Newsletter of the Climate Variability and Predictability Programme (CLIVAR)

# Exchanges

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## Special issue on: Coupled Modelling

### Latest CLIVAR News

- CLIVAR Conference Registration Deadline for a discounted fee is March 15th 2004
- Indian Ocean Panel formed. Visit http://www.clivar.org/organization/indian/
- Visit the calendar for details of meetings and conferences: http://www.clivar.org./calendar/index.htm

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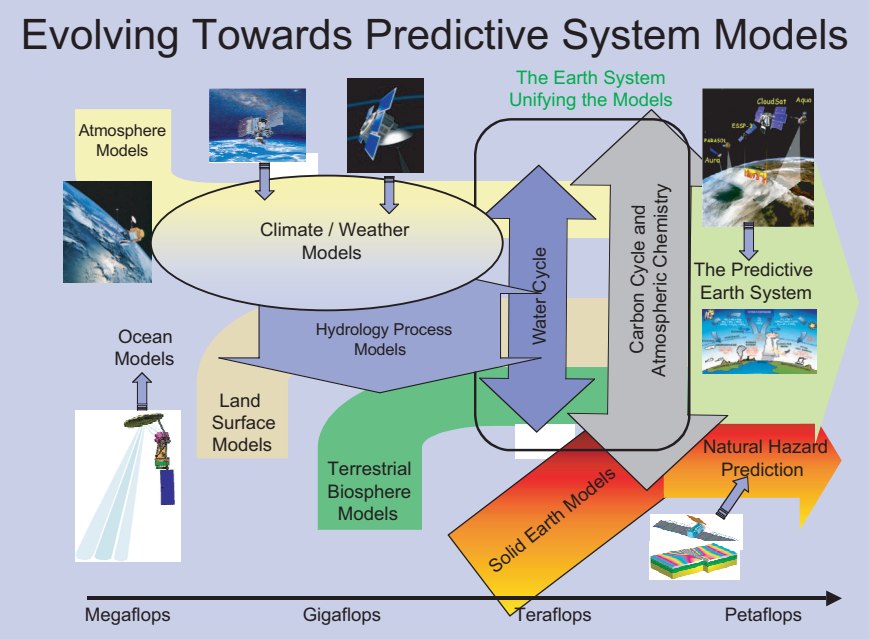
**CLIVAR** is an international research programme dealing with climate variability and predictability on time-scales from months to decades.

**CLIVAR** is a component of the World Climate Research Programme (WCRP).

### The European Network for Earth System Modelling (ENES)




*Coupled Climate Modelling evolves towards comprehensive Earth system modelling encompassing more and more components, such as biosphere, land surface, atmospheric chemistry and carbon cycle.*

*The PRISM approach described on page 18 will facilitate the exchange of different model components by building up an infrastructure of Earth System Models.*

*The figure illustrates the complex interactions of the different model components and their increasing demand in computational resources.*

### *Call for Contributions*

We would like to invite the CLIVAR community to submit papers to CLIVAR Exchanges for the next and subsequent issues. The overarching topic of the next issue will be on **'science related to the South American Low Level Jet Experiment'**. The deadline for this issue is **January 31, 2004.** The topic for the subsequent issue is **'Applications to CLIVAR Science'** and the deadline is **March 31st, 2004.**

Guidelines for the submission of papers for CLIVAR Exchanges can be found under: http://www.clivar.org/publications/exchanges/guidel.htm

## The Program for Integrated Earth System Modelling (PRISM) and the European Network for Earth System Modelling (ENES)

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The development of climate models has been an important milestone towards the quantitative assessment of human-driven perturbations in the Earth system. Complex models have been developed in several research centres in Europe, North America and Japan. These models have been evaluated, inter-compared, and used for various assessments including those performed by the Intergovernmental Panel for Climate Change (IPCC). In spite of the large efforts conducted by the scientific community during the last decades, many processes are still poorly represented in climate models, so that large uncertainties still exist in current models. These are often related to the way sub - grid processes (i.e., cloud and convective processes, precipitation, ocean eddies, etc.) are parameterized. Ensembles of multi-model integrations should help quantify these uncertainties and should provide a sense of the probability that a specific climate prediction may occur. Several groups are already developing the statistical methodologies needed to conduct and interpret such ensemble integrations.

Running codes by combining different model components developed in different institutions is an important aspect of the strategy developed in Europe. To achieve such a goal, model components need to be interchangeable without major efforts. This is being achieved by developing common physical interfaces that follow certain pre-established specifications. The PRISM Project (Program for Integrated Earth System Modelling[1]), an infrastructure project supported by the European Commission, is precisely designed to facilitate the exchanges of component models, and to integrate complex Earth System models under chosen configurations on different supercomputing platforms. The "science of model coupling" remains a challenging problem, as illustrated for example by Figure 1. Coupling different state-of-the-art atmospheric general circulation models with different ocean models leads, for example, to very different representations of the El Niño events. Issues related to the coupling of model components will become even more crucial as nonlinear biological and chemical processes are fully implemented in complex Earth system models (Figure 2).

PRISM was established following recommendations made in a Euroclivar report published in November 1998. This report called for increased cooperation between the different climate modelling centres in Europe, and suggested that model development consortia be established to perform model inter-comparisons and improve parameterizations. The exchange of software and model results was encouraged, and the need for a large European climate computing facility to perform long high-resolution multi-model ensemble integrations was identified. The objective of PRISM is therefore to develop a flexible model structure with interchangeable model components that can exchange information through standard interfaces and through a universal coupler. As a result, the European scientific community will adopt a common software framework for model development, model diagnostics and visualization. When completed, this infrastructure will become available to the scientific community. PRISM is coordinated by the Max-Planck-Institute for Meteorology in Germany, jointly with the Royal Netherlands Meteorological Institute.

What has soon become clear is that, beside the development of common software infrastructures, the various European centres must increase their scientific cooperation, and share a common vision for future research. The purpose of the European Network for Earth System Modelling (ENES - http://www/enes.org) is to facilitate exchanges of ideas and to develop new scientific and support initiatives. ENES includes more than 50 partners representing the academic world, national research centres, meteorological services, computing centres, and industry. The ultimate objective of ENES is to accelerate progress towards a better understanding of the processes governing the Earth system and towards the development of improved predictive capability. The ENSEMBLES project, recently approved by the European

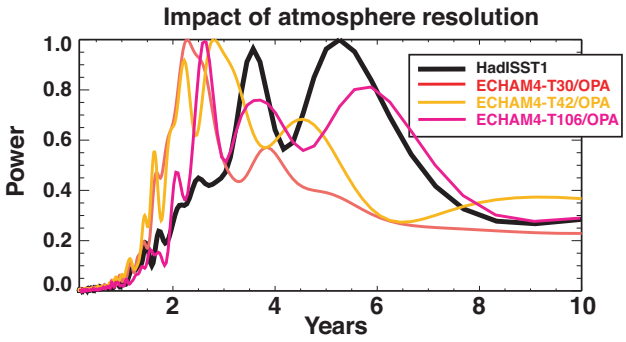


*Figure. 1: Different Spectra of the El-Niño phenomenon for different representations of the atmosphere in coupled Atmosphere-Ocean Global Circulation Model runs. From Guilyardi, 2003.*

[1] Funded by the European Commission under contract No.: EVR1-CT-2001-40012; http://prism.enes.org

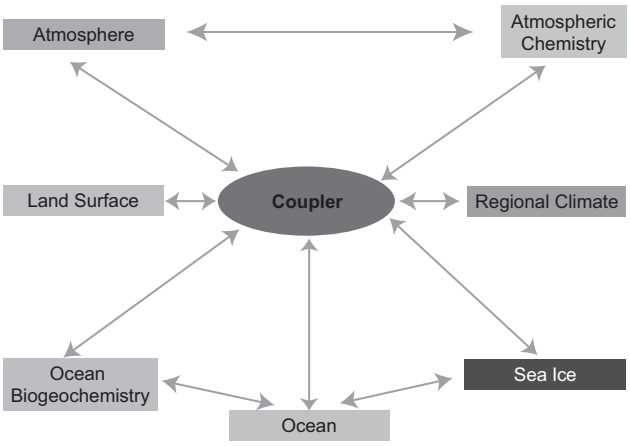


*Figure. 2: The PRISM configuration*

Commission, will address important scientific issues in support of the ENES objectives. ENSEMBLES, which includes 72 partners, is co-ordinated by the Hadley Centre in the UK.

One issue addressed by ENES is the lack of sufficient computing resources available in Europe to maintain a high level of climate modelling activities, and to contribute world-class science. Japan and the US have been developing strategic views on the question of hardware infrastructure. Europe must also establish its strategy, despite the complex institutional situation and the lack of a dedicated project by European industry in this respect. New climate assessments will require more complex and higher resolution models. Model integrations will cover longer time periods, and involve multi-model ensemble runs. Over the last decades, Europe has developed a strong intellectual capability in its research centres and universities, and has provided important scientific information to decision-makers. It will be able to contribute efficiently to future assessments and to decisions related to climate policy only if it maintains a strong research activity with the appropriate supercomputing infrastructure. Figure 3 (page 1) illustrates the processes that lead to more integrative Earth system models, and the associated level of computer resources that will be needed to develop and use these models in the future.

**Reference**

Guilyardi, E., S. Gualdi, J.M. Slingo, A. Navarra, P. Delecluse, J. Cole, G. Madec, M. Roberts, M. Latif, and L. Terray, 2003: Representing El Niño in coupled ocean-atmosphere GCMs: the dominant role of the atmosphere. *J. Climate*, submitted.