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Air-sea interactions and oceanic processes in the development of different Atlantic Niño patterns

Marta Martin-Rey (1,2), Irene Polo (3), Belén Rodríguez-Fonseca (1,2), and Alban Lazar (4)

(1) Universidad Complutense de Madrid, Facultad de Físicas, Geofísica y Meteorología, Madrid, Spain (brfonsec@fis.ucm.es), (2) Instituto de Geociencias, IGEO, centro mixto UCM-CSIC, (3) Department of Meteorology, University of Reading, UK, PO Box 243, Earley Gate, Reading RG6 6BB, U.K , (4) LOCEAN-IPSL, Paris, France

Atlantic Niño is the leading mode of inter-annual variability of the tropical Atlantic basin at inter-annual time scales. A recent study has put forward that two different Atlantic Niño patterns co-exist in the tropical Atlantic basin during negative phases of the Atlantic Multidecadal Oscillation. The leading mode, Basin-Wide (BW) Atlantic Niño is characterized by an anomalous warming extended along the whole tropical basin. The second mode, the Dipolar (D) Atlantic Niño presents positive Sea Surface Temperature (SST) anomalies in the central-eastern equatorial band, surrounded by negative ones in the North and South tropical Atlantic.

The BW Atlantic Niño is associated with a weakening of both Azores and Sta Helena High, which reduces the tropical trades during previous autumn-winter. On the other hand, the D-Atlantic Niño is related to a strengthening of the Azores and a weakening of Helena High given rise to a meridional Sea Level Pressure (SLP) gradient that originates an intensification of the subtropical trades and anomalous westerlies along the equatorial band. This different wind forcing suggests that different oceanic processes could act in the development of the BW and D Atlantic Niño patterns. For this reason, an inter-annual simulation with the ocean NEMO model has been performed and the heat budget analysis has been analysed for each Atlantic Niño mode.

The results suggest that the two Atlantic Nino configurations have different timing. The heat budget analysis reveals that BW Atlantic Nino SST pattern is due to anomalous air-sea heat fluxes in the south tropical and western equatorial Atlantic during the autumn-winter, while vertical processes are responsible of the warming in the central and eastern part of the basin during late-winter and spring. For the D-Atlantic Nino, the subtropical cooling is attributed to turbulent heat fluxes, the equatorial SST signal is mainly forced by vertical entrainment. The role of the oceanic waves in the development of the SST anomalies has been also investigated. The distinction of the different processes could be useful in order to predict the associated impacts.