Predictability Breakout Group

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a) What is hindering progress on predictability

- Next hour
  - Lack of 3D observations defining event and environment
  - Poor model physics
  - Limitations on data/assimilation
    - Corrections too large
    - Model transients too extreme on start up
- Next day
  - Model limitations (physics)
  - Data voids (e.g., west coast)
  - Inadequate ensemble spread and reliability

a) What is hindering progress on predictability

- Multiday
  - Model physics (surface processes)
  - Errors from other regions (tropics/arctic)
  - Lack of consistent physics between regional and global scales

b) Key sources of uncertainty? How to reduced?

- Need to eliminate bias (physics)
  - Identify bias using cycling data assimilation systems
  - Emphasize observable quantities in parameterization schemes
  - Collect forecaster input to capture conditional biases

c) Additional tools, models, observations, to address these challenges.

- Cycled data assimilation
- Ensemble sensitivity analysis (for IC errors)
- Addressing big biases in models via
  - Laboratory Cloud chambers for microphysics
  - Field projects targeting improved parameterizations (rather than more traditional process studies)

d) Limits to production of better quantitative forecasts.

- Better moisture observations
- Lack of history/climatology of extreme events
  - Do more reforecasting (CAM models)
- Accounting for conditional predictability
- Predicting predictability
- Inherent predictability
  - May be different for microphysics than dynamics

e) Improving representation of limiting processes

- Verifications are inadequate
  - For most forecast variables
  - For extreme events
- Make model physics processes verifiable
  - Regional variability of dominant processes
- Emphasize community-suite efforts for the improvement of physical parameterizations

f) Best way of illustrating uncertainties in forecasts.

- Cluster analysis
  - Weather
  - Hazards
- Provide skill scores relative to climatological skill thresholds
- Deterministic like representation of probabilistic concepts

f) Assessing IC errors propagating through forecasts.

- Ensemble/adjoint sensitivity analysis for IC errors
- Perfect model experiments (avoid specific biases)
  - OSSEs
- Run small IC ensembles for any physics tests

g) What data can be assimilated to reduce uncertainty?

- Emphasize improving fields at 50-200 km scales with available datasets
- Assimilate underlying data, not products
- Quantify uncertainty in the obs
  - Measurement and sampling errors
  - Representation and conversion errors
  - Time/space dependence

(Defer to other groups)