Factors controlling seasonal variations in isotopic composition of precipitation and atmospheric water vapor in Sapporo,Japan

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Sapporo is located in southwest area of Ishikari plain of Hokkaido, where is surrounded by ocean, and wind direction at Sapporo varies seasonally. Therefore, atmospheric water vapor which causes precipitation is likely to originate from various areas. Precipitation and atmospheric water vapor were sampled for isotopic analysis at Sapporo from June in 2006. Precipitation samples were collected for each precipitation event. Atmospheric water vapor samples were collected during daytime, several times a month. The delta-D and delta-^{18}O values were obtained, then d-excess defined as delta-D-8$*$delta-^{18}O was calculated.

The delta-^{18}O of precipitation at Sapporo ranged from -20 permil to -5 permil through a year. Isotopic composition of precipitation showed amount effect (decrease in isotope ratio with increase in precipitation) during summer, and temperature effect (decrease in isotope ratio with decrease in temperature) during winter. The d-excess value of precipitation ranged from 5 permil to 40 permil, showing clear seasonal variation. The d-excess value was low during summer, whereas it was high during winter, corresponding to the change in wind direction of monsoon.

The delta-^{18}O of atmospheric water vapor ranged from -26 permil to -12 permil, and varied with the change in wind direction, although a specific wind direction did not result in a specific change in delta value. Interestingly, decrease in delta value associated with the change in wind direction was observed when low pressure system was developed and passed nearby Sapporo. Precipitation process in the developed low pressure system may be responsible for the decrease in the delta values.