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Spatial-temporal variations in isotopic composition of precipitation over the Japan Alps area

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Precipitation samples, collected monthly at 14 locations over the Japan Alps area from July 2010 to June 2011, were served for isotopic analyses. The weighted mean values of $d^{18}O$, dD and d-excess ranged from -10.89 to -14.10 permil, from -77.25 to -93.2 permil and from 8.88 to 11.60 permil, respectively. Significant negative correlations were found between weighted mean values of d18O and dD and altitude. The slopes of altitude effect for $d^{18}O$ and dD were -0.12 permil/100m, -0.90 permil/100m, respectively. Although d-excess was low in summer and increased gradually toward winter in all the points, temporal patterns in monthly $d^{18}O$ were divisible into two groups, mountainous region (more than 1000 m of altitude) and basin region (less than 1000 m of altitude), according to cluster analysis. The high $d^{18}O$ in January was commonly found in mountainous regions, whereas monthly $d^{18}O$ of basin regions gradually decreased during winter season. Significant negative correlations between monthly $d^{18}O$ and altitude were found through warm seasons except June, whereas no correlation in November, December and January. Especially, no significant but positive correlation was found in January. To discuss this inverse relationship between altitude and $d^{18}O$ in January, we investigated the relationship between precipitation and synoptic conditions in winter and indicated that wintry pressure pattern had mainly brought precipitation in January. Therefore, high $d^{18}O$ of precipitation in January could be attributed to water vapor from the Japan Sea. These results suggest that isotopic composition in precipitation over Japan Alps area is controlled by altitude effect in warm seasons and affected by synoptic conditions in winter.

Keywords: water stable isotopes, precipitation, Japan Alps area