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Seasonality of the ENSO influence on the North Atlantic-European circulation

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The dominant variability modes of the North Atlantic-European [5S-80N/90W-40E] rotational flow are examined in this study. In this way a Principal Component Analysis (PCA/EOF) of the 200hPa streamfunction (psi200) is applied from the developing (JJA) to the decaying (MAM) phases of the ENSO cycle. The study is focused on 1957/58-2001/02 time period. Monthly psi200 dataset comes from the ERA-40 reanalysis. The associated atmospheric circulation has been described through 1000-100hPa geopotential height, velocity potential at 200hPa, and 850hPa air temperature from ERA-40 data. NOAA Extended Reconstructed SST and interpolated Outgoing Longwave Radiation together high-resolution University of Delaware precipitation (0.5ºlat-0.5ºlon) are also used in order to diagnose some climate impacts and proposed mechanisms.

Results reveal that the leading psi200-EOF mode, during the four seasons, does not project onto the North Atlantic Oscillation (NAO) and it has not a significant impact on the European anomalous precipitation. This regional mode displays a one-signed structure over most of the domain; and its regression onto the global SST exhibits a clear El Niño fingerprint in the tropical Pacific. This SST pattern has no signal over the Atlantic basin, except for MAM, in which there is a warming in the subtropical North Atlantic accompanied by a cooling in the subtropical southern basin. The global projection of this regional mode follows the development (SON), establishment (DJF) and damping (MAM) of the Tropical/Northern Hemisphere (TNH) pattern in the North Pacific ocean. Over the North Atlantic, a secondary wavetrain emerges from the tropical Atlantic and propagates along the eastern North Atlantic towards Europe. This Rossby wavetrain appears to be initiated by the local Gill-type response, over the Amazon convergence zone, as a consequence of the Pacific zonal heating compensation.
An important issue derived from this analysis has been to isolate the El Niño-forced variability from the NAO-related variability (second psi200-EOF) over the Euro-Atlantic sector, in contrast with previous works.