B2: Advancing Model Development

Parameterizations
- How do parameterized processes interact with each other and with dynamics?
- How to inspire creative ideas (for model developments)?
- Convective aggregation: need high-res models, or still parameterized?
- Need inviting more model developers to GC
- Scale interaction is a limitation for model development
- Do we really keep developing climate models?
- Can we use emergent constrains for efficient development?

Model systematic errors:
- Two strategies between forecast and climate change projection?
- Processes improved in NWP during the last 30-40 yrs, but we do not know what causes errors in climate models; how do we understand model systematic errors? Can we prioritize systematic errors?
- Model hierarchy for understanding & model assessment
- Try to use information about model diversity to emergent constraints
- Possible to coordinate model diagnostics (w/ CMIP5)?
- Emergent constraint relevant to errors in weather phenomena?
- Nudging approach as a good diagnostic framework

How to prioritize and facilitate model development

- Use emergent constraints as a way

- Use model hierarchy

- Understand interactions of model physics & dynamics

- Propose coordinated model diagnostics

What we learned from the issues raised from the group *A* discussion:

- *What will storm tracks change in a future climate?*

- *What controls the position and strength of the ITCZ?*

- *Is convective aggregation important for climate?*

- *What is the role of cloud-radiative effects and convective mixing for emergent properties of the climate system?*

Q. How do we link them to model development and experiments?

What we learned from the session talks:

1. Parameterizations for deep/shallow convections are the key (stochasticity, mid-level convection, aggregation) (*Christian/Bjorn/Tony/Martin*)

2. Parameterizations for non-convective clouds (condensation, microphysics) (*Thorsten/Hideaki/Jean-Louis*)

3. Resolution issue (high-res GCMs, XL LES) (*Pier/Peter/Masaki*)

4. Systematic error assessments (hindcast/analysis, AMIP-like run, multi-resolution) (*Hervé/Masahiro/Cathy/Peter*)

5. Emergent constrains (*Mark/Steve/Stephen*)

Candidate questions to articulate (initial homework):

G. Once we decide on *the questions*, how do we link to observations, model development, experimental (e.g., CMIP6), and (educational) activities? **(B1, B2 and B3)**