Exploring discrepancies in observed vs. modeled mid-latitude precipitation trends

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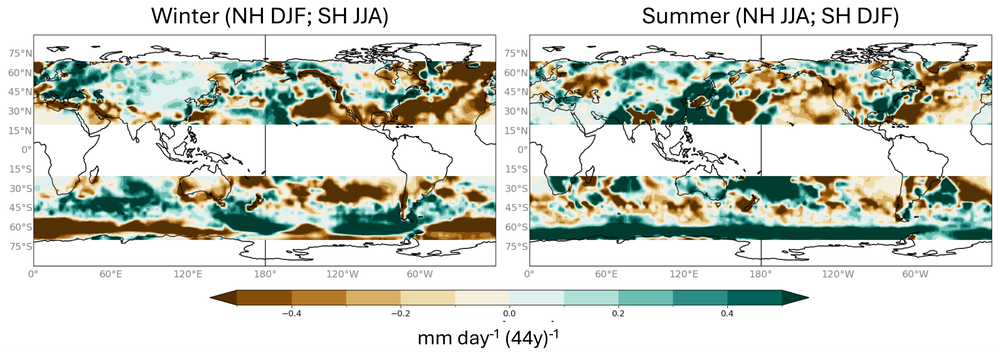
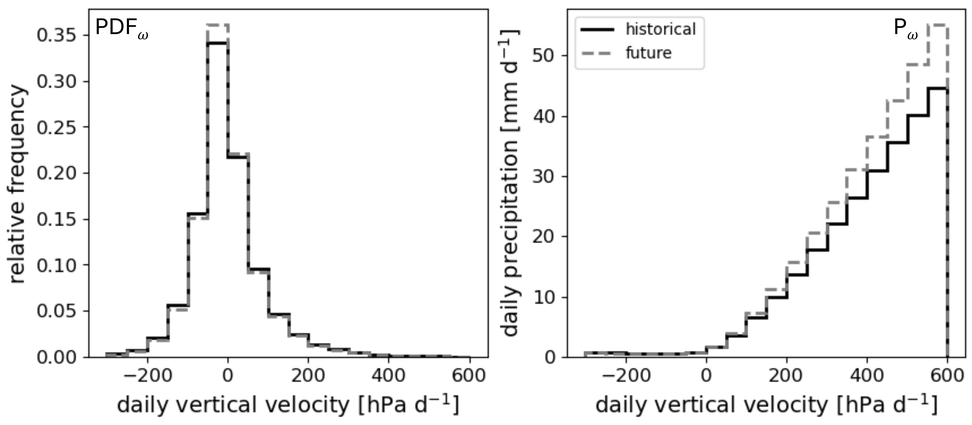
Background

What drives observed precipitation trends? Do any of the forced precipitation responses look like the observed trends from 1980-2023? Should the forced precipitation response look like the observed trend? To understand drivers of precipitation trends and change, we decompose precipitation change into its thermodynamic vs. dynamic contributions.



Methods

- Daily 500 hPa vertical velocity (ω) is used as a proxy for the strength of a 'dynamic disturbance' (Emori & Brown, 2005)
- Obtain the PDF of ω (PDF$_\omega$) for a historical (1981-2000) and future (2081-2100) period
- Composite daily precipitation for each ω bin for both periods (P$_\omega$)
- The change in PDF$_\omega$ represents the 'dynamic' change
- The change in P$_\omega$ represents the 'thermodynamic' change
- Results are shown for 50 members of CESM2-LENS (CMIP6 configuration)



References

Emori, S., and S. J. Brown (2005), Dynamic and thermodynamic changes in mean and extreme precipitation under changed climate, *Geophys. Res. Lett.*, 32, L17706, doi: 10.1029/2005GL023272.

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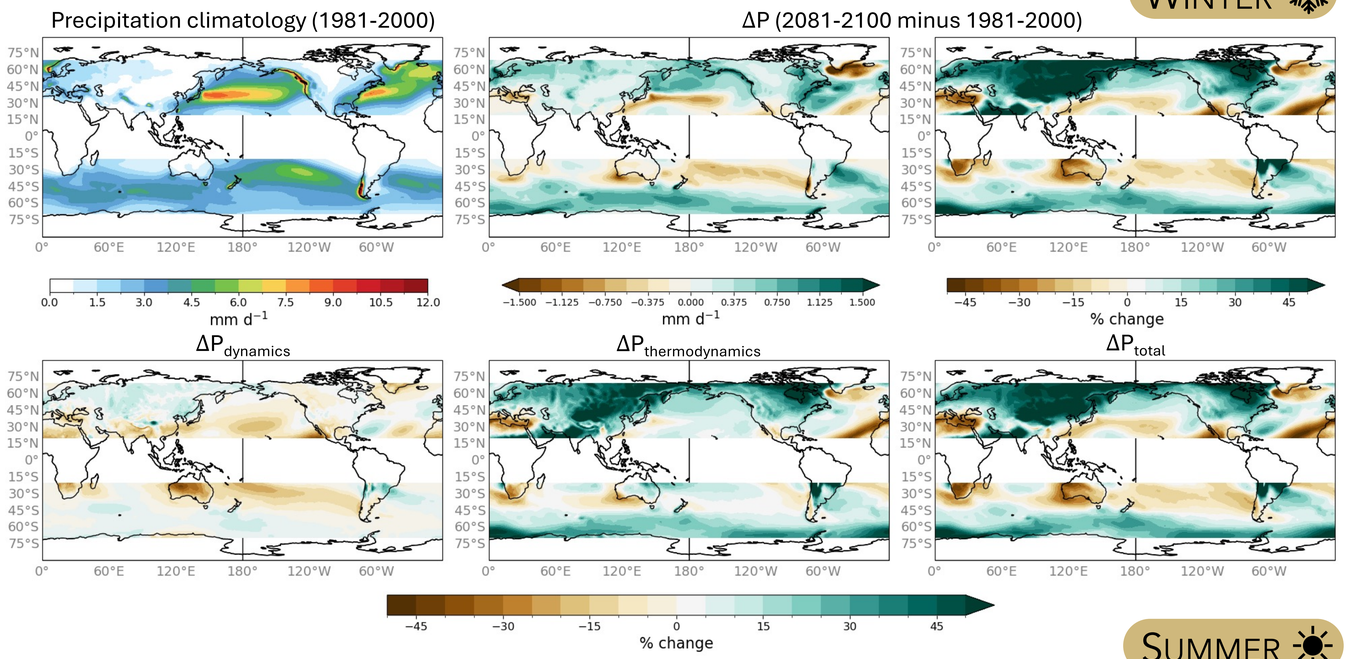
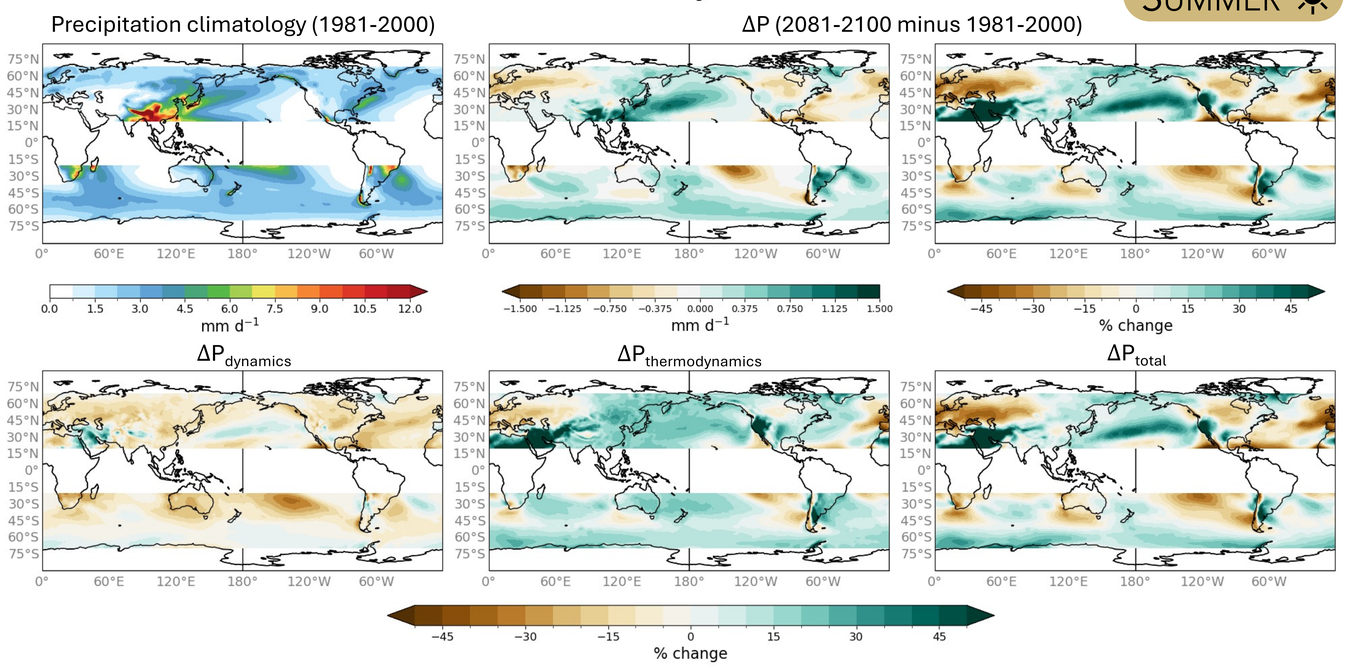
Initial Results

Winter



Summer



Next Steps

1. What is causing these patterns?
2. What can we learn from the ensemble spread in the precipitation decomposition?
3. Apply this methodology to different idealized experiments (e.g., wind-nudged experiments)