



## **Annual cycle of the atmospheric circulation modes over the Euro-Atlantic sector with emphasis on warm months**

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The modes of low-frequency variability of atmospheric circulation (teleconnections) have been studied mostly in winter. Of the four modes dominating over the North Atlantic – European sector (North Atlantic Oscillation, NAO, and East Atlantic (EA), Scandinavian (SCAN), and East Atlantic-West Russia, EAWR, patterns), only the NAO has been investigated in other seasons. The objective of this study is to describe the development of the North Atlantic – European circulation modes throughout the year and demonstrate their character in spring and summer (if they really exist).

The modes are identified in 500 hPa heights in the Northern Extratropics (north of 20°N inclusive) for period 1948-2016. The data source is the NCEP/NCAR reanalysis. The analysis tool is rotated principal component analysis (using covariance matrix and varimax rotation). The modes are detected within whole year using sliding seasons with a length of 93 days which are moved with a step of 5 days. That is, the entire year is covered by 73 (=365:5) sliding seasons. The number of rotated components (that means the number of detected modes) varies from 9 in winter to 13 in summer.

The four standard modes listed above are detected unambiguously from December to March. They change their position and spatial structure in spring; some new modes also appear. Specifically, the centres of the NAO shift westward in spring and northward in summer. The EA pattern loses its zonal character in the warm half year; its southern centre shifts towards Europe and weakens. Both meridional modes, SCAN and EAWR, break down into two modes each. The shape of the modes stabilizes in May and remains fairly stable until October when the circulation returns to the winter character. The results document the changes in circulation action centres and their connectivity and show the obvious asymmetry of annual course of modes. One point correlation maps are employed to support the results obtained by the principal component analysis.