



## Timescale propagation of geopotential height wavetrain-like patterns over the South Pacific during austral summer

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South America, the largest land mass south of the equator, exhibits a great variety of weather and climate patterns that arise from its meridional extension and orography. In particular, Southern South America (SSA) is exposed to mid-latitude perturbations associated with the storm track. However, tropical and subtropical forcing (including internal variability) can also have a significant climatic impact there. During austral summer (DJF), notable surface air temperature (SAT) departures from the climatology are observed over SSA. Although related teleconnections have been studied focusing on different seasons and timescales, relatively less work has dealt with the spread throughout a broad frequency range of corresponding summertime geopotential height and sea level pressure (SLP) perturbations.

In our work, we use historic DJF SAT measurements taken at various meteorological stations (accessed from the Global Historical Climatology Network) located next to the Atlantic coast, between approximately 36°S and 55°S, to identify SAT anomalies in SSA. We find that they are related to stationary geopotential height wavetrain-like structures over the South Pacific, resembling the Pacific-South American mode, which are partly originated by tropical forcing. Moreover, these perturbations also induce a teleconnection between Oceania and SSA.

We analyze how these seasonal patterns arise from persistent synoptic-scale phenomena which propagate their imprints into intraseasonal and even longer timescales. For this, we apply an objective cyclone identification and tracking scheme to the 6-hourly global SLP data of the Twentieth Century Reanalysis (20CR) ensemble, i.e. to each of the 56 ensemble members. This allows us to give an uncertainty estimation of our findings, which is particularly important when assimilated observations are sparse. For selected DJF seasons within the 20th century, we then associate 20CR cyclone fields and pathways over the South Pacific with significant observed SAT anomalies in SSA. Furthermore, in order to better interpret the factors modulating this teleconnection between the tropics and SSA, years corresponding to major volcanic eruptions and opposite SAM and ENSO phases are investigated separately.