Community-wide Consultation on Model Evaluation and Improvement

Please complete the following template by writing your answers into the boxes below the questions, sending any supplementary material such as clearly labeled figures in a separate file. Please submit your response electronically by ***15 January 2010*** to Anna Pirani at apirani@princeton.edu.

Q1: Please state your particular area of interest, e.g. global or regional climate or NWP modeling, seasonal prediction, sea-ice feedbacks, monsoons, troposphere-stratosphere exchanges, etc.

The Global Climate Observing System (GCOS) area of interest is all kind of climate and earth system modelling, from regional to global scale, where input from its observing systems is being used, or where there are unmet needs for observational inofrmation.

Q2: Given your interest, what would you consider/identify as the KEY uncertainties/deficiencies/problems of current models? What do you think should be evaluated/improved as a priority in models in terms of parameterization and/or interactions among processes? (Give references and/or one key figure where possible)

Areas of uncertainties for climate models are in particular:
- aerosol and cloud properties and their impact on the earth radiation budget
- convection
- atmospheric chemistry interactions
- land/atmosphere and ocean/atmosphere interactions

Q3: Do you see a particular gap (in knowledge, in observations or in practice) that would need to be filled, or a particular connection between different modeling communities or between modeling, process studies and observations that should be made a priority?

1. Water vapour measurements, particular in the upper troposphere/lower stratosphere (UTLS) region, are afflicted with high measurement uncertainties and even key mechanisms are not fully understood, leading to significant deficiency in the predictive skill of global climate models (GCMs). Existing records of upper-air measurements are not good enough for studying climate change: They greatly lack continuity, homogeneity and representativeness of data, because past observations were never made for climate research, but mainly for the purpose of short term weather forecasting (Soden et al. 2004). Therefore, we would need a way of separating the climate change signal from the inevitable non-climatic effects caused by the measurement uncertainty. Since the early 1990s, the climate research community has been calling for a ground-based reference observing system for measuring upper-air changes (Karl 1996; Karl et al. 2006; NRC 1999; Trenberth et al. 2002).

2. Validation and continuation of existing satellite observations to make them fulfil climate science requirements.

3. Quantifying modelling uncertainties and its representation of underlying physical and chemical processes.

4. Long-term continuity of climate-quality observations, in particular in the tropics and over the oceans

Q4: Do you see any particular resource or opportunity within the modeling/process study/observational/theoretical community (e.g. new results, new observations) that would be particularly useful and should be exploited to tackle this problem?

cf. 1. above: GCOS is working to help establish the GCOS Reference Upper-Air Network (GRUAN). The GRUAN should provide long-term high quality climate records of temperature, water vapour, and other key essential climate variables (In support to the work of IPCC and UNFCCC, GCOS defined a set of Essential Climate Variables: http://www.wmo.ch/pages/prog/gcos/index.php?name=EssentialClimateVariables), particularly in the troposphere and in the lower stratosphere by a combination of balloon-borne and remote-sensing state-of-the-art instrumentation, and constrain and calibrate data from more spatially-comprehensive global observing systems, including satellites and the radiosonde network. GRUAN would be a crucial element supporting the Global Space-Based Inter-Calibration System (GSICS).

cf. 2. above: A particular issue here, related to point 1. above, is the lack of provision for continuity of limb-sounding in planned satellite missions. GCOS has identified the need for this type of measurement in its updated Implementation Plan in support of the UNFCCC, which is currently subject to final revision following a period of public review.

Q5 What would best accelerate progress on the topics raised in questions 1-4? Do you have suggestions for new initiatives (new process studies, field campaigns, or new collaborative approaches, eg international Working Groups, Climate Process Teams)?

Fulfillment of the updated Implementation Plan by the nations (including their international agencies) responsible for atmospheric, oceanic and terrestrial observations.

Q6: Any other suggestions/issues to be raised?

References:

Karl, T. R., Ed., 1996: Long-Term Climate Monitoring by the Global Climate Observing System (GCOS): International Meeting of Experts, Asheville, North Carolina, U.S.A., January 9-11, 1995. Kluwer Academic Publishers, 518 pp.

Karl, T. R., Ed., S. Hassol, C. Miller, and W. Murray, Eds., 2006: Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences. U.S. Climate Change Science Program, Synthesis and Assessment Report 1.1, 164 pp.

NRC, 1999: Adequacy of Climate Observing Systems. National Academy Press, 51 pp.

Soden B.J., Turner D.D., Lesht B.M., and Miloshevich L.M. (2004): An analysis of satellite, radiosonde, and lidar observations of upper tropospheric water vapor from the Atmospheric Radiation Measurement Program. J. Geophys. Res., 109, D04105, doi:10.1029/2003JD003828.

Trenberth, K. E., T. R. Karl, and T. W. Spence, 2002: The need for a systems approach to climate observations. Bull. Amer. Meteor. Soc., 83, 1558–1559.