

Method for the determination of hydrogen and oxygen isotopic composition of each rain-drop

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Evaporation from falling raindrops is one of the important issues for understanding hydrological cycle in the atmospheric boundary layer, although there are few approaches for quantitative evaluation. We try to clarify it based on the isotopic approach as follows; 1) to develop the method for collecting each raindrop and 2) to develop the method for determining isotopic composition for micro-liter water samples.

Experiments

1) Method for collecting each size of raindrop

Water drops with the radius from 0.5mm to 1.5mm are frozen by liquid nitrogen and collected. Weight and isotopic composition of each size of ice particles are determined. Since water drops are suspended on the surface of liquid nitrogen until complete freeze, suspending time are also measured.

2) Method for determining isotopic composition of micro-liter water

For oxygen isotopic composition, three micro-liter of water is reacted with cobalt(III) fluoride heated at 370 degrees C under constant He flow. Generated oxygen gas is collected by molecular sieves cooled at liquid nitrogen temperature, then oxygen isotopic composition is determined by isotope ratio mass spectrometer (IRMS). For hydrogen isotopic composition, also three micro-liter of water is reacted with zinc (Indiana Zinc) in the reaction vessel. Generated hydrogen gas is directly introduced to IRMS.

Results

A good linear relationship between water drop and ice particle were found for their size and weight. Isotopic analysis for ice particles from 1.0mm to 1.5mm as equivalent drop radius resulted that each size of ice particles showed higher values both in hydrogen and oxygen and these difference were constant but independent from drop size. As a result, we concluded that isotopic composition of each raindrop could be determined by liquid nitrogen collecting method.