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Significance of the air moisture source on the stable isotope composition of the precipitation in Hungary

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In the last few years, the analysis of backward trajectories has become a common use for identifying moisture uptake regions for the precipitation of various regions. Hungary is influenced by meteorological (climatological) conditions of Atlantic, Mediterranean and North/East regions therefore this area is sensitive to detect changes in the atmospheric circulation. In this study we present the result of the investigation about the determination of air moisture source regions for six localities in Hungary for more than four years. To reconstruct the path of the air moisture from the source region, we ran the NOAA HYSPLIT trajectory model using the GDAS database with 1° spatial and 6 hours temporal resolution for every precipitation event, for heights of 500, 1500 and 3000 m. We determined the location where water vapour entered into the atmosphere by calculating specific humidity along the trajectories. Five possible moisture source regions for precipitation were defined: Atlantic, North European, East European, Mediterranean and continental (local/convective). Additionally, this study evaluates the regional differences in stable isotope compositions of precipitation based on hydrogen and oxygen isotope analyses of daily rainwater samples. Stable isotope variations show systematic and significant differences between the regions. The variability of moisture source shows also systematic seasonal and spatial distribution. Interestingly, the most dominant among the identified source regions in all stations is the Mediterranean area; while the second is the Atlantic region. The ratio of the precipitations originated in Eastern and Northern Europe seem to correlate with the geographic position of the meteorological station. Furthermore, the ratios of the different moisture sources show intra annual variability.

In each location, the amount weighted d-excess values were calculated for the identified moisture sources. The precipitation originated in the Mediterranean regions has systematically higher d-excess values than that originated in the Atlantic sector, independently from the absolute value which apparently changes from station to station. The precipitation fraction attributed to the Northern European sector has also relatively elevated d-excess values that might be related to the cold-season domination of moisture transport from this region. Thanks for the financial support of the National Research, Development and Innovation Office (project No. OTKA NK 101664, SNN118205/ARRS:N1-0054, PD 121387). György Czuppon also thanks for the support of the János Bolyai Research Scholarship of the Hungarian Academy of Sciences.