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ENSO influence on the North Atlantic European climate: a non-linear and non-stationary approach

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El Nino Southern Oscillation (ENSO) impact on the North Atlantic European sector (NAE) still rises many unanswered questions. Regarding stationarity recent studies have found a non stationary feature of this teleconnection, suggesting an effective modulating role of the ocean mean state. Nevertheless, physical explanations about the underlying mechanisms have been little studied in the available literature. In addition, ENSO events show different SST spatial patterns, phases, and amplitudes, which can also influence on the related remote impacts. In view of all this, in the present study a set of partially coupled experiments have been performed with a global atmospheric general circulation model in which different SST ENSO patterns are superimposed over distinct Pacific and Atlantic SST mean states. These SST background conditions are constructed according to the observational difference between periods with a distinct impact of ENSO on the leading Euro-Mediterranean rainfall mode in late winter-early spring. Our results point to two distinct mechanisms associated with ENSO that can be modulated by the SST mean state: (1) the thermally driven direct circulation (Walker and Hadley cells) connecting the Atlantic and Pacific basins, and (2) the Rossby wave propagation from the tropical Pacific to the North Atlantic. The latter explains a reinforced signature of Eastern Pacific Ninos on the Euro-Mediterranean rainfall when the tropical Pacific is warmer than usual and the North Atlantic is colder than usual. This feature is consistent with the changing ENSO impact identified in previous studies and demonstrates how the ENSO teleconnection with the NAE climate at interannual timecales could be modulated by multidecadal changes in the SST. According to our results, the assumption of stationarity which is still common to many studies of ENSO teleconnections clearly has to be questioned.