

Isotopic composition of atmospheric water vapor and evapotranspiration flux: Comparison between Japanese and Mongolian grasslands

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Cryogenic trapping of atmospheric water vapor at two levels above grassland was carried out in Japan (Tsukuba, Ibaraki Prefecture) and Mongolia (Kherlen-Bayan-Ulaan, Khentey Province), and isotopic composition of the collected water vapor was determined. Using the water vapor isotope data and mixing ratio, isotope flux ratio (i.e., isotopic composition of evapotranspiration flux) was evaluated by Mixing Line method.

The result of temperate grassland in Japan showed that isotopic composition of atmospheric water vapor was significantly lower than that of soil water. Isotopic composition of evapotranspiration was almost same with, or slightly lower than that of soil water. These results suggests that water vapor isotopes within a few meters height in the atmospheric surface layer is affected by mixing of upper air. In addition, calculation using these isotope data shows that transpiration shares more than approximately 90% of total evapotranspiration.

On the other hand, the result of dry steppe grassland in Mongolia showed that isotopic composition of evapotranspiration was lower than that of soil water. Ratio of transpiration against total evapotranspiration is relatively small, that is, contribution of evaporation from soil surface is significant.

It can be easily understood that the above results are induced by difference in Leaf Area Index between temperate grassland and dry steppe grassland.

Because the contribution ratio of transpiration and soil evaporation cannot be evaluated by micrometeorological observation including turbulence measurement, the information deduced from isotope measurement is useful, for instance, for validate ecosystem flux models. However, measurements at three or more levels are required for improvement of accuracy of isotope flux ratio determination.