frontiers in Environmental Science

EDITORIAL
published: 01 February 2016
doi: 10.3389/fenvs.2016.00001

Editorial: Wet and Dry Periods in Regions Surrounding the Atlantic Ocean Basin

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Keywords: Atlantic Ocean basin, climate variability, moisture transport, precipitation, droughts

The Editorial on the Research Topic

Wet and Dry Periods in Regions Surrounding the Atlantic Ocean Basin

The Atlantic Ocean is the second-largest of the world's oceanic divisions. It is bounded by the continents of America, Europe, and Africa and at its polewards margins by the Arctic and the Southern Oceans. Different climatic patterns can be observed along its large latitudinal domain, which extends from the equator to sub-polar regions. Thus, different tropical and extra-tropical meteorological systems may have some influence on the characterization of precipitation regimes observed surrounding the basin, such as the Intertropical Convergence Zone (ITCZ), tropical monsoon systems, westerly storm tracks, and atmospheric rivers. The subtropical regions of the Azores and South Atlantic high pressure systems are large evaporative areas which act as important moisture sources for the adjacent continents. Variations in the oceanic characteristics may influence the moisture transport toward the neighboring landmasses and alter the precipitation. The influence of climatic variability modes manifest not only over the Atlantic Ocean, but also over other oceanic regions, may also interact with the regional hydrological budget, thereby generating long periods of drought, or excessive precipitation over the Atlantic rim landmasses.

This Research Topic intends to highlight the advances of the scientific community in investigating the continental precipitation surrounding the Atlantic Ocean and its variability on various temporal and spatial scales. Out of the 10 works published, three of them are focused on the Northeastern Brazil (NE), a region prone to social-economical problems associated with arid climatic conditions and one of the tropical areas with the largest interannual variability in rainfall (de Albuquerque Cavalcanti). Although the linear component of the inter-annual variability may be modulated by the Equatorial Eastern Pacific and tropical South Atlantic sea surface temperature (SST) variability and the associated modifications in the Hadley and Walker cells, the non-linear signal may be influenced by others oceanic regions (da Silva and Mendes). For example, the composite analysis of de Albuquerque Cavalcanti revealed extratropical atmospheric influences of the North and South Atlantic in the pre-rainy season of NE. The non-stationary influence of the Atlantic and Pacific Niños on North Eastern South American rainfall in the twentieth century was investigated by the numerical study of Torralba et al. The authors found that while the Atlantic El Niño was of influence at the beginning of the last century, the Pacific El Niño plays a major role from 1970 onwards. However, the combined effect of both basins after the 1970s amplifies the anomalous rainfall response in the NE. The importance of considering the non-linear processes

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Edited by:
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Reviewed by:
Sergio M. Vicente-Serrano, Spanish National Research Council, Spain

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Specialty section:
This article was submitted to Atmospheric Science, a section of the journal Frontiers in Environmental Science

Received: *12 November 2015*
Accepted: *11 January 2016*
Published: *01 February 2016*

Citation:
Drumond A, Rodriguez-Fonseca B, Reason C and Solman SA (2016) Editorial: Wet and Dry Periods in Regions Surrounding the Atlantic Ocean Basin. Front. Environ. Sci. 4:1. doi: 10.3389/fenvs.2016.00001

for a more accurate local precipitation forecast was verified by da Silva and Mendes, who suggested the use of an Artificial Neural Network as a complementary forecast tool for improving the simulation of the daily precipitation over NE during the rainy season by general circulation models.

Still focusing on South America, the South Atlantic Convergence Zone (SACZ) is the dominant summertime cloudiness feature of the subtropics and the western South Atlantic Ocean. In order to facilitate the investigation on SACZ and climate change through the use of numerical simulations, Ambrizzi and Ferraz proposed an alternative objective criterion of the SACZ identification based mainly on precipitation, a variable easily obtained from general circulation models, instead of the intensely used outgoing long wave radiation.

Given the influence of the Tropical Atlantic over the annual migration of the ITCZ and, consequently, over the West African and Brazilian rainfall, oceanic processes in this region was the theme of two model studies. Faye et al. investigated the seasonality of SST and circulation in the North-eastern Atlantic Tropical Upwelling System, a component of the Guinea Gyre characterized by one of the largest annual SST cycles in the tropics. Polo et al. investigated the growth and decay of the equatorial Atlantic SST mode by means of closed heat budget in a coupled general circulation model.

Other studies show the importance of different sub-regions other than the tropical Atlantic in modulating the precipitation. For example, Sori et al. investigated how the moisture transport from the Atlantic Warm Pool may affect North/Central America and Western Europe through a Lagrangian analysis, exploring the interannual variability of moisture contribution from the pool in terms of its areal extent, and of the El Niño Southern Oscillation. Reason and Smart investigated warm events in the tropical south east Atlantic and associated episodes of large positive rainfall anomalies over Southern Africa during its late rainy season (February–April).

Finally, two articles illustrate the efforts in investigating the precipitation in the Atlantic basin during the past. Wade et al. analyzed the spatial representativeness of rainfall over the Saloum delta (Senegal), from seasonal to decadal timescales, useful for evaluating the significance of local long-term reconstructions of precipitation over northern Africa from paleoclimate proxies. They found that the summer rainfall shows extended spatial coherence associated with the West African Monsoon. An example of historical recompilation using several data sources, such as newspapers, meteorological data digitized from stations in Portugal and Spain and the twentieth century Reanalysis, is the case study of the record precipitation and flood event in south-western Iberia in December 1876 presented by Trigo et al. The authors reported an intense negative North Atlantic Oscillation Index event and the floods resulted from the continuous precipitation recorded between 28 November and 7 December, due to the consecutive passage of Atlantic low-pressure systems fuelled by the presence of an atmospheric-river tropical moisture flow over the central Atlantic Ocean.

The Atlantic Ocean still presents strong challenges in analysis and modeling. Most numerical models have important rainfall, wind and SST biases in the Atlantic, which compromise the representation of the climate. To enhance the reliability of models, the observational record must be better understood, and the origin of ocean variability and the role of the atmospheric components associated with rainfall need to be clarified. For this reason, this issue tackles the different hot topics at the cutting edge of the current state of the art, making a step forward in current understanding of the climate variability in the Atlantic Ocean.

AUTHOR CONTRIBUTIONS

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

ACKNOWLEDGMENTS

AD acknowledges the Spanish Government and FEDER through the support of the SETH project (CGL2014-60849-JIN). BR received funding from the EU FP7/2007-2013 under grant agreement no. 603521.

Conflict of Interest Statement: 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.