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Summer to late winter atmospheric response to the Atlantic Equatorial mode

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This work presents a description of atmospheric response in relation to the leading coupled mode between the summer Tropical Atlantic sea surface temperature (SST) and North Atlantic anomalous precipitation based on observational data and model results. To this aim, the authors analyse the impact of the SST anomalies applying a statistical tool of lagged Multiple Maximum Covariance Analysis (MMCA). In particular, the 4-months JJAS sequence is chosen to study the influence of the summer SST in relation to Atlantic basin precipitation. Different 4-month precipitation sequences, centred in JJAS, and lagging one month forward (JJAS to DJFM) are computed, using the Atlantic rainfall as a proxy of the atmospheric deep convection. The study is focused on the 1979/80-2001/2002 time period.

The observed atmospheric response has been studied using monthly horizontal velocity potential at 200hPa from NCEP-NCAR data, streamfunction at 200hPa and vertical velocity at 500hPa from ERA-40 reanalysis data. Monthly CMAP precipitation (pcp) and NOAA Extended Reconstructed SST dataset have been used to perform the SST-pcp MMCA.

A 4-member ensemble simulation with observed ERSST was performed, covering the period from 1950 to 2005, using the high resolution UCLA AGCM (2ºlat - 2.5ºlon, 29 sigma levels). The same methodology was applied to the model output, for the same period, in order to better understand the oceanic forcing of the observational atmospheric response.

The results show, first, how, during the spring-summer transition, the Atlantic Niño is associated with an eastward extension and a weakening of the Atlantic Walker circulation and, also, with a strengthening of the Atlantic Hadley circulation. A wide band

of precipitation covers the equatorial Atlantic from the Brazilian coast to the Guinean coast during the peak phase of the Atlantic Niño phenomenon (JJAS).

Later, during the autumn-winter-early spring transition, the deep vertical motions associated with the Atlantic Walker cell come back to its climatological location generating large upper tropospheric divergence (Rossby wave sources) and becoming effective to excite Rossby waves from Caribbean-northern Brazil region, waves that are trapped into the North African-Asian jet and propagate toward the Pacific Ocean.