

Proposal for an IPCC Expert Meeting on Assessing and Combining Multi Model Climate Projections

Submitted by the Co-Chairs of IPCC Working Group I and Working Group II

Background

Climate model results provide the basis for IPCC projections of future climate change. Previous assessment reports included model evaluations but avoided weighting or ranking models. Projections and uncertainties were based on a 'one model, one vote' approach, despite the fact that they differed in terms of resolution, processes included, forcings and agreement with observations. Projections in the IPCC's Fifth Assessment Report (AR5) will be based largely on the Coupled Model Intercomparison Phase 5 (WCRP CMIP5), a collaborative process in which the community has agreed on the type of simulations to be performed. The widespread participation in CMIP5 provides some perspective on model uncertainty. Nevertheless, these intercomparisons are not designed to yield formal error estimates and remain 'ensembles of opportunity.'

Since participation in the IPCC process is important for modelling centres, the number of models and model versions is likely to increase in CMIP5. Some groups may submit multiple versions of the same model with different parameter settings. The new generation of models is likely to be more heterogeneous than ever, as some but not all of the new models will include interactive representations of biogeochemical cycles, chemistry, ice sheets, land use or interactive vegetation. This makes a simple model average increasingly difficult to defend and to interpret. Many models are not independent and some are clearly more robust than others when compared with selected observations.

The reliability of projections could be improved if the models were weighted according to some measure of skill and if their interdependencies were taken into account. Indeed such methods using forecast verification were shown to be superior to simple averages in the area of weather forecasting. Since there is no verification for a climate forecast on timescales of decades to centuries, the skill or performance of the models needs to be defined, for example, by comparing simulated patterns of present day climate to observations. Such metrics are useful but not unique and often it is unclear how they relate to the forecast of interest. Defining a set of minimum criteria for a model to be 'credible' or agreeing on a metric of performance is therefore difficult and the criteria are likely to depend on the variable and timescale of interest. Combined with an estimated data volume exceeding 1000 Terabytes, the AR5 faces immense obstacles in trying to make sense of the deluge of model runs and data that it will produce.

Recent studies have started to address these issues by proposing ways to weight or rank models, based on process evaluation, agreement with present day observations, past climate or observed trends. While there is agreement that 'the end of model democracy' may be near, there is no consensus on how such a model selection or weighting process could be agreed upon. An IPCC expert meeting addressing these important questions will help to bring the community into a position to make better use of the new model results and will provide more robust and reliable projections of future climate, along with improved estimates of uncertainty. At the same time, the dialogue between WGI and WGII should be strengthened in order to determine what kind of model results from WGI can be provided to WGII and how that exchange can be organized efficiently, given the tight schedule of the AR5.

Objectives

The main objective of the expert meeting is to see if it is possible to establish some type of framework for using and assessing the AR5 model set. Components of this effort are

- To stimulate discussion on metrics to evaluate climate models;
- To learn from other communities where model skill based on forecast verification is used;
- To assess the potential of different model weighting, ranking and selection schemes for not equally credible models for their use in IPCC AR5;
- To determine whether minimum model performance requirements for inclusion in AR5 should and can be defined.

Expected outcome

The expert meeting will provide tentative best practices in selecting and combining results from multiple models for IPCC AR5; in short the beginning of a quantitative framework for analysis and assessment of the models. Specific aims of the meeting will be to maximize the robustness and policy relevance of the projections provided in the presence of model error, projection uncertainty, observational uncertainties and a heterogeneous set of models. Interactions between WGI and WGII will be ensured by the participation of a number of representatives from WGII with broad expertise on impacts and user needs.

Initial organising committee (a broader scientific steering committee will be formed)

Prof. Reto Knutti (ETH Zurich, Switzerland)

Dr. Benjamin Santer (Lawrence Livermore National Lab, USA)

Dr. Penny Whetton (CSIRO, Australia)

Dr. Mat Collins (Met Office Hadley Centre, UK)

Dr. Daithi Stone (University of Cape Town, South Africa)

Dr. Claudia Tebaldi (Climate Central/NCAR, USA)

Dr. Karl Taylor (Program for Climate Model Diagnosis and Intercomparison, LLNL, USA)

Timing: late 2009/early 2010, after the AR5 Scoping Meeting (dependent on date decided for IPCC 31st Plenary)

Duration: 2.5 to 3 days

Location: possible host organizations have been identified and are being explored with the relevant IPCC national focal point

Participants: About 40 participants in total, with broad international representation. It is proposed that 16 journeys for experts from developing countries and economies in transition including WGI and WGII Vice-Chairs are allocated as part of the line item “expert meetings related to the AR5” in the already agreed IPCC Trust Fund budget for 2009.

Expertise: Climate model development, model evaluation, statistical methods, uncertainty quantification.