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The Determination of the Effective Rainfall in the Badain Jaran Desert

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Located in western Inner Mongolia, Badain Jaran Desert is the second largest desert in China and consists of a regular series of stable megadunes, among which over 70 permanent lakes exists. The unexpected lakes in desert have attracted research interests on exploring the hydrological process under this kind of particular landscape. Among the desert hydrological process, the precipitation is often the solo source of water replenishment, while the infiltration is the main process to understand how much volume of rainfall could remain in sand to be available for the desert plants. That portion of rainfall remained in sand was called as effective rainfall. In this study, the effective rainfall is defined as the amount of soil water captured by the sand beneath the evaporation front by infiltrating water of a rainfall event, and thus not be evaporated, and is evaluated based on the unsaturated zone soil water balance model. In order to understand the effective rainfall in the Badain Jaran Desert, a field campaign was conducted with the monitoring of soil physical parameters and micrometeorological parameters. With the field data, the performance of a vadose zone soil water balance model in sand, the HYDRUS, was verified and calibrated. Then, the HYDRUS was used to produce the spatial and temporal information of coupled water, water vapor and heat transport in sand to characterize the variation pattern of the evaporation front before, during and after the rainfall, so that the volume of rainfall conserved in the sand could be assessed. Finally, the capacity of the sand dune for capturing certain amount of rainfall to be available for desert plants during a single rainfall event was discussed.