

## Definitions of North Atlantic Oscillation

To identify the North Atlantic Oscillation (NAO), Empirical Orthogonal Function (EOF) was applied to the monthly mean 500 hPa height anomalies over an Atlantic area ( $20^{\circ}$  -  $90^{\circ}$ N,  $90^{\circ}$ W -  $90^{\circ}$ E). The seasonal cycle has been removed from the monthly mean height field. The leading EOF modes capture the maximum amount of explained variance. The ERA-Interim dataset was employed at a horizontal resolution of  $(\text{lat, lon})=(2.5^{\circ} \times 2.5^{\circ})$  for the period 1979 to 2014. The covariance matrix is used for the EOF analysis. To ensure equal area weighting for the covariance matrix, the gridded data is weighted by the square root of the cosine of latitude.

The loading pattern of NAO is defined as the first leading mode from the EOF analysis of the monthly mean height anomalies. Note that year-round monthly mean anomaly data has been used to obtain the loading patterns. Since the NAO have the largest variability during the cold season, the loading patterns primarily capture characteristics of the cold season patterns.

Daily NAO index is calculated by projecting the daily 500 hPa height anomaly defined as a departure from ERA-Interim's daily 500 hPa height climatology, onto the leading EOF mode. The daily index is normalized by the standard deviation of the monthly index (1979 – 2014 base period).

### Structure of leading mode NAO (21.6 %)

