atmosphere

Editorial

Editorial for the Special Issue "Atmospheric Teleconnection"

Alexander Polonsky

Institute of Natural and Technical Systems, Russian Academy of Sciences, Lenin St. 28, 99011 Sevastopol, Russia; apolonsky5@mail.ru

This Special Issue of the open-access journal *Atmosphere* focuses on different aspects of atmospheric teleconnection, which represents one of the effective mechanisms of inherent variability within the climatic system.

Professor J. Bjerknes was likely the first scholar to recognize the importance of atmospheric teleconnection for the transmission of climatic signals. One of his first public explanations and demonstrations of the importance of this phenomenon occurred at the International Conference in Moscow more than 50 years ago [1]. Since the publication of these pioneering results, the majority of the meteorological community has clearly understood that atmospheric teleconnection is a real physical mechanism that accounts for a significant share of large-scale variance in meteorological fields across the globe. J. Bjerknes and many researchers after him revealed the teleconnection of tropical disturbances on an interannual scale. This research was based on the ideas by Gilbert Walker who first discovered atmospheric signals in the Equatorial Pacific, known as the Southern Oscillation [2],

Which has since been extensively researched. Sir Gilbert was also the first scholar to describe (together with his co-author) one of the most intense extratropical oscillatory modes—North Atlantic Oscillation (NAO) [3]. Around 55 years later, the authors of [4] found several persistent and significant extratropical interannual modes. Additionally, more low-frequency Atlantic Multidecadal and Pacific Decadal Oscillations (AMO and PDO) have been discovered and their regional manifestations described [5–8].

Therefore, it is now clear that atmospheric teleconnection stems from large-scale interannual-to-multidecadal disturbances in the climatic system that spread far from the regions of their generation through a large-scale atmosphere circulation, transient eddies, and planetary waves. There are numerous excellent publications concerning this phenomenon, majority of which were published later than the aforementioned works. This Special Issue "Atmospheric Teleconnection" summarizes some recent studies on the mechanisms and regional consequences of teleconnection.

The Special Issue consists of four papers [9–12]. The first paper focuses on the impact of the El Niño—Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) on South American rainfall during austral spring [9]. The authors used composite and linear regression techniques to analyze the rainfall anomalies of different ENSO/IOD phases and (without the influence of the second principal variable) residual signals for the period from 1951 to 2016. The authors confirmed a significant response of South American precipitation to the sea surface temperature (SST) anomalies in the Tropical Pacific and Tropical Indian Ocean, finding a remarkable nonlinear South American rainfall response to the residual IOD forcing. The authors' analysis focuses on austral spring because the IOD is the dominant mode in the Tropical Indian Ocean during this season, and the canonical ENSO event peaks in this season. They focused on the classic ENSO-event type described by E.Russmusen & T.Carpenter [13], while the second type (Modoki, or Central Pacific ENSO, e.g., [14]) has not been seperately considered.

The second paper concerns the teleconnection associated with ENSO, AMO and PDO and the joint AMO-PDO-ENSO manifestations in the precipitation and surface air temperature (SAT) variability across South America [10]. To some extent, this study developed and

check for updates

Citation: Polonsky, A. Editorial for the Special Issue "Atmospheric Teleconnection". *Atmosphere* **2023**, *14*, 9. https://doi.org/10.3390/atmos14010009

Received: 14 November 2022
Accepted: 6 December 2022
Published: 20 December 2022

Copyright: © 2022 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

corroborated the results of [8], which describes the impact of SST anomalies induced by the abovementioned phenomena on tropospheric anomalies in the Northern Hemisphere. The authors of [10] specified the regional consequences of AMO-PDO-ENSO for the South American SAT and precipitation anomalies for the period from 1901 to 2014 using a composite technique. They analyzed the ENSO impact on four mean states as the averages of the variable anomalies during sub-periods, overlapping the time intervals of the different AMO/PDO phases. Since these sub-periods include years under ENSO extremes, the authors could study the ENSO impact on the mean climatic states in different AMO/PDO phases. They concluded that for both seasons (austral winter and summer) and all mean states, there is detectable nonlinear ENSO effect on the averaged anomaly patterns.

The authors of the third paper analyzed in detail the issue of the interaction between IOD and ENSO [11]. Namely, they tried to explain why there are at least two different types of such interaction. In some cases, the characteristics of interannual ocean–atmosphere variability in the Indo-Pacific region are a result of the complex dynamics and thermodynamics of the ENSO–IOD system. However, in the other cases, IOD events are generated in the Indian Ocean without any ENSO participation [15]. The authors checked the following hypothesis: the IOD generation, as an inherent Indo-ocean mode, is due to the growing oceanic disturbances. These disturbances are a result of instability in the system of Indian Ocean zonal currents in the vicinity of the critical layer, in which the phase velocity of Rossby waves is equal to the average velocity of the zonal currents. This hypothesis was formulated more than 15 years ago [16], but it could not be accurately checked due to absence of appropriate data. In the discussed research [11], a study of the features of the critical layer formation in the equatorial–tropical zone of the Indian Ocean was conducted using different oceanic re-analyses, the RAMA (The Research Moored Array for African–Asian–Australian Monsoon Analysis and Prediction) measurements and standard theory of the Rossby waves. It was shown that the majority of the cases of the IOD events as inherent (independent on the Pacific processes) mode were accompanied by the critical layer formation in the South Equatorial Current vicinity. Usually, the critical layers occur in boreal spring, one to two months before the onset of the positive IOD events.

Finally, the authors of the fourth paper studied the monthly rainfall signatures of the North Atlantic and East Atlantic Oscillations (NAO and EAO) in Great Britain [12]. They used high-resolved gridded rainfall and Standardized Precipitation Index time series data to map the monthly rainfall signatures of the NAO and EAO in Great Britain over the period from 1950 to 2015. It was found that, in winter, the impact of NAO on rainfall and precipitation extremes is stronger in the northwest of Great Britain, while in the southern and central regions, EAO-induced rainfall prevails. It is interesting that in summer, the different opposing phases of the NAO and EAO result in stronger wet/dry signatures. Moreover, they are more spatially consistent than in winter. Therefore, the authors presented a composite analysis to study the regional manifestation of two principal Atlantic modes in precipitation using high-resolution rainfall data.

Unfortunately, a few manuscripts were rejected, whose authors described some additional regional aspects of teleconnection. These manuscripts were potentially fascinating, but they did not meet the high critical standards of the qualified reviewers chosen by the editorial board.

Overall, this Special Issue, entitled “Atmospheric Teleconnection”, offers a high-quality collection of successful and innovative research.

Funding: This research received no funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Bjerknes, J. A large-scale disturbance of the atmospheric circulation presumably originating from the equatorial Pacific. In *Dynamics of the Large-Scale Atmospheric Processes, (Dinamika Krupnomashtabnych Atmosfernych Processov)*; Nauka: Moscow, Russia, 1969; pp. 257–260.
2. Walker, G.T. Correlation in seasonal variations of weather. *Mem. India Meteorol. Dep.* **1924**, *24*, 275–332.
3. Walker, G.T.; Bliss, E.W. World weather V. Meteorology. *R. Meteorol. Soc.* **1932**, *4*, 53–84.
4. Barnston, A.G.; Livezey, R.E. Classification, Seasonality and Persistence of Low-Frequency Atmospheric Circulation Patterns. *Mon. Weather. Rev.* **1987**, *115*, 1083–1126. [CrossRef]
5. Kushnir, Y. Interdecadal Variations in North Atlantic Sea Surface Temperature and Associated Atmospheric Conditions. *J. Clim.* **1994**, *7*, 141–157. [CrossRef]
6. Schlesinger, E.; Ramankutty, N. An Oscillation in the Global Climate System of Period 65–70 years. *Nature* **1994**, *367*, 723–726. [CrossRef]
7. Mantua, N.J.; Hare, S.R.; Zhang, Y.; Wallace, J.M.; Francis, R.C. A Pacific Decadal Climate Oscillation with Impacts on Salmon. *Bull. Am. Meteorol. Soc. (BAMS)* **1997**, *78*, 1069–1079. [CrossRef]
8. Enfield, D.; Mestas-Nunez, A.M. Multiscale Variability in Global SST and Their Relationships with Tropospheric Climate Patterns. *J. Clim.* **1999**, *12*, 271–273. [CrossRef]
9. Kayano, M.T.; Cerón, W.L.; Andreoli, R.V.; Souza, R.A.; Souza, I.P.; Canchala, T. El Niño-Southern Oscillation and Indian Ocean Dipole Modes: Their Effects on South American Rainfall during Austral Spring. *Atmosphere* **2021**, *12*, 1437. Available online: https://www.mdpi.com/2073-4433/12/11/1437 (accessed on 30 October 2021). [CrossRef]
10. Kayano, M.T.; Cerón, W.L.; Andreoli, R.V.; Souza, R.A.; Avila-Diaz, A.; Zuluaga, C.F.; Carvalho, L.M. Does the El Nino-Southern Oscillation Affect the Combined Impact of the Atlantic Multidecadal Oscillation and Pacific Decadal Oscillation on the Precipitation and Surface Air Temperature Variability over South America? *Atmosphere* **2022**, *13*, 231. Available online: https://www.mdpi.com/2073-4433/13/2/231 (accessed on 29 January 2022). [CrossRef]
11. Polonsky, A.; Torbinsky, A. The IOD-ENSO Interaction: The Role of the Indian Ocean Currents' System. *Atmosphere* **2021**, *12*, 1662. Available online: https://www.mdpi.com/2073-4433/12/12/1662 (accessed on 12 December 2021). [CrossRef]
12. West, H.; Quinn, N.; Horswell, M. Monthly Rainfall Signatures of the North Atlantic Oscillation and East Atlantic Pattern in Great Britain. *Atmosphere* **2021**, *12*, 1533. Available online: https://www.mdpi.com/2073-4433/12/11/1533 (accessed on 20 November 2021). [CrossRef]
13. Rasmusson, E.M.; Carpenter, T.H. Variations in Tropical Sea Surface Temperature and Surface Wind Fields Associated with Southern Oscillation (El Nino). *Mon. Weath. Rev.* **1982**, *110*, 354–384. [CrossRef]
14. Harrison, D.E.; Larkin, N.K. El Nino-Southern oscillation sea surface temperature and wind anomalies—1946–1993. *Rev.Geophys.* **1998**, *36*, 353–399. [CrossRef]
15. Abram, N.J.; Wright, N.M.; Ellis, B. Coupling of Indo-Pacific climate variability over the last millennium. *Nature* **2020**, *579*, 385–392. [CrossRef] [PubMed]
16. Polonskii, A.B.; Meyers, G.; Torbinskii, A.V. Interannual variability of the heat content of the upper layer in the equatorial Indian Ocean and the Indian-Ocean dipole. *Phys. Oceanogr.* **2007**, *17*, 129–140. [CrossRef]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.