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Atmospheric Rossby Waves as a Link Between North Atlantic Storm Track Variability and Eastern Mediterranean Cyclones

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The Mediterranean Basin has several features that enhance cyclonic activity, such as its complex topography and sharp land-sea temperature differences. However, some processes occurring outside the basin can influence its seasonal variability. In this work, we highlight the relationship between the North Atlantic Storm Track (NAST) and cyclones passing through the Eastern Mediterranean (EM). We use Empirical Orthogonal Function (EOF) analysis of upper-level meridional wind variance to inspect monthly NAST regimes and their influence on wintertime flow in the EM.

We find that the higher functions (EOF4-5) show stronger links to the region and specifically, to anomalies in synoptic fields associated with cyclones (upper-level potential vorticity, sea level pressure) and in monthly precipitation. These functions manifest as a pair of orthogonal zonal waves, reminiscent of subseasonal teleconnections that were previously linked to seasonal precipitation extremes in the EM (the South Levant pattern). It is hypothesized that this connection is mainly brought about by large-scale adiabatic advection of PV in the upper levels. Meanwhile, the two leading NAST modes (“pulsing” and latitudinal “shifting”) were found to produce a comparatively smaller effect.

On the daily scale, we investigate the NAST-EM connection through the lens of zonally propagating Rossby wave packets, in both reanalysis and CMIP6 models (which capture the patterns well).