

Determining the role of dew in an alpine meadow in northeastern Qinghai-Tibet Plateau using hydrogen-oxygen isotope method

Jing Li¹, Fawei Zhang², Yangong Du³, Guangmin Cao¹, Bin wang⁴, and Xiaowei Guo¹

¹Northwest Institute of Plateau Biology Chinese Academy of Sciences

²Northwest Institute of Plateau Biology, Chinese Academy of Sciences

³Northwest Institute of Plateau Biology

⁴NSW Department of Primary Industries, NSW DPI, Wagga Wagga, NSW Australia, 2650

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Abstract

Dew is closely related to the micro-use of water and to large-scale hydrological processes. Dew formation on grasslands plays a particularly vital role in maintaining the ecohydrological cycle. Stable isotope information for dew, ambient water vapor, soil water, plant water, creek water, and precipitation were tracked to determine the role of dew in ecohydrological processes in the meadow. The structural equation modeling was used to investigate how environmental factors affect dew formation. The Mix SIAR model in R was used to determine the source of dew, and explore the dew transport route of six species of the graminoid-Kobresia meadow in an alpine graminoid-Kobresia meadow in northern Qinghai-Tibet Plateau. Our results showed that the amounts of dew ranged from 0.002 mm to 0.22 mm, the frequency of dew was 42.86%-45.83% during summer in 2020 and 2021. Both atmospheric pressure and temperature showed significant positive effects on dew formation, while wind speed had a negative effect. Evapotranspiration indirectly affected dew formation. The contribution rates of soil water, plant water, and ambient water vapor to dew formation were $48.20 \pm 5.46\%$, $38.30 \pm 5.07\%$, and $13.50 \pm 1.82\%$, respectively. The proportion of dew utilization by graminoid and Kobresia species showed no significant species differences. Our statistical analysis determines the role of dew in an alpine graminoid-Kobresia meadow in the northern Qinghai-Tibet Plateau, which provides an improved understanding of dew formation based on a stable isotope technology.

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