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Impact of moisture source regions on the isotopic composition of precipitation events at high-mountain continental site Kasprowy Wierch, southern Poland

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Five-year record of deuterium and oxygen-18 isotope composition of precipitation events collected on top of the Kasprowy Wierch mountain (49˚14'N, 19˚59'E, 1989 m a.s.l.) located in north-western High Tatra mountain ridge, southern Poland, is presented and discussed. In total 670 precipitation samples have been collected and analysed. Stable isotope composition of the analysed precipitation events varied in a wide range, from -2.9 to -26.6‰ for δ^{18}O and from -7 to -195 ‰ for δ^{2}H. The local meteoric water line (LMWL) defined by single events data (δ^{2}H=(7.86$\pm$0.05)δ^{18}O+(12.9$\pm$0.6) deviate significantly from the analogous line defined by monthly composite precipitation data available for IAEA/GNIP station Krakow-Balice (50^{o}04'N, 19^{o}55'E, 220 m a.s.l.), located ca. 100 km north of Kasprowy Wierch ((δ^{2}H=(7.82$\pm$0.11)δ^{18}O+(6.9$\pm$1.1). While slopes of those two LMWLs are statistically indistinguishable, the intercept of Kasprowy Wierch line is almost two times higher that that characterizing Krakow monthly precipitation. This is well-documented effect associated with much higher elevation of Kasprowy Wierch sampling site when compared to Krakow. The isotope data for Kasprowy Wierch correlate significantly with air temperature, with the slope of the regression line being equal 0.35$\pm$0.02 ‰^{o}C for δ^{18}O, whereas no significant correlation with precipitation amount could be established.

The impact of moisture source regions on the isotopic composition of precipitation events collected at Kasprowy Wierch site was analysed using HYSPLITE back trajectory model. Five-days back trajectories were calculated for all analysed precipitation events and seasonal maps of trajectory distribution were produced. They illustrate changes in the prevailing transport patterns of air masses bringing precipitation to the sampling site. Back trajectories for the events yielding extreme isotopic composition of precipitation collected at Kasprowy Wierch were analyzed in detail.

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