TYPE Editorial
PUBLISHED 24 January 2023
DOI 10.3389/fclim.2023.1138642

OPEN ACCESS

EDITED AND REVIEWED BY
Matthew Collins,
University of Exeter, United Kingdom

*CORRESPONDENCE
Carlos R. Mechoso
✉ mechoso@atmos.ucla.edu

SPECIALTY SECTION
This article was submitted to Predictions and Projections, a section of the journal Frontiers in Climate

RECEIVED 05 January 2023
ACCEPTED 09 January 2023
PUBLISHED 24 January 2023

CITATION
Mechoso CR, Wang C, Lübbecke J, Rodríguez-Fonseca B and Diakhate M (2023) Editorial: Interactions among climates of ocean basins. *Front. Clim.* 5:1138642. doi: 10.3389/fclim.2023.1138642

Editorial: Interactions among climates of ocean basins

Carlos R. Mechoso[1]*, Chunzai Wang[2], Joke Lübbecke[3], Belén Rodríguez-Fonseca[4] and Moussa Diakhate[5]

[1]Department of Atmospheric and Oceanic Sciences, College of Physical Sciences, University of California, Los Angeles, Los Angeles, CA, United States, [2]State Key Laboratory of Tropical Oceanography, South China Sea Institute of Oceanology, Chinese Academy of Sciences (CAS), Guangzhou, China, [3]GEOMAR Helmholtz Center for Ocean Research Kiel, Helmholtz Association of German Research Centres (HZ), Kiel, Germany, [4]Facultad de Ciencias Físicas, Universidad Complutense de Madrid, Madrid, Spain, [5]Université Amadou Mahtar MBOW, Dakar, Senegal

KEYWORDS

climate, interactions, teleconnections, ENSO, Indian Ocean Dipole

Editorial on the Research Topic
Interactions among climates of ocean basins

The study of *Interactions among climates of ocean basins* is a research frontier that has motivated the present article collection. Seven papers in the collection provide a sample of current work on the subject. This work addresses science questions raised using a variety of empirical, analytic, and modeling tools. The Climate Variability Component (CLIVAR) of the World Climate Research Programme (WCRP) has established a Research Focus to encourage scientific work on tropical basin interactions (TBI), including how these contribute to predictability and are affected by climate change. More papers about the subject of the present collection, therefore, are expected in the near future.

Several papers in the collection are dedicated to the relationships between El Niño/Southern Oscillation (ENSO) and the variability in the Indian Ocean. Current conditions in the tropical Pacific indicate La Niña conditions in 2020–2022 ("double-dip La Niña event") which are expected to persist for one more boreal winter, a situation that since 1950 only occurred in 1973–1976 and 1998–2001. Hasan et al. argue that the special conditions in the tropical Indian Ocean and tropical Atlantic helped maintain the prolonged 2020–2022 La Niña conditions in the tropical Pacific. These special conditions included a strong positive event of the Indian Ocean Dipole (IOD) in boreal fall 2019, a subsequent Indian Ocean basin-warming during boreal spring 2020, a noticeable tropical Atlantic warming during boreal winter 2019–2020, and an Atlantic Niño during boreal summer 2021.

Xu et al. emphasized the importance of the Indonesian Throughflow on the precursory relationship between the IOD and ENSO. They use observational data and simulations by the Coupled Model Intercomparison Project phase 5 (CMIP5). The establishment of a significant correlation with a 1-year time lag between the IOD and ENSO is consistent with oceanic channel dynamics—i.e., the connection from the Indian to the Pacific Ocean *via* the propagation of oceanic Kelvin waves that then impact equatorial Pacific SSTs. The authors also analyze the association between the IOD and ENSO by means of atmospheric bridges. This type of connection is highly dispersive among climate models and generally inconsistent with observations, suggesting that climate model data must be used with caution in this type of investigations.

Yuan et al. also emphasized the relationship between the IOD and ENSO, but with an emphasis on decadal time scales. For this, they examined the output from simulations by the Community Climate System Model 4 (CCSM4). Based on this examination, they suggest that "oceanic channel" dynamics are relevant during both positive and negative phases of the decadal variation. However, during the negative phases, the mean thermocline depth eastern tropical Pacific is deeper, resulting in a decoupling between subsurface and surface and thus making the oceanic wave processes less efficient.

Du et al. reviewed recent advances in Indo-western Pacific Ocean capacitor (IPOC) theory and the relationship with ENSO. IPOC events feature a tropical Indian Ocean (TIO) warming and an anomalous anticyclonic circulation over the western North Pacific (WNPAAC), which causes extreme events in East Asia such as heavy rainfall during boreal summer. Such events often occur in post-ENSO summers, but a significant TIO warming could sustain the WNPAAC without a strong El Niño. In these cases, the forcing is provided by a strong antecedent positive Indian Ocean Dipole (IOD). In such cases, the Indian Ocean and the western North Pacific act as a self-sustaining system. The authors analyze the mechanisms at work and different flow configurations in the different cases.

Tropical basin interconnections are particularly relevant where they result in changing weather pattern and impact precipitation over land. The climate of the typically arid and semi-arid region in northwest China has shown a warm and humid trend during the last 60 years, with both average and extreme precipitation continuing to increase. Ding et al. show that the interdecadal changes in sea surface temperature (SST) in the North Atlantic, North Pacific, and Indian oceans play important roles in these changes through effects on westward water vapor transport over the region. The authors discuss separately the relative contributions of each ocean to the observed trend.

Changing emphasis to the Atlantic-Pacific connections, Mochizuki and Watanabe demonstrated that SST anomalies in the tropical Atlantic during early 2000s contributed to the formation of high ocean-temperature anomalies in the tropical Pacific on subdecadal time scales. A novelty in their approach is the use of a data assimilation system with a global climate model. In this approach temperature and salinity data are assimilated in different regions of the Atlantic basin (Equator vs. North Atlantic) and the results are compared those obtained in a baseline simulation in which the data assimilation is performed globally. This procedure allows for an insight into the impact of anomalies in the equatorial Atlantic (*via* changes in the Walker circulation and associated Pacific trade winds) and in the subtropical North Atlantic.

Finally, Magaña and Díaz study the role of moisture flux from the Caribbean Sea to the tropical Pacific for the summer rainy season in Southern Mexico. The authors show that intensification of the Caribbean Low Level Jet in late May and early June increases the moisture transport into the eastern Pacific Intertropical Convergence zone (ITCZ) shifting its main convective activity westward. The resulting quasi-stationary low-level cyclonic atmospheric circulation then drives the moisture flux into southern Mexico, initiating the summer rainy season there. The inter-basin moisture flux is thus an important element in the timing of the Mexican rain season.

This collection of seven papers, therefore, highlights the role of the Indian Ocean Variability (and particularly the IOD) on ENSO by using observational, modeling, and theoretical results. An example of the combined impact of oceanic anomalies in different basins on climate over land (East Asia) is presented. The possibility of SST anomalies in the tropical Atlantic at and off the equator influencing the tropical Pacific provides further support to findings in pioneering studies. Finally, the role of interbasin moisture fluxes on the timing of the Mexican rainy season is examined in depth.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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.

Publisher's note