About the emergence of global conflicts due to climate change. |
| | April | 3 | Article (Nature): About the need to limit global warming to 2 degrees Celsius. |
| | June | 3 | Report (PNAS): Negative climate consequences of the use of HFK's in new refrigerators. |
| | July | 7 | G8 (L'Aquila, Italy): World leaders discuss the approach to climate change. |
| | | 3 | Article (Denmark): About the accelerated melting of the North Pole. |
| | August | 4 | Report (KNMI): Maintains previously presented scenarios. |
| | September | 5 | Report (European Commission): About the size of future climate funds. |
| | October | 4 | Climate Summit (Tokyo): World leaders discuss the approach to climate change. |
| | | 3 | Article (Peter Wadhams, Cambridge): About the accelerated melting of the North Pole. |
| | | 5 | EU summit (Brussels): EU leaders discuss the approach to climate change. |
| | November | 10 | 'Climategate': Various hacked emails are made public that suggest manipulation of climate graphs. |
| | December | 32 | COP 14 (UN Climate Summit): World leaders discuss a new climate protocol. |

# Glossary

## Abbreviations

| | |
|---|---|
| AGGG | Advisory Group on Greenhouse Gases |
| AR4 | Fourth Assessment Report of the IPCC (November 2007) |
| ARP | Anti-Revolutionary Party |
| ChristenUnie | Christian Union |
| D66 | Democrats 66 |
| GroenLinks | GreenLeft |
| GPV | Reformed Political League |
| IBO | interdepartmental policy research |
| IAC | InterAcademy Council |
| IMP | Indicative Environmental Multi-year Program |
| IPCC | Intergovernmental Panel on Climate Change |
| KNAW | Royal Netherlands Academy of Arts and Sciences |
| KNMI | Royal Netherlands Meteorological Institute |
| NMP | National Environmental Policy Plan |
| NWO | Netherlands Organisation for Scientific Research |
| PBL | Netherlands Environmental Assessment Agency |
| PCCC | Platform Communication on Climate Change |
| PPR | Political Party of Radicals |
| PvdA | Labour Party |
| PVV | Party for Freedom |
| REDD | Reducing Emissions from Deforestation and Degradation |
| RIVM | National Institute for Public Health and the Environment |
| RPF | Reformatory Political Federation |
| SGP | Reformed Political Party |
| VROM | Ministry of Housing, Spatial Planning and the Environment |
| VVD | People's Party for Freedom and Democracy |
| WMO | World Meteorological Organization |
| WUR | Wageningen University & Research Centre |
| WWF | World Wide Fund for Nature |

**Who was Rathenau?**
The Rathenau Instituut is named after Professor G.W. Rathenau (1911-1989), who was successively professor of experimental physics at the University of Amsterdam, director of the Philips Physics Laboratory in Eindhoven, and a member of the Scientific Advisory Council on Government Policy. He achieved national fame as chairman of the commission formed in 1978 to investigate the societal implications of micro-electronics. One of the commission's recommendations was that there should be ongoing and systematic monitoring of the societal significance of all technological advances. Rathenau's activities led to the foundation of the Netherlands Organization for Technology Assessment (NOTA) in 1986. On 2 June 1994, this organization was renamed 'the Rathenau Instituut'.