CMIP5 Review – Decadal Climate

• What were the science questions and what was done?
• What did we learn (scientifically and in terms of practical lessons)?
• What science gaps and systematic model errors remain and what science questions should be
• For CMIP6, what should be done differently?
Science Questions, What was done? What Did we Learn? Science Gaps?

- Decadal Predictability Limits
- Decadal Prediction
  - Retrospective Prediction Quality
  - Support Real-Time Prediction?
- Near Term Projection
  - Up to Mid-Century, but emphasize 2015-2035 Period
  - Supported by Near Term Predictions
    - Warming Hiatus
Predictability/prediction questions

- System “predictability” and “skill” as a function of forecast range
  - Does difference between $r$ and $\rho$ offer guidance and hope for improvement
- Importance of initialization vs external forcing (but with no cheating)

Annual means of surface air temperature
CMIP5 Raw SAT Retrospective Prediction
T2m Correlation: Initialized vs. Uninitialized

Initialized

Initialized - Uninitialized
Initialized Predictions vs. Projection 2012-2016
What Did We Learn? Science Gaps?

• Initialization Provides an Addition Source of Skill over some regions
  – Skill Assessment Challenging
• Provides Additional Information over the Forced Component Alone
  – Particularly useful for the “warming hiatus”
• Prediction Protocol Problematic
  – 5-year vs. Every Year Initialization
  – Not Accurate Assessment of Skill – Volcanoes
• Systematic Errors
  – Large
  – Removing Systematic Error Not Simple
  – Surprising regions where initialization reduces skill
Summary: CMIP6 decadal prediction component

• Main component is the production of decadal prediction hindcast data
  – Extension and improvement of CMIP5 protocol
  – Actual forecast approach, i.e. no information from the future
  – Data protocol aligned with rest of CMIP with proposed addition of basic, quick access data set

• Special purpose experiments under consideration but not (yet) formulated
  – Sources and Mechanisms of Skill
  – Idealized Predictability …