



Two-year record of triple isotope composition of daily precipitation at two contrasting sites in central Europe

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Better understanding of factors controlling stable isotope composition of precipitation on various temporal and spatial scales under present-day climate is a necessary step towards more efficient utilisation of water isotope records preserved in diverse environmental archives for reconstruction of past climatic and environmental changes. A two-year record of triple isotope composition ($\delta^{2}\text{H}$, $\delta^{18}\text{O}$, $\delta^{17}\text{O}$) of daily precipitation collected during 2017 and 2018 at two locations in southern Poland is presented. The sites differ greatly in their characteristics. The Krakow station is a low-altitude (220 m a.s.l.) urban site whereas Kasprowy Wierch is a high-altitude (1989 m a.s.l.) mountain station situated in the Tatra Mountains, ca 100 km south of Krakow. Isotope analyses of daily precipitation were conducted with the aid of Picarro L2140-i laser spectrometer. Altogether 591 samples of daily precipitation were analysed (184 for Krakow and 407 for Kasprowy Wierch).

The $\delta^{2}\text{H}$, $\delta^{18}\text{O}$ and $\delta^{17}\text{O}$ values measured in daily precipitation samples reveal expected seasonality, with a maximum of heavy isotope content during summer and a minimum during winter. The extreme $\delta^{18}\text{O}$ values recorded at both sites were as follows: -37.79‰ (d-excess = 9.0‰) in daily precipitation collected at Kasprowy Wierch on February 27, 2018, and -0.65‰ (d-excess = 8.7) in daily precipitation collected in Krakow on April 16, 2018. The δ values measured for Kasprowy Wierch samples are significantly lower than those obtained for Krakow samples, reflecting large difference in the altitude of both sites (ca. 1770 m). Local Meteoric Water Lines differ substantially: mean d-excess value for Kasprowy Wierch is equal approximately 14‰ to be compared with ca. 8‰ for Krakow. The $\Delta^{17}\text{O}$ values measured at both sites range from ca. -20 to 80 per meg, with the mean values of 30 (Krakow) and 31 per meg (Kasprowy Wierch). The $\delta^{2}\text{H}$, $\delta^{18}\text{O}$ and $\delta^{17}\text{O}$ values correlate well with daily air temperatures measured at both sites. The data yield the mean slopes of the best fit lines of isotope/temperature relationships equal 3.5 ± 0.2 , 0.44 ± 0.03 and 0.23 ± 0.02 , for $\delta^{2}\text{H}$, $\delta^{18}\text{O}$ and $\delta^{17}\text{O}$, respectively.

To link the observed triple isotope composition of daily precipitation collected at Kasprowy Wierch station, backward trajectory analysis of the moist air masses precipitating at this site during 2017-2018 period was performed. Backward trajectories were calculated and cluster analysis of this dataset was performed, yielding dominating directions of moist air masses bringing precipitation to Kasprowy Wierch and their respective isotope characteristics.

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