Spatial and temporal variation of stable isotopes in precipitation in Hokkaido, North Japan

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Stable isotopes in precipitation have been widely used for paleoclimate and paleohydrology reconstruction, which is based on its temperature effect and amount effect. However, the relationship of stable isotopes of modern precipitation against meteorological variables has not yet been understood well. In this study, precipitation was collected at 6 locations in Hokkaido during the period from March 2010 to February 2013 to investigate relationship between isotope ratios of precipitation and meteorological condition and to clarify the underlying processes. Relatively low $\delta^{18}O$ with high d-excess for annual averages were observed at three sites in the region along Sea of Japan (Teshio, Nakagawa and Sapporo), compared to the other three sites on Pacific side (Tomakomai, Shibecha and Akkeshi). Seasonally, winter precipitation showed the lowest $\delta^{18}O$ and highest d-excess among seasons. Weekly $\delta^{18}O$ was positively correlated with temperature and negatively with the amount of precipitation in most season and regions. To investigate the relationship between meteorological condition and $\delta^{18}O$ values, 264 precipitation events were identified. Precipitation events from low pressure systems were classified into three groups (northwest, southeast and middle) according to their trajectories. Precipitation events with trajectory of southeast of Hokkaido showed relatively lower $\delta^{18}O$ than those in northwest, although the amount of precipitation in Hokkaido area was not different between them. Lower $\delta^{18}O$ values observed in earlier case was attributed to lower $\delta^{18}O$ values of water vapor due to heavy rainfall in the upstream region of the trajectories of low pressure systems on Pacific Ocean. Observed isotopic composition of water vapor also supports this.

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