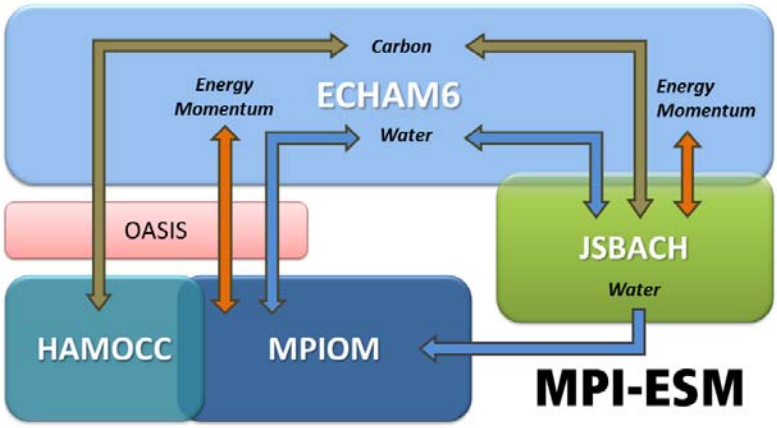
New Earth system model of Max Planck Institute for Meteorology

After five years of developing and improving the well-known ECHAM5/MPIOM climate model of the Max Planck Institute for Meteorology (MPI-M), the new Earth system model MPI-ESM is now ready and available for use by the scientific community. The present and future workhorse of all three MPI-M departments has already been used for comparative model calculations in the context of the CMIP5 process ("Coupled Models Intercomparison Project Phase 5"). The main improvement to the previous ECHAM5/MPIOM is the coupled carbon cycle, which now allows studying feedbacks of climate change on to the carbon cycle itself. The representation of shortwave radiative transfer, surface albedo and aerosol has also been improved. The representation of the middle atmosphere as well as the land surface with interactive vegetation dynamics and the possibility of using different resolutions depending on the different questions were also incorporated into the design of the MPI-ESM. A special issue of the Journal of Advances in Modeling Earth Systems (JAMES) will be dedicated to the initial description of the MPI-ESM, through numerous papers (currently in review) by MPI-M researchers.



About the MPI-ESM

The MPI-ESM couples the atmosphere, ocean and land surface through the exchange of energy, momentum, water and important trace gases such as carbon dioxide. It has been used for comparative model calculations in the context of CMIP5, which constitute the German contribution to the Fifth Assessment Report of the IPCC (Intergovernmental Panel on Climate Change), scheduled for publication in late 2013. Compared to the previous version ECHAM5/MPIOM, the MPI-ESM was extended by numerous developments. It is based on the components of ECHAM6 for atmosphere and MPIOM for ocean as well as JSBACH for terrestrial biosphere and HAMOCC for the ocean´s biogeochemistry. The coupling of atmosphere and land on the one hand and ocean and biogeochemistry on the other hand is made possible by the separate coupling program OASIS3.

Energy, momentum, water and CO2 are exchanged with the help of this coupling. The most important changes and improvements of the MPI-ESM compared to the previous model ECHAM5/MPIOM are:

- advanced/improved treatment of radiative transfer
- improved representation of surface albedo
- new and improved representation of the aerosol
- much better representation of the middle atmosphere
- a capacity to simulate at a range of different resolutions depending on the question
- interactive vegetation dynamics
- coupled carbon cycle

The simulation of the carbon cycle allows statements about the effects of climate change on the carbon cycle itself. The MPI-ESM has been freely available to the scientific community since February 2012, and can be accessed with a license on the MPI-M website:
Available models
Model distribution procedure

JAMES Special Issue about the MPI-ESM, it´s components and the CMIP5 simulations

The new Earth system model MPI-ESM will be scientifically documented by a series of papers. These include a full overview over the MPI-ESM as well as publications which focus on phenomena and processes within the whole model or one of it´s components. Many of the submitted papers are based on the CMIP5 runs, but also more exotic configurations of the model, which go beyond the CMIP5 protocol, are discussed. In agreement with Dave Randall, the publisher of Journal of Advances in Modeling Earth Systems (JAMES), a special electronic edition about the MPI-ESM will be published.

Link to the submitted papers of the JAMES Special Issue.

CMIP5

In CMIP5 („Coupled Model Intercomparison Project Phase 5“) all current questions about mechanisms and characteristics of climate change are being studied. An important improvement in CMIP5 is the integration of idealized experiments to understand decisive climate processes like clouds, short runs starting from common initial conditions for exploring decadal prediction, and the incorporation of new model diagnostics, which leads to a better comparison of model results to satellite data.

CMIP5 promotes a standard set of model simulations in order to:

- evaluate how realistic the models are in simulating the recent past
- provide projections of future climate change on two time scales, near term (out to about 2035) and long term (out to 2100 and beyond)
- understand some of the factors responsible for differences in model projections, including quantifying some key feedbacks such as those involving clouds and the carbon cycle
- understand cloud feedbacks and other climate processes

The following experiments about different issues were elaborated and calculated with the MPI-ESM:

- baseline experiments: for example historical climate simulations (from 1850 to 2005)
- future projections of climates associated with different scenarios (from 2100 to 2300)
- decadal climate predictions
- the role of the carbon cycle for climate changes
- the more distant past, for example the last glacial maximum or from 850 to 1850
- idealized experiments, including aqua-planets and realistic planets with idealized forcings

The standardized experiments were carried out by 20 climate modeling groups from around the world with their respective climate model or Earth system model.

Further information:

CMIP5 project: http://cmip-pcmdi.llnl.gov/cmip5/

Press release: http://www.mpimet.mpg.de/nc/en/news/single-news/article/from-the-past-into-the-future-new-climate-simulations-for-science-and-society.html

Illustration: Michael Böttinger, German Climate Computing Center (DKRZ)

Contact:

Dr. Annette Kirk
Max Planck Institute for Meteorology
Public Relations
Phone: +49 (0)40 41173 374
E-mail: annette.kirk@zmaw.de

Michael Böttinger
German Climate Computing Center (DKRZ)
Visualizations and animations
Phone: +49 (0)40 460094 344
E-mail: boettinger@dkrz.de