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EDITED AND REVIEWED BY
Yuqing Wang,
University of Hawaii at Manoa, United States

*CORRESPONDENCE
Maria Elisa Siqueira Silva,
elisasiq@usp.br
Andréa S. Taschetto,
a.taschetto@unsw.edu.au

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Editorial: Pacific multi-decadal variability and Enso impact on South American climate

Maria Elisa Siqueira Silva[1]*, Andréa S. Taschetto[2]* and Everaldo Barreiros De Souza[3]

[1]Department of Geography, University of São Paulo, São Paulo, Brazil, [2]Climate Change Research Centre and ARC Centre of Excellence for Climate Extremes, University of New South Wales, Sydney, NSW, Australia, [3]Institute of Geosciences, Federal University of Pará, Belém, Pará, Brazil

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Editorial on the Research Topic
Pacific multi-decadal variability and Enso impact on the South American climate

The tropical Pacific and Atlantic oceans are known to modulate year-to-year rainfall variability over South America, causing extreme climatic conditions such as floods and multi-year droughts. In this volume, we welcomed studies considering the South American climatic impacts associated with Pacific and Atlantic variability. The studies in this special collection highlight climatic impacts varying from continental to local scales and multi-decadal to sub-daily time ranges. Local scale impact is analysed in the case of an extreme precipitation event (244.5 mm in 24 h) recorded in the Emeraldas River basin, northwestern coast of Ecuador, on 24-25 January 2016 (Pineda et al.). The high precipitation amount was caused by a mesoscale convective complex embedded in climatic conditions associated with the strong 2015-2016 El Niño phenomenon. Eastward flow of moist air over land from an early-arriving February-April weather state along with orographic uplift, anomalous northward displacement of the Inter-Tropical Convergence Zone, and a low-middle level moisture influx from the Amazon basin associated with changes in the Walker circulation are some of the physical explanations presented by the authors for the strong mesoscale convective complex development.

Strong El Niño, such as the 2015-2016 event, is only one of the diverse types of El Niño that affect South America. It is now recognised that distinct types of El Niño influence regional climate in different ways. While Eastern Pacific El Niño is associated with stronger and well-defined positive precipitation anomaly in southeastern South America, Central Pacific El Niño shows weaker and even an opposite signal over the region, and Mixed El Niño events present a spatial pattern of precipitation anomalies similar to eastern events but with lower intensity (Goudard et al.). The intensification of South American low-level jet, the subtropical jet and better structured extratropical atmospheric Rossby waves from South Pacific to South America are commonly observed in eastern and Mixed El Niño events, though, being weaker in the latter ones. On the other hand, Central Pacific El Niño events present weakening and spatial displacement of the circulation conditions leading to negative precipitation anomalies in most seasons over southeastern South America.

The interannual impacts of the El Niño-Southern Oscillation on South America are modulated by interdecadal climate variability in the Pacific and Atlantic oceans. Interdecadal variations of sea surface temperature over the central-west equatorial Pacific have a stronger influence on rainfall over central Andes compared to those from the Atlantic Multidecadal Oscillation (Sulca et al.). The warm phase of the Interdecadal Pacific Oscillation is associated with increased December-to-February precipitation toward the Bolivian Altiplano, provided by enhanced moisture transport from the lowlands, and dry conditions over the southern Peruvian Andes.

Not only do those atmospheric teleconnections vary on inter-decadal timescales, but they may also be influenced by regime shifts, for example the one identified in the North Pacific sea surface temperature by Xiao and Ren. Associated with this regime shift, annual surface air temperature showed increased values over the high-latitude continental areas after 2014 and declined values over Canada and southeastern Greenland. At the same time, annual precipitation increased in the Northern Hemisphere and decreased in the Southern Hemisphere continental monsoon regions, including South America.

The studies presented in this volume offer valuable insights into the diverse scale variations of South American climate that are influenced by the Pacific and Atlantic oceans. However, some important aspects remain unclear and may be explored in further research. These include the impacts related to variability of the Indian Ocean and other climate drivers such as the Southern Annular Mode, as well as changes in future teleconnections and associated impacts occurring under increased greenhouse warming, along with corresponding uncertainties. We hope you enjoy the content published in this volume.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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