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High-resolution hydrologic dynamics of the Nadadish experimental catchment in Chuzhou Hydrology Laboratory, China

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To obtain new hydrologic data and reveal new hydrologic mechanisms, it is key to perform high-resolution observation of hydrologic dynamics in experimental catchments. Supported by Chuzhou Hydrology Laboratory, this study conducted experimental investigation of hydrologic dynamics in Nandadish experimental catchment during 2015-2019. Nandadish with an area of 7897 m^2 is a natural experimental catchment covered by forest whose dominant tree species are B. papyrifera and Q. acutissima. The surface surrounding boundary was sealed by concrete so that Nadadish forms an excellent critical zone experimental block (CZEB). Four rain gauges were installed over the towers to measure the rain over the trees (inferred as P); 144 rain gauges were used to measure the rain under the trees (i.e. throughfall); and 31 trees were equipped to collect stem flow. A separate runoff observation system was constructed to measure the runoffs in different layers: the uppermost trough collects throughfall; the next lower trough collects surface runoff (RS); the two lower troughs collect subsurface flow from soil layers with the depths of 0–50, and 50–100 cm (inferred as R50 and R100). Soil moisture was observed by 31 profile-type sensors with 9, 12 or 15 sensor points with a depth spacing of 10 cm. An array of 30 galvanized tube wells intersected through the soil till the bed rock. Water table measurement was performed with pressure-type sensors at the bottom of each well. According experimental results, conclusions are determined as following: (1) Throughfall variability during the leafed period was slightly higher than that during the leafless period inferred from the coefficient of variation of throughfall amounts, with 13.2-40.9% and 18.7-31.9%, respectively. The multiple regression model analysis suggested that the controlling factors of throughfall variability were significant differently in different periods. (2) B. papyrifera required less precipitation amount (4.3 to 5.8 mm) to initially trigger stemflow than Q. acutissima (5.4 to 6.0 mm). (3) Under the condition of P≥25 mm, the proportion of RS, R50 and R100 was 46.3%, 15.2% and 38.5%, and thus the subsurface runoff dominated the runoff. The synthetic runoff coefficient of total runoff was 0.33; the synthetic runoff coefficients of Rs, R50 and R100 were 0.15, 0.05 and 0.13, respectively. (4) The depths of soil distinction layers were located at the range of 80-90 cm based on the data of profile soil moisture. (5) Saturated overland flow occurred in the area where the gentle slope with soil depth of less than 1 m was located at the mid-downstream through analyzing the water table dynamics. This investigation can enhance the in-depth understanding of hydrologic dynamics in the small forest headwater catchments.