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Nonstationary relationship between the Euro-Mediterranean rainfall and the El Niño phenomenon

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The precipitation over Europe and the Mediterranean region has been usually associated to the North Atlantic Oscillation (NAO). However, several studies have shown how, the El Niño-Southern Oscillation (ENSO), which is the globally dominant climate mode at interannual timescales, also influences the Euro-Mediterranean Rainfall variability (iEMedR). An interesting point is that, at interannual timescales, the regional atmospheric spatial pattern at surface levels over the Euro-Mediterranean region associated with the Pacific El Niño presents a similar structure to the one associated with the NAO (Brönnimann, 2007, García-Serrano et al., 2011). In this way, although most of the NAO signal has an internal origin, external contributions associated with Sea Surface Temperature (SST) changes in the Pacific can have a determinant impact on the centers of action of the NAO, which makes difficult distinguish between NAO and ENSO signals over the Mediterranean.
Other studies have found nonstationary features in these signals along the 20th century (Mariotti et al., 2002, Zanchettin et al., 2008, Vicente-Serrano et al., 2008). Specifically, this study represents a continuation of the results recently published by the same authors (Lopez-Parages and Rodríguez-Fonseca, 2012), where they presented statistically significant evidences about how the Atlantic Multidecadal Oscillation (AMO) and Pacific Decadal Oscillation (PDO) seem to play and important role in the nonstationary relationship between El Niño phenomena and the leading mode of variability of the iEMedR. Although this study point to the fact of considering the changes in the mean state as the modulator factor of ENSO teleconnections, many questions, mainly related to the possible mechanisms which could explain the nonstationary relationship identified, remain open. Here, new analysis based on observations and also on the CMIP5 simulations of the CNRM-CM5 model have been done. The analysis of the long control run shows how the model is able to reproduce the leading mode of precipitation, and how its relation with El Niño is non stationary, as in the observations. Also, the model shows how this changing teleconnection has a periodicity which broadly coincides with the periodicity of the AMO and PDO of the model. Moreover, observations and model results suggest changes in the zonal mean flow, and in the Walker-Hadley circulations, associated to the non-stationary El Niño- iEMedR teleconnection.
The results of this study confirm, in this sense, the lack of stationarity, but also represent a step forward in the state of the art, by the identification of multidecadal natural variability as a potential modulator of the interannual teleconnections.

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