EGU2020-11413
https://doi.org/10.5194/egusphere-egu2020-11413
EGU General Assembly 2020

Statistical relationship between the air moisture source and stable isotope composition of precipitation in Hungary

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This study presents a detailed statistical analysis on the relationship of precipitation water origin and its stable hydrogen and oxygen isotope compositions for six sites in Hungary. We carried out a moisture source diagnostic by analyzing backward trajectories as it has become a common method for identifying moisture uptake locations. For providing 96 hours long precipitation-event based backward trajectories, we used the NOAA HYSPLIT model on daily basis for six sites of three elevation, 500 m, 1500 m and 3000 m. The moisture uptake regions were determined by calculating specific humidity along the trajectories. Five possible moisture source regions for precipitation were defined: Atlantic Ocean, North European Seas, Mediterranean Sea, Black Sea, Carpathian Basin and European continental areas excluding the Carpathian Basin. The main water vapor source areas are in order the continental regions following by the Mediterranean Sea and the Atlantic Ocean. However, there are spatial differences among the sampling sites reflecting the importance of the geographical locations. Principal component analysis based on the d-excess value of precipitation events showed that source regions such as the Carpathian Basin, the Atlantic Ocean and Mediterranean Sea are separated on the plain determined by the first two principal components. In order to evaluate the impact of the moisture source region on the d-excess value of precipitation events, we carried out ANOVA on the precipitation-event based macrosynoptic classification (Hess-Brezowsky and Péczely). Our results suggest that there are significant differences between amount-weighted d-excess values belonging to different macrosynoptic patterns and these types are related to precipitation events from different moisture source regions. Cluster analysis confirmed the differences in precipitation stable isotope values according to the moisture sources. The observations (precipitation events) were projected on the plain outspreaded by the first two principal components. The coordinates of the observations in this coordinate-system are separated according to the three main moisture source regions. Cluster analysis was also carried out based on d-excess values. The investigation showed that lower d-

excess values are related to the Atlantic Ocean, while higher values to the Mediterranean Sea. Thus, we can conclude that the moisture source has strong impact on the stable isotope composition of precipitation water even relative far from the marine regions. The research was supported by the ÚNKP-19-3 New National Excellence Program of the Ministry for Innovation and Technology, the National Research, Development and Innovation Office (project No. OTKA NK 101664, PD 121387) and the AgroMo project (GINOP-2.3.2-15-2016-00028).