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What drives variability of the Australian summer monsoon?

Hanna Heidemann^{1,2,3}, Josephine Brown^{1,2}, and Sugata Narsey⁴

¹University of Melbourne, School of Geography, Earth and Atmospheric Sciences, Parkville, Australia

²ARC Centre of Excellence for Climate Extremes, Monash University, Clayton, Australia

³Centre for Applied Climate Sciences, University of Southern Queensland, Toowoomba, Australia

⁴Bureau of Meteorology, Melbourne, Australia

The variability of northern Australian rainfall is related to local processes and remote teleconnections, which operate on subseasonal to interdecadal timescales. This includes the Madden-Julian Oscillation, Indian Ocean Dipole, El Niño-Southern Oscillation (ENSO) and Interdecadal Pacific Oscillation. The influence of these climate drivers and local sea surface temperatures (SSTs) on northern Australian rainfall evolves during the wet season, from austral spring through to autumn. Our study shows that ENSO as well as SSTs in the Timor Sea, Arafura Seas and Coral Sea are the key sources of rainfall variability in the pre-monsoonal months September to November. SST indices explained up to 50% of variance in observed northern Australian rainfall in October and November between 1940 and 2023. However, the teleconnection between northern Australian rainfall and ENSO, and also the influence of local SSTs, breaks down with the onset of the Australian summer monsoon in late December. This leads to 0% explained variance in northwestern Australian rainfall and 9% explained variance in northeastern Australian rainfall in January using SST indices only. This presentation will discuss which processes and feedbacks might instead drive rainfall variability over northern Australia during the monsoon season and how they differ from pre- and post-monsoonal conditions.