

# C2SM-NEWSLETTER

Center for Climate Systems Modeling  
No. 3, September 2010

## Climate modeling across scales

*Reto Knutti – C2SM member*

One of main objective of C2SM is to bridge the gap between the different spatial and temporal scales and between the different components of the climate system. But there is only one Earth, so why not just build one big all-purpose model to study everything on Earth?

When controlled and repeated experiments with a system are impossible, as it is the case with climate and weather, numerical models are the preferred tools to learn about the system. In a world of infinite computing power, storage capacity, perfect observations and unlimited brainpower, we might be able to build a numerical model of the Earth representing all processes accurately at all scales.

So why are C2SM scientists using a regional climate model, a global climate chemistry model, and a zoo of other models? Well, few things in life are infinite, so limitations in computing, observations, but also our ability to understand, conceptualize and implement knowledge into a computer code force us to simplify. Current climate models are pushing the limits of scientific computing, and maintenance of a million code lines is expensive. But such external limitations are only one factor.

Einstein is credited with the quote: "Make everything as simple as possible, but not simpler". Indeed the true value of a model is that it allows us to keep things fixed and to test specific hypotheses. >> [page 2](#)

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Rather than having a model in which everything interacts, and in which we are unable to determine cause and effect, it may be more illuminating to build a simpler model. If we can explain and understand our data in a simplified model, we can learn a lot about what really matters. A simpler or limited model is often more beautiful, easier to understand and to operate, more efficient, and more straightforward to adapt to a new problem.

So the dynamicist uses an atmospheric model, the marine biologist an eddy resolving ocean carbon cycle ecosystem model, and the physicist interested in future climate uses a global ocean atmosphere model. Each of them focuses on their own specific interest, trying to get the details right in what he or she considers important, but happy to ignore many other things. The physicist may have a simple representation of the carbon cycle in his global model, but what if changes in wind or ocean circulation affect small scale ocean eddies, which in turn affect carbon fluxes into the ocean?

Coupling the detailed ocean carbon cycle to the global model may be unfeasible, because the temporal and spatial scales of the two systems are so vastly different, but it may also not be needed. If we can describe the effect of the large scale climate change on ocean eddies, and relate that again to large scale carbon fluxes, then we could get a grip on whether this process is important. We have to trace processes through different hierarchies of models. We are not there yet, but I'm convinced we will be.

I'm also convinced that we will continue to need a hierarchy or spectrum of models of different complexities, describing different sub-systems, and targeting different processes. The question at hand determines the appropriate model. The community has been pretty successful in this specialization, but less so in integrating the different parts again into the bigger picture. Interactions on temporal scales from seconds to millennia, and spatial scales from micrometers to thousands of kilometers make it a formidable task, and yet they are known to be important.

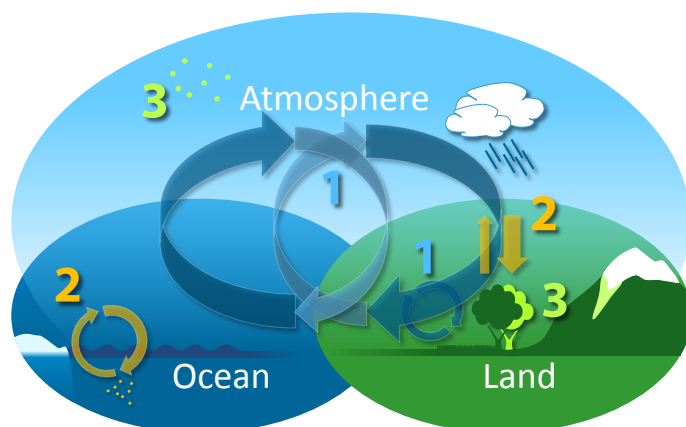
Modeling across scales: The goal of C2SM is arguably not simple to achieve. It requires new tools, progress in specific directions but also communication across disciplines. What if the physicist actually looked at the data of the marine biologist? What if MeteoSwiss, ETH, Agroscope, NCCR and OccC actually worked together on a new climate scenario report for Switzerland, sharing ideas from weather prediction, climate modeling, and end user needs? Well, that and much more is really happening in C2SM! I'm excited, and I hope you are as well. Stay tuned.

## Planning the next phase of C2SM

**A science planning meeting will be held on 4 October 2010, from 12 to 2pm in room CHN P12 at ETHZ, to discuss future science proposals to be submitted in 2011.**

As indicated in the June edition of this newsletter, the preparation of the second phase of C2SM is well underway. At the end of August, the C2SM Steering Committee has met to review the different proposals generated by the "call for ideas" which was launched in June 2010 to engage the C2SM community in the preparation of the second phase. Three overarching themes were selected, including water cycle in a changing climate from global to regional scales, assessment of sources, sinks and transport of greenhouse gases, and geoengineering.

On 4 October from 12 to 2pm, a science planning meeting will be held to further discuss these topics and initiate the preparation of science proposals to be submitted to for example the Sinergia or the CHIRP frameworks in 2011. Detailed planning of the meeting will become available on the event page of our homepage (link at the end of the article).



Sample illustration of potential themes for the second phase of C2SM. (1) Water cycle in a changing climate from local to global scales, (2) Sources, sinks and transport of greenhouse gases, (3) Geoengineering.

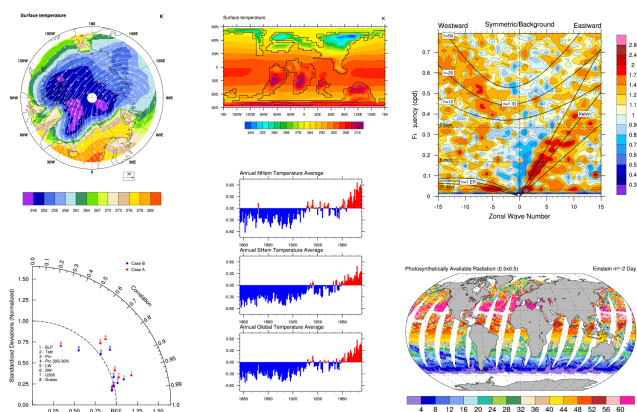
Sandwiches and drinks will be available starting from 11:30 and throughout the meeting. In order to help us ordering the right amount of food, please register by sending an email to Rahel Buri before September 25 if you intend to come to the meeting and have lunch. For additional information, please contact Isabelle Bey or members of the C2SM Steering Committee. (ib)

» [www.c2sm.ethz.ch/news/second\\_phase](http://www.c2sm.ethz.ch/news/second_phase)  
» [rahel.buri@env.ethz.ch](mailto:rahel.buri@env.ethz.ch)

## NCAR Command Language (NCL)

C2SM supports the usage of the excellent data processing and visualization tool NCL.

From 30 August to 2 September 2010, three developers of NCL, Mary Haley, Dennis Shea and David Brown, paid Zurich a visit. In a workshop organized and sponsored by C2SM, they introduced more than 30 scientists to the secrets of data processing and visualization. Attendees included researchers from ETH Zurich, MeteoSwiss and University of Bern. The workshop was performed in a mixture of lectures and lab sessions with the possibility to work with own datasets.



Sample visualizations produced with NCL..

NCL is a free interpreted language with a unique characteristic: It is developed specifically for the use in climate science. It has excellent support for netCDF, HDF and GRIB, and can read and write many further file formats. The visualizations are world class and highly customizable. The tool is actively developed and boasts a large and lively user and support community.

The usage of NCL is clearly on the rise throughout the climate community worldwide, but also within the C2SM community as attested by the number of researchers interested in the workshop. The C2SM staff would like to encourage the entire Center's community to use NCL and is ready to facilitate the switch to NCL by assisting the translation of existing tools from another languages to NCL and by helping to implement missing features.

Scientists interested in using NCL are invited to contact us for assistance. (tc)

- » [thierry.corti@env.ethz.ch](mailto:thierry.corti@env.ethz.ch)
- » [www.ncl.ucar.edu](http://www.ncl.ucar.edu)

## Presentation of the new COSMO code repository

As announced in the last newsletter, a new code repository (SVN) has been set up at CSCS (Swiss National Supercomputing Centre) to manage the different versions of the COSMO model and associated programs used within the C2SM community.

C2SM strongly encourages the COSMO users to adopt this new tool and invites all potential users to a short presentation of the new code repository. The presentation will be given on 26 October 2010 at 10:00 in room CHN L17.1 at ETHZ by Anne Roches. The structure of the repository and its functionalities will be explained and examples will be presented. (ar)

- » [anne.roches@env.ethz.ch](mailto:anne.roches@env.ethz.ch)

## Call for contributions to the C2SM wiki

We have started to collect helpful information for climate scientists, such as tools, manuals and scripts on data analysis and information on climate models. All material is published on a collaborative website (a "wiki"), allowing everyone to browse and search for helpful content, to advertize own research and developments, and to share knowledge.

The goal is to collect and make available a large range of useful material, for instance instructions on format conversions, a discussion on the best ways to read certain files in R, or a list of useful tools for the COSMO model. Whatever can be useful to more than one specific research group is welcome.

Send us your best scripts, manuals and hints, either via email or by contributing directly to the wiki. (tc, ar)

- » [wiki.c2sm.ethz.ch](http://wiki.c2sm.ethz.ch)
- » [thierry.corti@env.ethz.ch](mailto:thierry.corti@env.ethz.ch), [anne.roches@env.ethz.ch](mailto:anne.roches@env.ethz.ch)

# Agenda

## 2° - Das Wetter, der Mensch und sein Klima

bis 20. Februar 2011  
Kunstfreilager Dreispitz, Basel

» [www.2grad.ch](http://www.2grad.ch)

## 4. Nationales Klimaforum - „Create Impact“

Mittwoch, 20. Oktober 2010  
Congress Hotel Seepark, Seestrasse 47, Thun

» [www.climateforum.ch](http://www.climateforum.ch)

## Geoprotecta 2010

Donnerstag - Samstag, 11. - 13. November 2010  
Olma Messe, St. Gallen

» [www.geoprotecta.ch](http://www.geoprotecta.ch)

## 8th Swiss Geoscience Meeting

Friday / Saturday, 19 / 20 November 2010  
Pörolles 2, Fribourg

» [www.geoscience-meeting.scnatweb.ch/sgm2010](http://www.geoscience-meeting.scnatweb.ch/sgm2010)

## 2. Symposium Anpassung an den Klimawandel

26. November 2010  
Universität Bern

» [www.proclim.ch/4dcgi/proclim/en/Event?1271](http://www.proclim.ch/4dcgi/proclim/en/Event?1271)

## Updates & Further events

» [www.c2sm.ethz.ch/news](http://www.c2sm.ethz.ch/news)

## Imprint

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