

Break-out group discussion IMPACTS

What role do WCBs play in weather extremes, regime transitions, and global climate?

Participants:

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Interaction of WCB with large-scale flow

- When does a WCB amplify a flow or not?
 - Role of background flow (upper-levels) vs. inflow moisture
 - case study evidence of strong jet stream hindering flow amplification, weak jet prone to amplification
 - Open question: how important is the inflow moisture vs. initial jet strength?
 - -> ongoing PhD work Christopher Rausch and Katharina Heitmann ETH Zurich

Role of inflow moisture

- for extreme precipitation cases, a single WCB with high inflow moisture can amplify flow
- inflow moisture critical for precipitation amount and outflow intensity.
- WCB most sensitive on inflow moisture
 - -> better constrain analysis, more observations in subtropics and in AR and WCB inflow regions.
 - AR Recon goes in this direction and can help making better use of satellite observations.

Importance for extended-range predictability (1)

- We already see biases for WCBs at day 5 in NPAC and NATL. Are these related to MJO or other phenomena/local dynamical processes?
 - Work is currently underway to systematically assess forecast error with WCBs.
 - Error could be related to sensitivities to local environment (dynamics) or misrepresentation of WCB activity during background states (MJO)
 - We first need the systematic understanding (currently done at KIT).
- Is the WCB a pure communicator/amplifier of error -> predictability barrier ? Or does the WCB cause fcst error -> then we could go beyond the current skill barrier, by improving the models?
 - WCB can be seen as a process-oriented diagnostic, which integrates processes involved in error growth.
 - It represents a chain of processes which projects signals to the large-scale extratropical Rossby wave pattern.
 - Both initial condition error and error in representation of latent heat release in the WCB can amplify.
 - So WCB rather provides integrated view on model fields and forecast error. Improving WCB forecasts can bring actual forecast skill closer to the intrinsic limit of predictability. -> WCB is amplifier/communicator
 - We should also focus on other sources of error that might affect WCB activity : large-scale circulation, gravity waves, inflow moisture, baroclinicity

Importance for extended-range predictability (2)

- How is WCB activity during more predictable modes?
 - Preliminary work at KIT shows strong modulation of WCB activity with MJO phases. This WCB activity links MJO signals to extratropics.
 - Systematic studies needed if WCBs involved in diluting signal from predictable modes. (Julian at KIT working on it)

WCB and trends in context climate change

- We see trends in IVT in West Atlantic which are relevant for WCB activity and more ridging (Work Federico LMU)
- Investigations of WCBs in future climates may help to learn about dynamics and sensitivities of WCB activity in current climate (work Federico LMU, Katharina ETH)
- Key variables interaction of background flow and inflow moisture in future climates?

WCBs in other world regions

- understanding of relevance of WCB in southern hemisphere is missing
- also lack of knowledge in the group about biases in large-scale flow representation in SHEM

WCB and extremes

- EFI IVT forecast product very valuable forecast products for assessing probability of heavy precipitation
- enhanced IVT in western NATL important for ridging and downstream extreme precipitation (Federico)
- Differences in relevance of IVT / AR for extreme precipitation North America vs. Europe
 - lifting mechanism required
 - Which role does WCB play in this lifting?
 - Relevance of orientation of IWV flux to local topography (Helen Griffith, Reading)
 - Do consecutive AR events matter for impact?