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Moisture regions in Europe

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Water vapor plays a major role in the process of radiation, cloud formation, energy exchange within a system, and remains a key component of the Earth's atmosphere. The purpose of this study is to examine the water vapor content of the troposphere over Europe and the Norteastern Atlantic both in horizontal and vertical context. Daily data on moisture content in the atmosphere were used: total column water vapor (TCWV), specific humidity (SHUM) and relative humidity (RH) for the period 1981–2015. The data were obtained from the ERA-Interim reanalyses database (ECMWF).

Analysis of the spatial structures of water vapor content in the troposphere has shown a strong regional pattern of moisture conditions in Europe. Spatial pattern analysis was performed using cluster analysis (k-means method, number of clusters distinguished after PFT analysis) as well as selected variables describing moisture content independently for every studied season: TCWV, TCWVσ, SHUM950, SHUM850, SHUM700, SHUM500,SHUMσ, RH950, RH850, RH700, RH500, RHσ (where 950, 850, 700, 500 are pressure levels and σ is standard deviation) and TCWV annual amplitude.

Six distinct moisture regions were identified in the study area. Their characteristics are defined independently in absolute terms and in terms of averages for the whole study area. The most stable moisture conditions are identified in the southern part of the Atlantic region (highest water vapor content in air and smallest differentiation) and the Arctic region, which is characterized by the lowest water vapor content in air and small annual fluctuations and at the same time the greatest degree of saturation. Moisture content varies the most in the Mediterranean and southern temperate continental regions of the study area.

Analysis of the spatial structures of water vapor content in the troposphere over Europe and adjacent to the west Atlantic Ocean has shown the usefulness of TCWV as an indicator of the continental nature of the climate.