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 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)