

WCRP Workshop on CMIP5 Climate Model Analysis

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Speakers who welcomed the attendees to the WCRP Workshop on CMIP5 Climate Model Analysis: left to right, Gerald Meehl (WGCM co-chair, chair of the Organizing Committee), Sandrine Bony (WGCM co-chair, member of the Organizing Committee), Kevin Hamilton (local host and Director of the International Pacific Research Center at the University of Hawaii), Karl Taylor (WGCM and CMIP Panel member, member of the Organizing Committee), and Thomas Stocker (co-chair, Working Group 1, IPCC Fifth Assessment Report).

The CMIP5 workshop was convened by the World Climate Research Programme (WCRP) Working Group on Coupled Models (WGCM) on 5-9 March 2012 at the International Pacific Research Center (IPRC), University of Hawaii, USA. The workshop sponsored by WCRP, IPRC, CSIRO, US CLIVAR, NSF, DOE, NASA and NOAA provided the participating scientists with the opportunity to present new results emerging from analyses of the multi-model data that are part of the Coupled Model Intercomparison Project Phase 5 (CMIP5). This and previous phases of CMIP have been organized and coordinated by the WCRP WGCM. Model data are openly available from the Earth System Grid Federation, an international distributed data archival and access system, and more information can be found on the Program for Climate Model Diagnosis and Intercomparison (PCMDI) web page (<http://cmip-pcmdi.llnl.gov/cmip5/>). The workshop also served to address a variety of issues related to climate extremes for the U.S. National Climate Assessment.

Priority for presentations was given to multi-model CMIP5 analyses, balance of analyses that spans the various categories of CMIP5 model experiments, and research that is far enough along to show substantive results. Based on these criteria and in order to comply with the venue capacity, 170 abstracts were accepted for presentation among the 231 submitted. Attendees, therefore, included scientists with accepted abstracts and sponsor representatives.

Here are the initial impressions of the three members of the organizing committee. Since nearly all the results are preliminary and unpublished, this summary is necessarily general and is not intended to be comprehensive. Rather, it illustrates some of the notable aspects of the results with a few examples, and next steps.

In spite of some delays in model availability and challenges in downloading model data (though CMIP5 analyses are farther along than at a similar stage in CMIP3), results from a wide variety of analyses of the different categories of CMIP5 model configurations were presented which included between 15 and 22 Atmosphere-Ocean Global Climate Models (AOGCMs, with components of atmosphere, ocean, land and sea ice); 4 to 8 decadal

prediction simulation sets (AOGCMs initialized with observations); about 6 high-top models (AOGCMs with increased vertical extent to reach well into the stratosphere); or 3 to 8 Earth System Models (ESMs, with inclusion of at least a coupled carbon cycle in an AOGCM). A notable feature of the workshop was the considerable interest and excitement from the participants in analyzing model data to learn new things about the climate system.

The concern that the spread of future projections (from either the new generation of AOGCMs with more realistic complexity, or from ESMs with coupled carbon cycle) would be wildly greater than from the AOGCMs of CMIP3 appears to have been unfounded. The spread of projections in CMIP5 AOGCMs is roughly the same as the previous generation of models in CMIP3. Most first generation ESMs are well-behaved and produce comparable first order results to AOGCMs, but also include the additional capabilities of ESMs.

Patterns of future change of temperature and precipitation, equilibrium climate sensitivity, and spread among CMIP5 models are similar to previous generations of models and present the opportunity to better understand the spread. This increases confidence in these results. Characteristics of model simulations in CMIP5 are either similar to CMIP3 or have improved somewhat, and almost nothing appears to have degraded.

Some quantities show considerable improvement (e.g. rate of sea ice loss in Arctic, reduction in cloud brightness) or a decrease in model spread (e.g. Atlantic Meridional Overturning Circulation--AMOC, seasonal cycle of precipitation in Caribbean, Greenland ice sheet mass balance from temperature and precipitation, El Niño standard deviation). Some aspects have not significantly improved (e.g. double ITCZ, Arctic clouds and atmospheric circulation, Antarctic sea ice loss, southern ocean too warm, SPCZ too zonal, humidity in subtropical descent regimes too high).

CMIP5 provides many more capabilities and new types of climate change information:

- carbon cycle feedback, quantifying sources and sinks of carbon for land vs ocean, allowable emissions for different levels of mitigation in the RCP scenarios, ocean acidification, physiological effects of vegetation changes
- high resolution time slices to study tropical cyclones
- decadal climate prediction for short term climate change and possible climate shifts
- paleoclimate simulations that allow analysis of climate response across past, present and future climates, and that provide "out of sample" insights to build model credibility and provide possible constraints on the nature and magnitude of future climate change
- analysis of cloud feedbacks
- revisiting of forcing and feedback better helps to interpret the spread of model projections
- attempts to relate 20th century model biases to projections

There were also new types of results that were shown, and these are just a few examples (many more presented):

- Atlantic multidecadal variability appears to be more predictable than Pacific multidecadal variability
- critical thresholds for Arctic sea ice loss
- regional climate regimes like Indian Ocean Dipole and connections to east African rainfall
- South Pacific Convergence Zone
- ocean wave heights
- changes in monsoon onset characteristics
- role of salinity and patterns of changes connected to hydrological cycle and ocean response
- effects of aerosols on Atlantic SSTs
- tracking regional ocean heat content changes and relation to regional patterns of sea level rise
- better quantification of factors affecting cloud feedback

- mechanisms for regional precipitation and temperature changes and extremes—Caribbean drying, SE US wetter, drying Amazon, connecting Arctic sea ice loss to European cold extremes, atmospheric rivers and extreme precipitation, importance of circulation changes, blocking, what will not change in a future climate is also useful information

The workshop closed with a request to model analysts to refer to the model runs as “CMIP5 models”, not “IPCC models” or “AR5 models”. This is because the WCRP coordinates international climate science research, and the WCRP WGCM organizes CMIP. The IPCC assesses that science, but does not perform or coordinate science.

The participants were encouraged to include the CMIP5 acknowledgment found at:

<http://cmip-pcmdi.llnl.gov/cmip5/citation.html>, and to ensure that plots and figures clearly identify individual models, and refer to models by “official” acronyms found at:

http://cmip-pcmdi.llnl.gov/cmip5/docs/CMIP5_modeling_groups.pdf.

CMIP5 publication information can soon be entered on the PCMDI website. If the analysts wish their results to be assessed in the IPCC AR5, publications can be sent directly to the lead authors, or to the IPCC WG1 TSU at wg1@ipcc.unibe.ch, before July 31, 2012. However, the WCRP CMIP5 project continues to 2013 and beyond, and the CMIP5 multi-model data will be a resource for the entire climate science community for years to come.

Analysts were advised to consult and interact with modeling groups when they find interesting or confusing results, or if they find anything they think would help the groups understand/improve their models (or the analysts can go through PCMDI to reach the modeling group contacts).

Due to the wide variety and diversity of the CMIP5 model experiments, CMIP5 analysts were encouraged to look at the new classes of CMIP5 experiments that provide opportunities to analyze novel aspects of the climate system as represented by the broad scope of the model experiments. Indices of weather and climate extremes (coordinated by ETCCDI) are being calculated for the CMIP5 models and for the reanalyses data, and will be made available for users to analyze through a data base, initially from the Canadian Center for Climate Modeling and Analysis (CCCma), and subsequently on the PCMDI web site. More model data will continue to come in to CMIP5, so analysts were instructed to include more models in their multi-model results as they become available.

Finally, the Organizing Committee thanked all the participants for their interest, energy and enthusiasm, and for taking on the challenges of analyzing the CMIP5 model simulations to advance the state of human knowledge of climate science.



Participants (about half the total are pictured) at the WCRP Workshop on CMIP5 Climate Model Analysis listen to short presentations at the beginning of one of the sessions.