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Seasonality of the teleconnection between ENSO and rainfall over subtropical South America: the leading Pacific South American mode

Laura Zamboni (1,2,3), Fred Kucharski (2), and Carlos Roberto Mechoso (3)

(1) Centro Euro-Mediterraneo per i Cambiamenti Climatici, Bologna, Italy (laura.zamboni@cmcc.it, +390513782655), (2) The Abdus Salam, International Centre for Theoretical Physics, Trieste, Italy, (3) Dept. of Atmos. and Ocean. Scie., University of California Los Angeles, Los Angeles, CA, USA

The relationships between El Niño Southern Oscillation (ENSO) and leading Pacific-South American (PSA1), and ENSO and rainfall over South Eastern South America (SESA), reported in the literature, suggest that the PSA1 mode represents the physical teleconnection between ENSO and rainfall over SESA. In testing this hypothesis we identified relevant differences among different seasons.

We present the existence of a pervasive mode of upper level atmospheric variability which dominates the circulation over South America in all seasons. The mode consists of a continental scale vortex centered over the Atlantic coast of subtropical South America; it resembles the eastern end of the PSA1 but it cannot be trivially identified with it. We found that rainfall anomalies in SESA are physically related to the vortex, which affects the transport and convergence of moisture coming from the Atlantic and the South American Low Level Jet over SESA during the austral spring, summer and fall.

Interestingly, the relationship among the vortex and rainfall is present even in seasons in which ENSO is not at its peak, suggesting that the dynamical chain ENSO->PSA1->vortex->rainfall might depend on the season.

We found that in spring and fall the whole chain of elements can observed: the vortex, and thus precipitation in SESA, is forced by ENSO via excitement of the leading PSA mode (3rd mode of upper level variability over the Southern Pacific sector). However, the leading mode of the same field is unrelated to SSTs but related to the vortex, suggesting that the latter can be an internal mode of variability as well as a mode forced by ENSO during these seasons.

In summer the vortex is uncoupled from the circulation over the Southern Pacific, supporting the interpretation that South American regional effects dominate during the monsoon season. Further, no connection of the vortex with SSTs is found for this season.

In view of our results, we underline that the leading Pacific-South American pattern properly comprehends centers of anomalies over the Southern Pacific Ocean only but not those over the South American sector.