RT5-RT4 Workshop on model uncertainties and biases
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A workshop was held during the ENSEMBLES General Assembly to discuss the status of the global climate model evaluation with the project and its links to climate prediction. This was part of a larger discussion, that included a second workshop on "weighting, credibility, and reliability", to provide the current status of the evaluation of the full ENSEMBLES prediction system.

The workshop started with a short introduction by P Braconnot on the state of the art of model evaluation, as illustrated in the IPCC 2007 report. Braconnot also summarized the objectives of the global climate model evaluation with ENSEMBLES:

* To construct metrics of different level of complexity for a systematic model evaluation.

* To understand the different model responses at different time scales.

* To assess the role of model biases in climate projections at different time scales.

The aspects addressed in the workshop included the long-standing "cold tongue" bias in the sea surface temperatures in the Eastern Equatorial Pacific, the representation of clouds, the assessment of biogeochemical cycle, the role of the stratosphere in the climate system and the common basis of the model errors in seasonal and climate prediction.

A Bellucci presented the status of current climate models concerning the "double ITCZ" problem, a long standing systematic bias affecting both the precipitation and the sea surface temperatures in the (eastern) tropical Pacific. The association of this bias with the atmospheric circulation is manifested in a seasonal cycle bias of the mid troposphere vertical velocity and in an erroneous frequency of subsidence (low precipitation) versus ascent (high precipitation) occurrence. From the point of view of the atmospheric model, it is not found a simple relationship between the model configuration and the bias.

J-L Dufresne has reviewed the spread of climate sensitivity results within climate models and its subdivision by component. Cloud feedback emerges as a large source of uncertainty, motivating a closer look at the representation of clouds in atmospheric models. A diagnostic technique to compare satellite derived cloud distributions and modeled clouds has been presented. The main results are that a rather different high cloud and low cloud distribution is currently modeled by the atmospheric model considered.

Carbon and temperature feedbacks in climate models with the carbon cycle were assessed by P Braconnot. The model dependent magnitude of these feedbacks contributes to the wide range of the projected temperature responses. Seasonal cycle and interannual variations of the atmospheric CO2 have been reported to be reasonably well simulated. The intriguing aspect of the possibility of cancellation of errors when processes are coupled has been highlighted, motivating the combined evaluation of both the comprehensive (coupled) models and their stand alone components.

M A Giorgetta has reported about the impact of modeling the stratosphere in climate models. In two experiments, designed to minimize the differences in the troposphere of a high top (including the full stratosphere and part of the mesosphere, in addition to the troposphere) and a low top model (covering the troposphere and the lower stratosphere only) a general global raise in tropospheric temperature of 0.5 K has been found.

The status of biases in seasonal and climate probabilistic prediction has been presented by F. J. Doblas-Reyes. The probability density function (pdf) of predictions from a multi model ensemble is affected by two types of errors, fundamentally different: model and initialization errors. Because of the number of factors that enter in the probabilistic prediction system, it is hard to formalize direct links between systematic model errors and the capability of prediction. Reliability is a measure of the ability to issue trustworthy probability, hence sometime a probability forecast has to fail.

Part of the discussion also involved the motivation to perform the multi model evaluation and what we can learn from it. Multi model evaluation was concluded to be a necessarily condition for establishing a baseline status of the capability of the models (benchmark science). It cannot solve the problems by itself, but it gives a relative description of the problem, it identifies outliers or if all the models deviate in a similar way, and it may provide insights on how to tackle the problems. In general, the current climate models are such that a range of behaviors are found, usually encompassing the observations.

An additional strength of the multi model approach is that the relationship between model biases and model prediction can be identified. Given the above mentioned caveats (prediction errors are not only due to model errors) it is clear that it is not straightforward to establish a direct link. However, there is a number of cases (tropical Pacific, for instance) for which systematic model errors get established on relatively short time scales. This means that, once these aspects are made explicit, climate model development can take the benefit, because with the prediction system these errors can be investigated within short term simulations.

The works presented in the workshop will be part of a number of publications and/or reports that will contribute to the Major Milestone "Evaluation of the systematic error of the ENSEMBLES for the mean and the major variability patterns" in the last year of ENSEMBLES.