Breakout Session on Numerical Model Improvement Goal

Chair: Baylor Fox-Kemper

July 19, 2012

Newport Beach, California

Draft Mission and Goals (latest version)

Mission Statement

US CLIVAR addresses the understanding, modeling, and prediction of climate variability and its impacts on seasonal–to-centennial timescales, with emphasis on the role of the ocean and its interaction with other elements of the Earth system. US CLIVAR serves the climate community through the coordination and facilitation of research on outstanding climate questions.

Goals

1. Improve understanding of the processes of climate variability and change in the past, present and future.
2. **Reduce and better quantify uncertainties in the predictions of climate variability and change that derive from general circulation models.**
3. Improve practices in the development, validation, provision and uses of climate information and forecasts.
4. Strengthen connections between the US climate and other Earth science communities with an interest in climate variability (the carbon-flux and ocean-biology communities, etc.).

From Lisa's Introduction Talk

U.S. CLIVAR
Climate Variability & Predictability

Draft Mission and Goals (later version)

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1. Improve understanding of the processes of climate variability and change in the past, present and future.
2. **Reduce errors/biases and better quantify uncertainties in simulations of climate variability and change**
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GOAL 2: Reduce errors/biases and better quantify uncertainties in simulations of climate variability and change

Reducing Errors:

1. Quantify model errors in mean state, variability, and extremes

2. Improve model representation of the physical processes, both resolved and subgridscale, that determine the climate and its variations

3. Use Climate Process Teams to accelerate the use of observations and theory to improve important process representation in models

4. Identify and assess model sensitivity to important processes that are understood, but have yet to migrate into modeling practice (e.g., surface waves, tides, etc.)

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Reducing Errors:

5. Improve computational capability and numerical efficiency, so that higher resolution and more simulations are possible

6. Enhance pathways for understanding model biases and and addressing them with model development

7. Use physically and statistically sound validation against data and higher resolution models to detect and correct errors in processes and reduce the number and range of tunable parameters

8. Assess model components independently to strengthen the whole, but also validate the whole coupled system directly

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GOAL 2: Reduce errors/biases and better quantify uncertainties in simulations of climate variability and change

Quantify Uncertainties:

9. Forge and adapt tools to use multiple models and ensembles to assess predictability, skill, sensitivity, and uncertainty in mean state, variability, and extremes

10. Collect, identify, share, and develop relevant datasets, state estimates, reanalyses, and reconstructions for validation of model parameters, mean, variability, and extremes

11. Suggest robust metrics and products from models, for informing the public and validation against data

12. Develop a dynamic envelope of metrics of data quality, predictability, and uncertainty spanning seasonal to centennial and regional to global scales

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Simulation Sub-Goals:

13 Study in models and data the multiplicity of large-scale climate modes, such as ENSO, the annular modes, PNA, and stratospheric warmings, to better quantify their impacts, their simulation fidelity, their sensitivity to one another and to climate change, and their implications for predictability and uncertainty

14 Simulate synthetic observations to anticipate difficulties and optimize process studies and data collection arrays

15 Encourage a diversity of models, to understand why they differ and gain confidence when they agree.

m. Understand how different models--varying in initialization, forcing, boundary conditions, resolution, stochastic vs. deterministic, and subgridscale treatments--may be better suited to address different problems. E.g., deterministic climate and earth system models for climate projections, stochastic models for uncertainty quantification, high-resolution and large eddy simulations for processes and validation, and a variety of models for seasonal to decadal predictions, reanalyses, hindcasts and reconstructions, and state estimation.

n. Improve models to allow seamless prediction across scales, both as general tools and to deepen understanding and improve subgridscale treatments

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