MODELING NOTES from presentations and discussion

1. How well can models simulate LSMPs and the associated T/P extremes?

- The consensus is that CMIP5 models are better than expected in simulating LSMPs (better than CMIP3).
- Models under produce blocking events; a common issue is that some models appear to have lower persistence than the observed features.
- The model discrepancies in simulating cold extremes are generally larger than those for warm extremes (Kharin et al. 2013).
- Warm extremes are reasonably well simulated compared to reanalyses (Kharin et al. 2013).
- Storm track results for the Northern Hemisphere are mixed in AR5 due to microphysics, radiation, SSTs.
- Moderate resolution GCMs appear to do about the same as finer resolution models (e.g., in NARCCAP). However, finer resolution models do a little better with extremes, but depend on the parameterizations, physics, ..
- Numerical models produce heavy tails for precipitation, but not as heavy as observations.
- Uncertainty in extreme precipitation in the tropics and subtropics remains very large, both in the models and reanalysis (Kharin et al. 2013).

2. What are the uncertainties in simulating/predicting the LSMPs and extreme T/P?

- Models capture the broad features of the LSMPs, but there are substantial intermodal differences.
- LSMPs and extreme T/P are better captured in winter than in summer.
- An important issue is to look at key ingredients that explain LSMPs or extreme T/P; sometimes a key ingredient is necessary but not sufficient to produce an extreme; in other cases it may be necessary to look at the temporal evolution of an event.
- Future extreme precipitation may not respond to current convective parameterization schemes (model physics)
- Downscaling challenge – What kind of convection-related errors may appear with increasing fine resolution? other issues to consider: coupling with the larger scale.
-

3. **What insights can models provide to better understand the relationships between LSMP and extreme T/P?** Assessment of model simulation of extremes in the LSMP context (such as: LSMPs in models versus analyses, developing LSMP-based metrics, assessment of model dynamics in LSMP formation.)

NEEDS:

- - Someone suggested to create a database of model runs with higher resolution and/or not as complex as the CMIP5 models
- - There is a need to have algorithms to follow the evolution of some LSMPs

Modeling Breakout Session

The Context

- Due to their resolution models are better at generating large scale circulation patterns than temperature and precipitation extremes
- If one can establish relationships between extremes and LSMPs then
  - Such relationships can be used for extended-range predictions
  - Assessing projections in extremes and building credibility in such assessments

Model Simulations

- Advantages
  - Much larger data sets to work with
  - Ability to do controlled experimentation
  - Encouraging to see ability of current generation of models to simulate LSMPs
- Disadvantages
  - Biases
  - Building confidence across different set of informations

Outstanding Questions

- How stationary is relationships between extremes and LSMPs in a changing climate?
- CMIP6 data needs
  - Pseudo radar refelectivities as a model out (similar to ISSCP cloud simulator)
  - Standard outputs for LSMP indices
  - Higher time resolution
- How the LSMPs precursor evolve with time? → establishing the predictive value
- Developing a standard set of metrics for LSMP evaluation in models?
  - Quantifying when good is good enough?

Outstanding Questions

- Best approaches for techniques for identification of LSMPs in model simulations
- Need to look past hydrostatic model simulations
- Connecting biases in extremes-LSMPs connection in observations and model simulations
- How is variability changing under a changing climate? Change in the base or frequency of LSMPs also changing?
- Identification of case studies for model validations?