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ANALYSIS OF OCEANS' INFLUENCE ON SPRING TIME RAINFALL VARIABILITY OVER SOUTHEASTERN SOUTH AMERICA DURING THE 20th CENTURY

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Southeastern South America (SESA) rainfall presents large variability from interannual to multidecadal times scales and is influenced by the tropical Pacific, Atlantic and Indian oceans. At the same time, these tropical oceans interact with each other inducing sea surface temperature anomalies in remote basins through atmospheric and oceanic teleconnections.
In this study we employ a tool from complex networks to analyze the collective influence of the three tropical oceans on austral spring rainfall variability over SESA during the 20th century. To do so we construct a climate network considering as nodes the observed Niño3.4, Tropical North Atlantic (TNA), and Indian Ocean Dipole (IOD) indices, together with an observed or simulated precipitation (PCP) index over SESA. The mean network distance is considered as a measure of synchronization among all these phenomena during the 20th century.
The approach allowed to uncover large interannual and interdecadal variability in the interaction among nodes. In particular, there are two main synchronization periods characterized by different interactions among the oceanic and precipitation nodes. Whereas in the '30s El Niño and the TNA were the main tropical oceanic phenomena that influenced SESA precipitation variability, during the '70s they were El Niño and the IOD.
Simulations with an Atmospheric General Circulation Model reproduced the overall behavior of the collective influence of the tropical oceans on rainfall over SESA, and allowed to study the circulation anomalies that characterized the synchronization periods. In agreement with previous studies, the influence of El Niño on SESA precipitation variability might be understood through an increase of the northerly transport of moisture in lower levels and advection of cyclonic vorticity in upper levels. On the other hand, the interaction between the IOD and PCP can be interpreted in two possible ways. One possibility is that both nodes (IOD and PCP) are forced by El Niño. Another possibility is that the Indian Ocean warming influences rainfall over Southeastern South America through the eastward propagation of Rossby waves as suggested previously. Finally, the influence of TNA on SESA precipitation persists even when El Niño signal is removed, suggesting that SST anomalies in the tropical north Atlantic can directly influence SESA precipitation and further studies are needed to elucidate this connection.

KEY WORDS: climate networks, synchronization events, climate variability, tropical ocean teleconnections, tropic-extratropic teleconnections, precipitation over SESA.