

B2: Advancing Model Development

How to prioritize and facilitate model development

- Use emergent constraints as a way

Definition of emergent constraints:

Possibly observable current/past climate quantities translated to future climate projection

- Use model hierarchy
- Understand interactions of model physics & dynamics
- Propose coordinated model diagnostics

Storm track change

- Are there already emergent constraints for storm tracks?

Current position vs magnitude/position of future storm tracks

Possibility of using proxy

- Use model hierarchy

Aquaplanet (slab, too)

high-res lifecycle experiment

high-res AGCM/CGCM

relaxation experiments

Test cases, eg, 2010 summer/2014 winter, southern ocean summer clouds

- Propose coordinated model diagnostics

6hrly outputs, dynamic diagnostics (PV on theta), tendencies,

Further analysis to CMIP5 outputs, simulating proxy data

ITCZ intensity and location

- Are there already emergent constraints for ITCZ?
Need to distinguish oceanic ITCZ and Asian/African monsoons
Possible palaeo constraint?
- Use model hierarchy
RCE, **Aquaplanet**, Idealized palaeo experiments, sensitivity experiments (sfc albedo, imposing high-lat heat flux, COOKIE, SPOOKIE), **relaxation experiments (for systematic errors), high-res AGCM/CGCM**
- Understand interactions of model physics & dynamics
Diurnal cycle, WTG, cold tongue bias
- Propose coordinated model diagnostics
Tendency diagnostics, tropical weather diagnoses, link between ITCZ and SST biases, TRMM new simulator

Convective aggregation

- Use model hierarchy

RCE using LES/CRM/GCM(w/ varying resolution)

RCE with rotation

RCE-SCM-**APE**-AMIP using the same AGCM

Smaller Earth

SST sensitivity experiment

- Propose coordinated model diagnostics

High-frequency outputs, diagnostics of aggregation using obs/CRM,
ISCCP daily simulator outputs, **tendency diagnostics**

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 constraints 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

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?