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Effects of Niño1+2 and Niño3.4 ENSO Events over Euro-Mediterranean Climate Variability

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El Niño Southern Oscillation (ENSO) is a climate phenomenon that affects the atmospheric circulation of the Northern Hemisphere and causes short-term variability in temperature and precipitation patterns. ENSO impacts over the Euro-Mediterranean (EM) region are commonly defined by using Niño3.4 and Niño3 indices. However, some recent studies indicate that the ENSO event represented by both Niño1+2 and Niño3.4 indices (shared ENSO) is more effective over EM region climate.

In this study, we examine the response of the EM climate to ENSO events detected by Niño1+2 and Niño3.4 regions. NCEP/NCAR Reanalysis surface air temperature, precipitation, 500 hPa geopotential height, 850 hPa wind, and 300 hPa zonal wind datasets and SST-based ENSO indices from ERSSTv4 were used in the analysis for boreal winters between 1950 and 2019. For composite analysis, we separated ENSO events as El Niño and La Niña according to those observed in Niño1+2, Niño3.4, and both regions. We also tried to understand if there is any relation between ENSO and teleconnection patterns such as NAO, East Atlantic (EA), Trough Displacement Index for the Mediterranean Trough (TDI_MedT), and East Atlantic/Western Russia (EAWR) by using the cross-correlation analysis. Additionally, investigate the winter (December, January, February, DJF) ENSO's possible lagged impacts on the teleconnection patterns in the subsequent seasons, spring (March-April-May, MAM), summer (June-July-August, JJA), and autumn (September-October-November, SON).

The major finding of this study is that the shared ENSO event is more effective over the EM climate than the ENSO events detected only by Niño1+2 or Niño3.4 indices. Further, it is also important for the predictability of the EM climate. In the shared El Niño event, the Middle East and much of North Africa tend to become colder than climatology while Europe becomes warmer. The anticyclonic wind anomaly over western Europe causes drier air in southern Europe and wetter air in northern Europe. The shared El Niño event also modulates the westerly flows at the upper troposphere. The westerly flow accelerates over high latitudes while decelerates over European mid-latitudes, causing northern Europe to be wetter and the Mediterranean Basin to be drier. The cross-correlation analysis including all SST-based ENSO indices and teleconnection indices that the EA index has a significant correlation with the Niño1+2 index across all seasons.