

Non-rainfall water inputs in Hulu catchment of Qilian Mountains, northwest China

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Purpose: Non-rainfall water inputs (NRWIs) mainly includes dew/frost, fog water and water vapor adsorption (Agama et al., 2006; Ucles et al., 2013). NRWIs has important ecological significance for the survival and growth of animals, plants and microorganisms in a dry environment (Beysens et al., 2016). NRWIs is frequently abundant in high mountain areas. What is the effect of NRWIs on the hydrological cycle and response to climate change in the high mountain region?

Methods: Lysimeter is a container used to measure gains and losses of water including NRWIs. To measure the amount of dew water by two lysimeters from 2013 and to harvest fog water use three identical standard fog collectors in different elevation from July 2014.

Results: From 2013 to 2016, dew water quantity observed in alpine grassland area of Hulu catchment was 32.5mm, 31.7mm, 29.4mm and 30.0mm, respectively. One year fog collecting observational data shows: fog water with elevation gradient is obvious. NRWIs amount can reach 5.1-6.2% of the precipitation in the same period, which is an important part of the hydrological process in this area. Frequency of NRWIs continue to occur is considerably higher than the precipitation; NRWIs can be seen as the adjustment amount water resource of alpine mountain hydrological cycle process.

Interpretation: As the temperature increases, the atmospheric water holding capacity increases and the water cycle accelerates. The change relationship between saturated water vapor pressure and temperature represents an increase of one degree Celsius in temperature will increase the atmospheric water content by 6.1-7.0%. With the increase of atmospheric moisture content, the occurrence frequency of NRWIs events and amount also increases.

Conclusion: NRWIs is an important part of the hydrological process in the high mountain area. NRWIs is of great significance for maintaining fragile ecosystems in high mountain areas and is a sustained-release agent for ecological and hydrological processes in high mountain areas. The condensation and evaporation process of shallow soil may be one reason why the surface energy is not balanced. Seasonal NRWIs frequent enrichment is a potential exploration point for hidden water sources in high mountains.