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Circulation background of spatial patterns of atmospheric moisture content over Central Europe

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Atmospheric water vapour plays an important role in physical processes in the troposphere, i.e. radiation budget, cloud formation or precipitation, being also a crucial element of climate change analyses.
The aim of the study is to investigate the spatial and temporal variations of atmospheric moisture content over Central Europe and their circulation background.

Gridded daily values of specific humidity (s), relative humidity (RH) and total column water (TCW) obtained for main pressure levels from NCEP/NCAR reanalyses were taken into consideration to distinguish moisture conditions whereas atmospheric circulation characteristic was based on 850 hPa geopotential height and wind parameters as well as sea level pressure for all grid points. The calculations were performed for the period 1961-2015.

In the first step moisture vertical structure was described, using specific and relative humidity values at 850, 700, 500 and 300 hPa pressure levels and total column water data. The profiles were grouped into clusters for each season independently. Their spatial patterns were identified by empirical orthogonal function analysis. The modes were regressed to atmospheric variables to estimate the circulation factor.

Atmospheric moisture content demonstrates a significant seasonal differentiation, mostly due to transitional location of the Central Europe region. Oceanic and continental influences are visible in both vertical structure and spatial patterns of atmospheric water vapour content. Detailed analysis of extreme dryness and wetness episodes confirmed their dependence on large scale circulation patterns but indicated also an important role of mesoscale atmospheric and environmental conditions.