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ENSO contribution to North Atlantic dipolar variability during midwinter

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The dominant variability modes of the North Atlantic-European rotational flow are examined by applying a principal component analysis (PCA/EOF) to the 200hPa streamfunction mid-winter anomalies (Jan-Feb monthly means; 1958-2002 ERA-40 dataset). The results reveal that, when this norm is used, the leading mode (EOF1) does not correspond with the traditional North Atlantic Oscillation (NAO), here the EOF2. This mode corresponds to the local manifestation of the leading hemispheric streamfunction EOF. The regression of this regional mode onto the global SST field exhibits a clear and significant El Niño signature, with no signal over the Atlantic; while the associated upper height anomalies project on the Tropical/Northern Hemisphere (TNH) pattern.
The tail of the EOF1-based TNH along the east coast of North America produces a dipole-like pattern at lower levels. Although this pattern in some ways resembles the NAO (EOF2), the dynamics of both modes are very different in that only EOF2 is associated with a latitudinal shift of the North Atlantic stormtrack. Thus, the choice of the streamfunction norm allows decoupling two different mechanisms that can produce dipolar surface pressure anomalies over the North Atlantic, although with different impact on European climate. These modes also differ on their contribution to global variability at lower levels: while NAO-EOF2 is mostly constrained to the North Atlantic; TNH-EOF1 has a more annular character. At upper levels NAO-EOF2 also produces a global response, but the circulation anomaly projects on the nonannular circumglobal teleconnection.