

CMIP5: Preparing climate simulations and projections for the Fifth IPCC Assessment Report

16.10.2008

The World Climate Research Programme's Working Group on Coupled Modelling (WGCM) held a historic meeting in Paris, France on 22-24 September 2008 where representatives from 20 of the global coupled climate modelling centres from around the world were invited to hear about the next climate model intercomparison project (CMIP5). CMIP5, proposed and developed by the WGCM community in conjunction with the International Geosphere-Biosphere Programme's Analysis, Integration and Modelling of the Earth System (AIMES) project, will provide the framework for climate change modelling research for the next five years. Results from these experiments will provide the basis for the next Intergovernmental Panel on Climate Change Assessment (AR5) which is scheduled for publication in 2013. As the international climate modelling community takes on ever-increasing climate change modelling challenges, WGCM has been able to build tangible linkages through shared activities and direct communication with other groups representing the research communities involved with CMIP5 (including WCRP activities conducted by CLIVAR Working Group on Seasonal to Interannual Prediction (WGSIP), GEWEX and the Gewex Cloud System Study (GCSS), SPARC, the Atmospheric Chemistry and Climate (AC&C) project, and the Working Group on Numerical Experimentation (WGNE). WGCM is now linked even closer to the IPCC Working Groups to formulate and coordinate the new mitigation scenarios based on evolving atmospheric CO₂ concentrations.

Climate model intercomparisons

Climate researchers world-wide use different climate models to answer different science questions. Global coupled atmosphere-ocean general circulation models (i.e. 'climate models') have reached a high degree of complexity incorporating the carbon cycle, atmospheric chemistry and aerosols and other components. Among other uses, such models are employed to detect anthropogenic effects in climate records of the past century and to project future climate changes due to human production of greenhouse gases and aerosols. However, all existing climate models are still insufficient in simulating the evolution of climate over the next decades and longer time scales. Intercomparisons of coupled climate models help to discover why different models give different output in response to the same input, or to identify aspects of the simulations in which 'consensus' in model predictions or common problematic features exist.

International facilitation of carefully structured climate model intercomparisons has been an important part of the World Climate Research Programme's mission for over two decades. Working through its projects and working groups, WCRP has strongly supported over 40 model intercomparison projects (MIPs), which have typically found that: (i) no one model performs well in all the evaluations employed; (ii) no one test evaluates all aspects of the participating models; and (iii) the model group mean generally outperforms any one model, where performance is measured against observational data.

Phase 5 of the climate model intercomparison project (CMIP5)

CMIP5 is building on the great successes of CMIP3 which provided simulations on past climate and projections of the future climate, both assessed by the Fourth IPCC Report (AR4), which was published in 2007. The grand challenge of the new set of climate models examined in CMIP5 is to resolve regional climate changes, particularly in the next few decades, to which human societies will have to adapt, and to quantify the magnitudes of the feedbacks in the climate system, such as feedbacks in the carbon cycle.

The advances of CMIP5 compared to CMIP3 include two classes of models which address two time frames and two sets of science questions: i) decadal prediction and predictability for the decade to come until 2035; and ii) long-term climate prediction until 2100 and beyond. Decadal prediction models are higher in resolution (50 km) and will therefore address science questions related to regional climate and extremes. In contrast, the models developed for centennial predictions have intermediate resolution (200 km) and will include fully coupled Earth System Models, addressing climate feedbacks and other large-scale processes. The latter set of models will be driven by new emission stabilization (mitigation) scenarios which are currently under development (Aspen 2007).

The Program for Climate Model Diagnosis and Intercomparison (PCMDI) will again play the leading role in supporting the international climate community and the data management needs of CMIP5 will be met by an international federated, distributed data archival and retrieval system called the Earth System Grid Center for Enabling Technology (ESG-CET) that is being developed in partnership with PCMDI.

In addition to serving the coupled modelling community with the coordinated experiments and its data collection and archival needs, the WGCM Paris meeting addressed its other focus topics of improving models, in particular the simulation of cloud and moist processes, and addressing emerging issues including ice sheets and air chemistry. Other major foci for WGCM are regional climate modelling and how this community can best organize itself at an international level and wider modelling issues within WCRP as

its remit evolves to address the science questions emerging with the development of the next generation of models in the next decade and beyond.

Links & references

Aspen 2007 http://wcrp.wmo.int/documents/Aspen_WhitePaper_1final_000.pdf

IPCC <http://www.ipcc.ch>

PCMDI http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php

WCRP-CLIVAR <http://www.clivar.org>

WGCM <http://www.clivar.org/organization/wgcm/wgcm.php>

WGCM-12 presentations and pre-meeting reports
<http://www.clivar.org/organization/wgcm/wgcm-12/wgcm12.php>.