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The University of Reading



Meeting report of the ad-hoc  
group for the modelling and  
assessment of contributions  
of climate change (MATCH)

27 to 28 October 2005  
Reading, UK

15 November 2005

Prepared by Niklas Höhne and Esther Lahme

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## 1. INTRODUCTION

As part of the negotiations on the Kyoto Protocol, the delegation of Brazil made a proposal, in May 1997, to set differentiated emissions reduction targets for Annex I Parties of the UNFCCC according to the impact of their historic emissions on temperature rise (FCCC/AGBM/1997/MISC.1/Add.3).

After two expert meetings held under the auspices of the SBSTA (28 – 30 May 2001 in Bonn, Germany; 25 - 27 September 2002 in Bracknell, UK), the SBSTA agreed that the work should be continued by the scientific community. Subsequently, further expert meetings were held on the initiative of the governments of UK, Brazil and Germany.

In August 2003, the UK Department for the Environments (DEFRA) commissioned Ecofys to provide administrative, secretarial and scientific assistance as 'support unit' for the process until the end of 2005.

During the expert meeting held in Berlin on 8/9 September 2003, draft terms of reference and a draft work plan for a process until 2005 were discussed for the now called "Ad-hoc group for the modelling and assessment of contributions to climate change (MATCH)". Participants for a scientific coordination committee were selected, which guides and coordinates the process.

The meeting in Cologne, May 2004 consisted of the following: First, the Scientific Coordination Committee discussed organization aspects of MATCH. Second, authors presented the current status of the development of paper #1: "Analysing countries' contribution to climate change: Scientific uncertainties and methodological issues". Third, experts discussed themes of three additional scientific papers and the content of paper #2.

At the expert meeting in Rio de Janeiro, Brazil on 11/12 April 2005, the paper #1 was finalized. The content and approach for paper #2 "Attributing a fraction of climate change to a nation's historical emissions: closure and scientific uncertainty" was discussed as well as new ideas concerning the continuation of the process beyond November 2005.

This document is the report of the meeting of MATCH held on 27/28 October 2005 in Reading, UK. It was drafted by Niklas Höhne and Esther Lahme, Ecofys, Germany and reviewed by the participants of the meeting.

The agenda of the meeting (Annex A) consisted of three major parts. First, a quick review of timelines, tasks, goals and long-term work plan was presented and the status quo reported. Second, the paper #2 "Attributing a fraction of climate change to a nation's historical emissions: closure and scientific uncertainty" was introduced and each chapter presented by co-authors, followed by discussion of the participating experts. Third, the experts discussed the way forward with paper #3 and #4 and developed new ideas how to continue the process beyond November 2005. All presentations held during the meeting are available on the web site [www.match-info.net](http://www.match-info.net).

The meeting was hosted by Reading University, Department of Meteorology and the UK Metoffice, and organized by Ecofys. 20 Participants attended the meeting (Annex B).

## 2. ISSUES DISCUSSED BY THE SCIENTIFIC COORDINATION COMMITTEE

The members of the scientific coordination committee (SCC) Jan Fuglestvedt, Michel den Elzen, Jason Lowe and Niklas Höhne met on Wednesday evening (26 October) to

- Review the agenda of the MATCH meeting in the light of the recent developments
- Update the status of funding of developing country experts
- Discuss on future work
- Collect news from the SCC for the next day

## 3. AGENDA OF THE MEETING

Jan Fuglestvedt opened the meeting as Co-Chairman of the scientific coordination committee of the MATCH group. He expressed his thanks on behalf of the experts to Reading University's head of the Department of Meteorology, Keith Shine for hosting this meeting. The agenda of the meeting is included in Annex A.

Niklas Höhne introduced all participants to the history of MATCH and listed agreements made during past expert meetings including timelines. He also mentioned that the SBSTA is likely to discuss the matter in May 2006, not in November 2005 as previously planned. This leaves 6 more months to complete the work of MATCH.

Niklas Höhne also mentioned that in the last two expert meetings 7 experts from developing countries were supported with travel and subsistence costs while at the present meeting 5 experts were funded. There is additional money for additional 7 experts trips available in the fund provided through the UK, German and Norwegian governments. It was asked whether the remaining funds could also be used for other issues such as supporting workshops and conferences. Ecofys mentioned that any diversion from the agreed funding arrangements with the UK, German and Norwegian government would need to be agreed by the funding governments first. Ecofys will put forward this issue to the sponsors.

The rest of the meeting was filled with a discussion on paper #2 and then a discussion on future work. On day 2, *Guoquan HU* from China presented results from his model runs with a simple climate model. He had assessed the impact of the uncertainty of emissions as well as certain levels of stabilization.

## 4. DISCUSSION OF PAPER #2

*Jason Lowe* presented an **introduction of paper #2**: "Attributing a fraction of climate change to a nation's historical emissions: closure and scientific uncertainty". A draft of the paper was available to the participants. The outline of paper #2:

- Introduction
- Long-lived greenhouse gases
- Short-lived greenhouse gases

- Radiative forcing and climate change
- Conclusion

In order of chapters the authors presented an **outline of and work in progress on every chapter of paper #2.**

- Atsushi Kurosawa – CO<sub>2</sub> and CH<sub>4</sub> uncertainties
- Jan Fuglestedt – Modelling of CH<sub>4</sub> and N<sub>2</sub>O
- Niklas Höhne – SF<sub>6</sub>, PFCs, HFCs, CFCs, HCFCs, other halocarbons and stratospheric O<sub>3</sub>
- Joyce Penner – Direct / indirect Aerosols
- Jan Fuglestedt – Tropospheric O<sub>3</sub>
- Jason Lowe – Other natural forcings
- Jason Lowe – Radiative forcing and climate change

All presentations are available at the file exchange of the MATCH web side.

On day 2 slides by Atul K. Jain about closure uncertainty of CO<sub>2</sub> were presented by Niklas Höhne. Christiano Pires de Campos followed with his results on CO<sub>2</sub> from land use change using a new version of Ben Matthew's Java model. Peter Stott and Jason Lowe gave the preliminary structure of chapter 4 again. Finally Michael Prather stated a possible structure of the conclusions to be drawn in chapter 5 of paper #2 (Annex C).

It was agreed to include a new chapter 5. The goal is to show the uncertainties of the contribution of emissions of the group of countries that are in the UNFCCC Annex I and in the OECD for the period from 1990 - 2002 to current temperature increase including the uncertainties stem from the reporting, biochemical cycles and climate system models. These uncertainties should be combined to generate probability distribution functions for the temperature change in 2002 due to the group of countries. A decision about this must be made in March.

In the later afternoon of day 2, timelines (Annex D) were agreed and present authors confirmed their intent to contribute to the different sections (Annex C).

## **5. DISCUSSION ON FUTURE WORK**

After lunch of the first day, Niklas Höhne introduced some options for the long-term future work (Annex E). They included the following

- Option A: Continuation of present situation
- Option B: Development of a tool
- Option C: Application of the contribution results
- Option D: Assessment of future regime designs

Ben Matthews presented a possible way forward for paper #3 using response plots to characterise the parameter space and uncertainties. These plots could be used as input for a computer tool.

Jan Fuglestedt led the discussion on paper #4. This paper should be an update of paper #1 with improvements based on the results from paper#2. If paper #4 will be done depends on the final outputs of paper #2.

Part A of paper #4 could include the following updates of paper #1

- 1) Data update from EDGAR (year 2000)
- 2) Further components like CFCs, HCFCs, SO<sub>2</sub>, black carbon, organic carbon ...
- 3) Other background scenarios
- 4) Further indicators
- 5) Smaller geographical resolution (country level)

Part B of paper #4 could be based on input from paper #2 and how this transforms to uncertainty ranges in estimates of countries' contributions to climate change.

Advantages of paper #4 compared to paper #1 would be:

- More information – data, gases, geographical resolution
- Change of indicators, like the change of time period will show other results
- Connects the results of paper #1 and paper #2

In the general discussion on the future of MATCH, it was emphasized that the strengths of MATCH (expertise on emissions, gas cycles, aerosols, forcing, climate modelling, climate policy, etc) would be a good starting point for further development of MATCH and that it is important to build on this by expanding the group rather than changing the composition of the group.

The final discussion resulted in the following conclusions:

- The group agreed to conclude paper #2 by March 2006, so that there is enough time to prepare presentations for the SBSTA report in May 2006. The report of MATCH is part of the SBSTA agenda. There the group can present its work in form of a statement. Additionally, the MATCH project will be given a side event (e.g. 2 hours) for presentations in more depth.
- The next MATCH meeting would be held in March 2006 to complete the work. Paper #2 should be almost ready to submit. It will then be decided if we go for paper #4
- The MATCH group will continue to complete its work on paper#2 until the SBSTA in May 2006. Paper #4 as an update of the previous work would complete this task. One option could be to go on with the present type of work for one or two years from now (Option A) to finalize paper #4 (if it is decided to complete it) while at the same time starting with Option D in 1 or 1 1/2 year from now.
- Option B (tool development) is similar to the present focus of paper #3. It is open to be done by those experts that are interested. The MATCH network of scientists can be used for comments and discussions. Funding would need to be found for software development. But MATCH does not take the responsibility to deliver the final products (tool and paper).
- Option C (application of the contribution results) was not attractive to any of the attending participants.
- Most of the members preferred option D (assessment of future regime designs). The group agreed that the presentation to the SBSTA will mention that the MATCH has the capabilities assessment of future regime designs. But the final initiative to undertake the work would have to come from the governments themselves. The scope of the work should not only include future emission reductions but also approaches to address vulnerability and adaptation. It could e.g. address how calculations of contributions to climate

change also can be used in connection with for transfer of funds to compensate impacts and support adaptation. It was recognized that this would move the group further towards policy questions. As in the past, the MATCH group would only assess the *implication* of policy choices, without making any *recommendations* on these choices.

- Authors of paper #1 were encouraged to present the paper at conferences and workshops. It was agreed that Ecofys should apply for a side event at COP 11 in Montreal November 2005 at the Canadian pavilion to present paper #1.

## ANNEX A



The University of Reading



## DRAFT AGENDA

AD HOC GROUP FOR THE MODELLING AND ASSESSMENT OF CONTRIBUTIONS OF CLIMATE CHANGE (MATCH)

27-28 OCTOBER 2005, READING, UK

VERSION 31 OCTOBER 2005

Thursday, 27 October 2005

9.00 – 11.00	Chair: Jan Fuglestedt	- Welcome - Review of timelines (SBSTA), tasks, goals of MATCH, review of our project list & long-term work plan (Niklas Höhne)	2h
11:00	Coffee Break		30'
11.30 – 13.00	Chair: Michael Prather	Introduction to the draft paper #2: "Attributing a fraction of climate change to a nation's historical emissions: closure and scientific uncertainty" (Jason Lowe) Presentations on the chapters by the co-authors	1.5h
13.00	Lunch		1h
14.00 – 15.30	Chair: Joyce Penner	Organization of future work - Discussion on paper #3, "Formal assessment of uncertainties and clarification of parameter space to be covered / use of response plots". (Ben Matthews / Niklas Höhne) - Discussion whether a paper #4, to prepare an update of paper #1 is necessary (Jan Fuglestedt) - The report and presentation of MATCH to the SBSTA May 2006	1.5h
15:30	Coffee Break		30'
16:00- 17:30	Chair: Michael Prather	Discussion of the draft paper #2 - Discussion of the sections - Agreement on timeline and tasks - Agreement on target journal	1.5h
17:30	End		
19:00	Dinner		

Friday, 28 October 2005

9.00 – 11.00	Chair: Michael Prather	- Presentations on Closure Uncertainty of CO <sub>2</sub> /LUC - Discussion of the draft paper #2 continued	2h
11:00	Coffee Break		30'
11:30 – 12:30	Continued		1.0h
12:30- 13:00	Presentation from Guoquan HU 'A simulation study on the uncertainty of GHG emissions to global temperature rise by a simple climate model'		0.5
13:00	Lunch		1:00
14:00 – 16.00	Chair: Jan Fuglestedt	- Stocktaking - Work plan - Next meeting - Distribution of tasks until next meeting	2h
16:00	End		

## **ANNEX B**

### **Participants of the meeting**

The following experts attended the expert meeting:

- Atsushi Kurosawa, Japan
- Ben Matthews, Belgium
- Christiano Pires de Campos, Brazil
- David Warrilow, UK
- Esther Lahme, Germany
- Guoquan HU, China
- Jan Fuglestedt, Norway
- Jason Lowe, UK
- Jesper Gundermann, Denmark
- Joyce Penner, USA
- Katherine Bass, UK
- Malte Meinshausen, Switzerland
- Maria Silvia Muylaert de Araujo, Brazil
- Michael Prather, USA
- Michel den Elzen, Netherlands
- Mohan Munasinghe, Sri Lanka
- Murari Lal, Fiji Islands
- Niklas Höhne, Germany
- Peter Stott, UK
- Sarah Raper, UK

## ANNEX C

### Structure of paper #2 and authors

*MATCH paper #2*

#### Attributing a fraction of climate change to a nation's historical emissions: closure and scientific uncertainty

##### 1. Introduction

- Jason Lowe
- Joyce Penner
- Michael Prather

Big table with attributable emissions (Kyoto gases): First lay out by Michael, filling numbers by Niklas

Table with other forcings from RF table: Niklas/Joyce

Gas	$\Delta$ RF	Lifetime	GWP	Average emissions in CO <sub>2</sub> eq. 1990 - 2002			
				USA 1990-2002	EU 15 1990-2002	OECD Annex I 1990-2002	Estimated Global 1990-2002
CO <sub>2</sub> fossil							
CO <sub>2</sub> LUCF							
CH <sub>4</sub>							
N <sub>2</sub> O							
HFCs							
PFCs							
SF <sub>6</sub>							

##### 2. Long-lived Greenhouse Gases:

Structure:

Biochemistry, summary of sources, sinks, budget, current, global

Fig a: Gas abundance (X=time (1800-2000), Y= gas)

Table a: Gas (t)

Fig b: Derived gas fluxes (X=time (1800-2000), Y=  $\Delta$  gas)

Table b:  $\Delta$  gas

Annex I error analysis

##### 2.1. CO<sub>2</sub>

- Atul Jain
- Christiano Pires de Campos
- Ben Matthews
- Atsushi Kurosawa

##### 2.2. CH<sub>4</sub>

Lead by Michael and Jan including calculations for section 5

- Jan Fuglestedt
- Michael Prather

**2.3. N<sub>2</sub>O**

- Jan Fuglestedt
- Michael Prather

**2.4. SF<sub>6</sub>, PFCs, HFCs**

- Niklas Höhne

**2.5. CFCs and HCFCs**

- Niklas Höhne

**3. Short-lived Greenhouse Agents & other forcings:**

**3.1. Tropospheric and stratospheric O<sub>3</sub>**

- Jan Fuglestedt
- Michael Prather
- Niklas Höhne

**3.2. Aerosols Direct**

- Joyce Penner
- Peter Stott

**3.3. Aerosols Indirect**

- Joyce Penner
- Peter Stott

**3.4. Derived Net Aerosols (+O<sub>3</sub>?)**

- Joyce Penner
- Peter Stott

**3.5. Other/ natural Forcings**

- Jason Lowe
- Peter Stott

**4. RF and Climate Change**

- Jason Lowe
- Peter Stott
- Sarah Raper

**5 Uncertainty of impact of OECD Annex I emissions**

- Jason Lowe
- Michael Prather

Table with emissions (OECD Annex I 1990 to 2002 per gas) and template Excel spreadsheet

- Niklas Höhne

Example for Methane:

- Total of OECD Annex I emissions from UNFCCC with the reported uncertainty range (50%)
- Adjustment of the uncertainty range of emissions by comparison with global budgets -> OECD Annex I emissions from 1990 to 2003 with associated PDF
- Using the climate model derive the timeline of the difference in concentration and radiative forcing due to the OECD Annex I emissions 1990 to 2002 with associated PDF

## **6. Conclusions**

- Michael Prather

## ANNEX D

### Timeline

	2005			2006				
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
UNFCCC meetings								
MATCH meetings								
Paper #1	Published							
Paper #2	Full draft						Submission & presentations	SBSTA report
Paper #3								
Paper #4/ update #1								
Paper on future work								Presentation

#### 15 November:

- Base line RF table checked and a priori probability

#### 1 December:

- D/A aerosol for chapter 4 ready to Sarah
- Decision about climate model parameters
- Sarah to start MAGICC runs for section 4

#### 31 December:

- Decision about PDF for aerosol forcing
- Finalization of chapter 2 and 3
- Delta of RF for GHG for section 5 ready
- MAGIC runs for section 4 ready

#### 31 January:

- Jason completes chapter 4
- Sara completes delta of RF runs for section 5

#### 28 February:

- Jason completes analysis for chapter 5
- Finalization of chapter 5
- Full draft sent to authors

**March 2006** (possibly week of 13th): MATCH meeting (maybe in Belgium with a meeting on carbon cycle, east coast of the USA (Washington), Netherlands, Cologne)

- Finalization of paper #2

#### April 2006:

- Submission of paper #2
- Practice the SBSTA presentations and visit various governments

**May 2006** (15-26 May): Report to the SBSTA

## **ANNEX E**

### **Way forward after paper #2 - Possible future work of MATCH**

Niklas Höhne, Michel den Elzen

Draft 24 October 2005

Several options exist how the MATCH group could continue its work beyond 2005. Some options are sketched out in this paper to be discussed at the MATCH meeting on October 2005.

#### **Option A: Continuation of present situation**

The MATCH group could extend the time horizon of its work for e.g. 3 more years and continue to work on scientific and methodological aspects related to contributions to climate change. The group would generate as output scientific papers on contributions to climate change, including more sensitivity and regional detail. The participation with respect to competence could stay unchanged.

#### **Option B: Development of a tool**

It could be desirable to develop a computer tool that could widely be used to calculate contributions to climate change. The user would select the specific input emission data and would make the policy choices like a time horizon and indicator.

#### **Option C: Application of the contribution results**

To move the content of the work one step further, the group could explore using the results of the contribution calculation, e.g. in burden sharing or contributions to adaptation fund. Several groups have published work on burden sharing using the Brazilian proposal (approx. 6 groups). They could potentially be interested in a joint paper.

#### **Option D: Assessment of future regime designs**

Finally, the group could broaden the scope even wider to assess the options for the design of a future international climate regime such as a Multistage approach, Triptych or Contraction and Convergence. The focus of the work should be quantitative analysis resulting in scientific papers.

Table 1 provides an overview of the options.

Table 1. Summary of the options

	<b>Continuation of present situation</b>	<b>Development of a tool</b>	<b>Application of the contribution results</b>	<b>Assessment of future regime designs</b>
<b>Topics of work</b>	Regional/national contributions to climate change	Regional/national contributions to climate change	Emission allowances as a result of applying the Brazilian Proposal	Options for the design of the international climate regime post 2012
<b>Potential participants</b>	Climate modellers (from simple climate models to more complex models)	Developers of simple climate models plus potentially computer specialists, small group	Research institutions that applies the Brazilian proposal, e.g. RIVM, Ecofys CICERO, Kyoto University, ...	Research institutions working on policy options, e.g. ...
<b>Outputs</b>	Joint scientific papers (and info to policymakers) on contributions to climate change, more sensitivity, indicators and regional detail	A computer tool to calculate contributions to climate change using user defined parameters and emission data	Joint scientific papers (and info to policy makers) on the application of the Brazilian Proposal	Joint scientific papers (and dialog with policy makers) on the options for an international climate regime post 2012
<b>Arguments in favour</b>	Still the full uncertainty space needs to be explored and models can be improved.	A standard tool would cope with the fact that the policy choices are more important than scientific uncertainties	Now that we have the results what would be their application (as a principle for burden sharing or as one element in a burden sharing scheme)? Relevant for policy makers working on preparations for post 2012 regimes.	Very high interest by policy makers working on preparations for post 2012 regimes.
<b>Arguments against</b>	Interest by the policy community for additional work may be low	Do not need a group and coordinated process for this. Difficult to design the one standard. Can it be misused? Interest by the policy community may be low. (?)	The Brazilian proposal is not the most discussed option on future international climate policy	Very broad scope. Need to define our role clearly. Would need to emphasize role of uncertainty in climate and regional issues