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Hydrology of precipitation and groundwater in a plateau area, southward South Carpathians, Mehedinti district, Romania, identified from isotope and climate monitoring

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The investigated region of around 100 square km and is situated on a plateau between 270 and 350 m elevation, between the South Carpathians to the north and Danube to the south. The area is represented by a plateau crossed from north-west to south-east by dry valleys, which cut in the sandy and clayely deposits of Pliocene age. In the region, the primary sources of drinking and irrigation waters are related to natural springs or wells. Through the valleys, water is flowing only temporarily after strong storms or during rainy periods. Between July to September, due the hot summer continental climate, population and crops suffer of water shortage. The objectives of this study are: 1) to determine the Local Meteoric Water Line (LMWL) for the plateau area by measuring the isotopic composition of precipitation in the region; 2) to determine the position of various aquifers in the region; 3) to measure the isotopic composition of spring waters and compare it to precipitation waters, in order to evaluate the source of water. The data set consists of monthly monitoring of rain isotopic composition (for 2012 to 2013), locating the regional distribution of springs and their isotopic composition and measuring daily variations of air temperature and humidity. Water samples were analysed for hydrogen and oxygen isotopic composition at the centre of Environmental Research, Lublin, Poland.
The hydrogen and oxygen isotopic composition of precipitation range from -119 to -23 permil and -14 to -4 permil, respectively. Regression of the data resulted in a meteoric water line which is highly significant (r square = 0.98). The monthly isotopic composition indicates temperature-dependent seasonality. The more negative values occur in the winter to early spring (November–April) and more positive values occur in the late spring to early fall (May–October). The deuterium excess (d-excess) value of precipitation range between 16.3 to 5.7 permil, with an amount weighted mean value of 10 permil. The d-excess values are the lowest in the summer/early fall and highest in the winter. Spring distribution with altitude indicate the presence of two aquifers. The hydrogen and oxygen isotopic composition of spring waters plot close to the midpoint of the LMWL. The isotope data indicate that an integration rain- and snowfall is the water source for the springs and drill water. Therefore, spring isotopic composition is controlled by climate, including amounts of precipitation gain and evaporation loss. Less moisture on multiannual to decadal time scale most probably leads to lower water table height and reduced inflow.
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