



## Multidecadal Modulation of the interannual rainfall variability over the Euro-Mediterranean region.

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Several studies have shown how the anomalous precipitation over the Euro-Mediterranean region is influenced by the ENSO phenomena. However, this influence is not stationary, with maximum correlations in the beginning of the twenty century and since the 1976-1977 Climate Shift and no influence during the 1940's-50's-60's. The role of Natural Multidecadal Variability in the non-stationary relationship between ENSO and interannual precipitation over the Euro-Mediterranean region is analyzed for the 20th century. As representative of the natural multidecadal variability, we have chosen the Atlantic Multidecadal Oscillation (AMO) and the Pacific Decadal Oscillation (PDO) defined as the leading EOF of the SST anomalies for the Atlantic and North Pacific basins.

To this aim, a Gram-Schmidt orthogonalization methodology has been used to generate an orthogonal base able to discriminate the AMO and PDO influence on the rainfall modes. Next, Principal Component Analysis (PCA) of the winter (JFM) anomalous rainfall for the 20th century is performed considering or not the projection on each elements of the base.

The role of AMO and PDO seems to influence the atmospheric variability, with changes in the Sea Level Pressure (SLP) anomalous projection, from a zonally-symmetric dipolar NAO-like pattern to an undulatory pattern. The results should be interpreted with caution due to the length of the time period analyzed, which includes variability at interannual and decadal times scales.

To find out the influence of AMO and PDO on the interannual rainfall (considered as the difference between one year and the next), a correlation along the 20th century between the Nino3.4 index and the interannual Euro-Mediterranean rainfall has been done. The correlation with the interannual rainfall reconstructed with PC1 for a 20-year moving window shows a significance multidecadal modulation, particularly with AMO. The second mode, on the other hand, seems to be more influence by GW.

The results suggest that the impact on the Euro-Mediterranean area of the Pacific ENSO is not stationary and it is statistically related to the Atlantic ocean mean state. In this way it seems that the Atlantic-Pacific connection, which is influenced by the Atlantic mean state, could play an important role in this non-stationary relationship.