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An annual cycle of the circulation variability modes dominating over the Euro-atlantic sector

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Modes of circulation variability in 500 hPa fields were recognized to be the main drivers of surface climate variability on monthly and seasonal scale. It is widely assumed that the circulation modes occur in all seasons with only slight changes of their character. They have been used in several ways including a validation of circulation in global climate models, an explanation relationships between atmospheric circulation and surface climatic elements and recently also as a support tool for the seasonal forecast.

In this research, the circulation modes over East-Atlanic sector were detected using Northern Hemisphere extratropics in NCEP/NCAR reanalysis period 1948-2016. Instead of common monthly means, the modes were detected using the method of sliding months of the 31-day length shifting within the calendar year with a ten-day step. In case of substantial changes in position or intensity of action centres the step was modified to 5 days. Means of sliding months were reduced by mean standard deviation to include the disparity in winter and summer circulation variability. Principal component analysis (PCA) was applied to mean 500 hPa heights of sliding months; from 8 to 11 components were rotated in individual seasons. Annual cycles of the North Atlantic Oscillation (NAO), Euroatlantic mode (EA), Scandinavian mode (SCAN) and Euro-Asian mode 2 (EU2, named also East Atlantic-West Russia mode) are displayed.

The results show that the zonal modes (the NAO and EA) can be easily detected within the year even though the position and intensity of their centres change from winter to spring and summer. Two main meridional modes (SCAN and EA2) change its shape considerably and their existence in summer is debatable.