C2SM-NEWSLETTER

Center for Climate Systems Modeling
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The Fifth IPCC report – Why yet another report?

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The Fourth IPCC report (AR4) in 2007 stated that global warming is unequivocal. It also stated that with a probability greater 90%, most of the observed warming of the last 50 years is due to anthropogenic emissions of greenhouse gases. These two statements are as clear as they can be. We know that global warming is happening and that we need to act now if we want to limit global warming to a global mean temperature increase of not more than 2°C. Then, why do we need yet another IPCC report?

One wouldn't need another report if its sole purpose was to convince policy makers to start with mitigation of greenhouse gas emissions. The existing IPCC reports are sufficient for this. But the IPCC reports are more than that. They synthesize the knowledge about different aspects of climate change by bringing together the whole climate science community in a unique and successful way. Moreover, they initiated the climate model intercomparison projects (CMIP) and with that provide incentives for the climate modeling centers to constantly improve their models.

The Fifth IPCC report of Working Group 1 will have 14 chapters as compared to 11 chapters in AR4. One of the new chapters is devoted to the carbon cycle and other biogeochemical cycles, particularly that of nitrogen.

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This chapter is motivated by the fact that the carbon cycle is an integral and interactive element of the Earth System, and therefore critical for determining the future climate for a given emission scenario.

For the first time there will be a separate chapter "Clouds and Aerosols". This is timely because cloud feedbacks determine climate sensitivity and continue to be the largest source of inter-model differences in estimates of climate sensitivity. Aerosols, on the other hand, are the largest uncertainties in forcing and have pronounced regional signals. Clouds, cloud processes and the aerosol are also crucial for the energy budget and precipitation both globally and regionally. The climate community has a new generation of models simulating clouds and aerosols from the process to the global scale. This combined with the revolution in our ability to observe clouds and aerosols enables an unprecedented ability to evaluate the representation of clouds and aerosols in climate models.

Because of the large uncertainties related to sea level change in AR4, also sea level change will have its own chapter. AR4 could only estimate the projected sea level rise due to thermal expansion and melting of glaciers, ice caps and ice sheets, but could not estimate the changes in sea level due to changes in ice flow because the ice flow models were not sufficiently advanced at that time. The potential ice sheet instability and its implications will be addressed in AR5.

Climate projections in AR5 will be divided into near-term climate change projections and predictability and long-term climate change projections, commitments and irreversibility. Predictability on interannual to decadal time scales is a new area of research, which will be addressed for the first time in AR5. These near-term predictions will start from the observed climate state, particularly that of the oceans, since this is the system that has the largest memory. This approach is standard for numerical weather prediction but has not been utilized for near-term climate change projections so far.

A new topic that will be covered in AR5 is geoengineering. Geoengineering can be divided into "solar radiation management" methods that encompass proposals such as a "permanent volcano" or brighter clouds, which will be covered in the chapter "Clouds and Aerosols". Geoengineering involving the carbon cycle, so called "carbon dioxide removal methods", such as iron fertilization of the ocean, will be discussed in the chapter "Carbon and Other Biogeochemical Cycles". The near-term climate change associated with different geoengineering options will be addressed in chapter "Near-term Climate Change: Projections and Predictability".

The Fifth IPCC report will be based on more data and better models run in higher resolution. It will thus be able to provide better regional information. It also includes new scenarios including mitigation and stabilization. This combined with covering the new topics mentioned above, the Fifth IPCC report promises to be another seminal report concerning the past and future global warming.

» www.c2sm.ethz.ch

Presentation of the new Swiss climate change scenarios CH2011

New climate change scenarios for Switzerland will be presented in the Auditorium Maximum at ETH Zurich on 28 September 2011, from 15:00 to 17:00.

The climate of Switzerland is changing. The Swiss Climate Change Scenarios CH2011 provide a new assessment of how climate may change over the 21st century in Switzerland. The assessment is the result of an initiative coordinated by various members of C2SM including Christof Appenzeller (MeteoSchweiz), Isabelle Bey (C2SM), Mischa Croci-Maspoli (MeteoSchweiz), Jürg Fuhrer (Agroscope Reckenholz- Tänikon), Reto Knutti (ETH Zürich), Christoph Kull (OcCC), and Christoph Schär (ETH Zürich).

At the presentation event in September, the authors will present the most important results, provide information on the methodological background and answer questions from the audience. Print versions of the accompanying report and a summary will be available on site.

At the same time, electronic copies of the report and the summary as well as the accompanying data will be made available online.

The event is free of charge. Participants are asked to register online by 16 September 2011. **(tc/ib)**

» www.c2sm.ethz.ch/url/registration
» www.c2sm.ethz.ch/services/CH2011

PhD project “Role of chemistry-aerosol-cloud interactions in climate stabilization”

Direction and magnitude of the climate impact of aerosols depend on their size, optical properties and chemical composition. Current climate models, however, often need to employ computationally efficient but crude methods to describe them, resulting in considerable uncertainties in projections of aerosol-induced climate effects. How can we improve the description of aerosols in climate models?

A particularly challenging problem is the representation of secondary aerosol components. They make up a large fraction of aerosols, but their formation is linked to complex gas-phase chemistry not included in current climate models. Therefore, efforts are directed towards the combination of air quality models, capable of simulating emissions, transport, conversion and removal of gases and aerosols; and climate models, able to simulate changes on decadal timescales. Coined on COSMO, the regional modeling system supported by C2SM, this means coupling the climate version (CCLM) to an air quality component.

For this purpose, C2SM member Empa has adopted the online-coupled chemistry-transport model COSMO-ART, recently developed at KIT Karlsruhe, Germany. Thereby we are able to simulate the complete lifecycle of gases and aerosols including their interactions. This modeling system is one of the very few “online-coupled” models, where treatment of aerosols and gases is consistent with meteorology and climate feedbacks on radiation and clouds can be simulated.

The PhD project of Christoph Knote is dedicated to the advancement of the description of ambient aerosols in a regional model and its use in predictions of aerosol-climate interactions. In a first step we put together a comprehensive set of emission and boundary data for gases and aerosols to make realistic simulations feasible. We then evaluated the model against various types of observations including datasets of aerosol chemical composition and size distributions that have become available only recently (see Figure below).

Interactions of aerosols and gases with clouds have been found to be highly important, both from a microphysical and from a chemical point of view, though still not adequately described. This led to the third part of the project, the development of a comprehensive scheme to describe wet scavenging of aerosols and gases by clouds and rain, aqueous-phase chemistry and the processing of aerosols by clouds. Once these adaptations have been made we will conduct sensitivity simulations with changes in precursor emissions and identify the most efficient emission reduction strategy to reduce particulate matter concentrations.

With the final modeling system we will be able to better quantify changes in aerosol mass and properties under changing emissions and a changing climate and therefore to better assess the response of climate to such changes.
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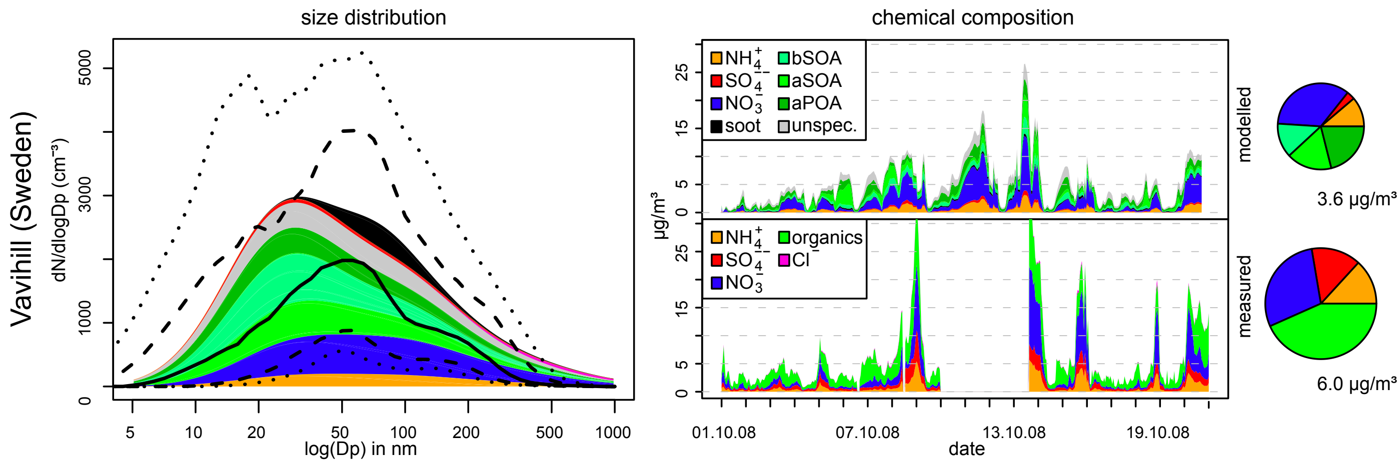
» www.c2sm.ethz.ch/research/phd/chemistry-aerosol-cloud



Evaluation of aerosol characteristics at Vavihill (Sweden) for a 20 day period in October 2008. Right plot: time evolution and mean concentration of non-refractory particulate matter below 1 µm, modelled chemical composition (top) against aerosol mass spectrometer measurements (bottom, courtesy of E. Swietlicki, U. Lund). Left plot: Comparison of size distributions. Lines show statistical parameters of measured distributions (solid line is median, dashed line 67 % range, dotted line 90 % range, courtesy EUSAAR, A. Asmi), colored area shows modelled results.

Agenda

Einfluss der Klimaänderung auf die Wasserkraftnutzung
Donnerstag, 8. September 2011
Theater La Poste, Visp

» www.hydrologie.unibe.ch/lehre/ccwasserkraft.html

The New Swiss Climate Scenarios CH2011
Wednesday, 28 September 2011
ETH Zentrum, Main building, Zurich

» www.c2sm.ethz.ch/news/scen_presentation/

AGU Chapman Conference on Advances in Lagrangian Modeling of the Atmosphere
Monday-Friday, 10-14 October 2011
Grindelwald

» www.agu.org/lagrangian

Updates & Further events

» www.c2sm.ethz.ch/news

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Page 3: Christoph Knote

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