

Friday Morning

BOG 4 Long-Term Perspective

Long term perspective

BOG 2 OBS

- Need DIPS – data intercomparison projects
- **Need MIPs4Obs**
 - **perfect model experiments using measurement proxies**
 - test different obs data products within models to better understand consistency, to establish expected mis-match between models and obs
 - Self-consistency check of benchmark datasets used for model evaluation
- Need new obs for unconstrained processes and features that models show sensitivity to
 - (e.g., biomass/carbon cycle, snow on sea ice, topography under ice sheets, potentially currently unobservable)

Long-term Perspective

BOG 3 EvalTools

- Increase transparency to accelerate scientific understanding of climate
- We need to stay ahead of an accelerating global change with global flat funding and these tools will help
- Improve the accessibility and uptake of the CMIP model evaluation tools within model development teams
- Lower the barriers to access and broaden the community using the the CMIP evaluation tools and model (e.g. observational and impact communities, policy makers, public)
- Latch onto technological advances that make model diagnosis more efficient
- **Systematically grow the standard for model evaluation to further accelerate advance of earth system understanding**

Systematic Biases: Future and Vision

BOG 5 Systematic Biases

- Evaluating impact of higher resolution on systematic biases (opportunities and costs)
- More systematic availability of observations (and multiple observational datasets) for ESM evaluation and improvement
- Observing system design based on systematic bias in projection uncertainty
- **More Climate Process Teams (modelers + observationalists) (need to understand)**
- Carbon reanalysis based on earth system model assimilation of observations
- **Improve decadal prediction by reducing systematic bias**
- Learning to live with systematic bias
- **Extracting useful information from imperfect models (operationalizing climate projections)**
- Broaden interaction with a diversity of impacts and observational communities

Long term perspective?

BOG 6 Emergent Constraints

- **Problem: How do we combine (synthesize) independent ECs of different vars?**
- Need: Better tools to make extracting and analyzing data from the CMIP archive (for example) easier?
- Need: Better incorporation of uncertainty bounds on model values (due to e.g. internal variability) and observations
- **Problem: How do we ensure our learning about ECs makes its way into model development?**

Long-term perspective?

BOG 8 Weighting

- **Moving beyond model democracy will become unavoidable**
- **Connecting model weighting to ECs and D and A.**
- Identifying the role of structural vs internal variability across MMEs
- Moving beyond mean state weighting, incorporating temporal/spatial variability into weighting schemes
- The development of a statistical methodology/ strategy to account for multiple chains of influence, orthogonal uncertainties
- **Better documentation that tracks model interdependence**
- **Defining what it means for models to be interdependent, moving beyond error covariance and model lineage (tension between model independence and model improvement)**
- Assessing model interdependence by examining simpler idealised problems, toy models, idealised experiments etc

Long-Term Perspective

BOG 9 Impacts

- Merge offline models with ESM projections to create better/more specific drought indices
- Better understanding of monsoons
- Better observations and resolve differences across products
- Hard to measure and poorly derived critical observations (e.g., evapotranspiration, humidity, soil moisture)
- Finer resolution of air quality and aerosol information, especially within urban areas
- Reanalysis of land models with better agriculture representation (better biogeochemistry land use in data assimilation systems)
- Hourly data for timeslices over certain time periods (conditional high frequency output)
- Full integration of economics, crop, and ESMs: from carbon to human outcomes
- **Evaluation of impacts relevant metrics (incl. regional) to facilitate applications and inform model development**

Historical View of Model Evaluation, and the Role of Models in Understanding the Climate System – BOG1

Long-term perspective

- Shift from documenting model errors to understanding the model behavior and fit-for-purpose
- Need for more and better observations, especially relating to land and ocean biogeochemical cycling.
- Better documentation of model development and tuning practices, but no obvious solutions
- **More strategic balancing of computational resources, given needs to characterize natural variability, increase resolution, increase complexity, and characterize parametric and structural uncertainty.**
 - Improved evaluation of low-probability, high impact events, e.g. tipping points and extreme events, especially joint probabilities of extremes.
- Better use of paleoclimate data to evaluate models.

Process oriented metrics - BOG4

- **Progress on process representation, and process oriented metrics (see BOG4 for specific examples)**