

Spatiotemporal variations of groundwater level and gully impact in two peatland watersheds in the Source Region of the Yellow River

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Abstract

The spatiotemporal variability of groundwater level (GWL) is an important property of peatland hydrology that directly affects fluctuations of water storage. Nonetheless, current understanding of the variations of GWL in different time scales still remains unclear. In this study, two peatland watersheds (0.151 km² for W1 and 0.844 km² for W2) in the Zoige Basin in the Source Region of the Yellow River (SRYR) were selected for monitoring the temporal variability of GWL using self-recorded water loggers during 2017-2021. The main results demonstrate that: (1) GWL variations tended to be controlled by gully drainage in sites adjacent to the gully and be more synchronized with rainfall in sites distant from the gully. The GWL near the gully that cuts through the peat layer was lower than that near the gully without cutting through the peat layer, with a maximum difference between the former and the latter of 58.3 cm, indicating the effect of longitudinal attenuation of the GWL in W1. (2) Because rainfall had a lag effect on the GWL, the length of lag gradually decreased with increased rainfall intensity (i.e., the lag time of sites far away from the gully was about 18 min shorter than that of sites close to the gully in W1). (3) The peak values of the GWL occurred simultaneously with the maximum and minimum rainfall in W2, and the peak occurrence time was related to the ratio of precipitation to evaporation. In the downstream sites, GWL fluctuated more intensively than the upstream ones in W2. Moreover, the average GWL of the upstream sites was 14.3 cm higher than that of the middle ones, indicating a decreasing trend of water storage along the gully. (4) The GWL discrepancy between wet and dry seasons was explicit, but the difference was smaller in the upstream sites due to limited gully incision and higher water storage within the peat layer. Additionally, rainy days dominate the GWL change in wet and dry seasons, but the different rainfall intensity resulted in a stable GWL in the dry season and an oscillating GWL in the wet season in W2. This study uncovers the spatio-temporal variation of groundwater level in two peatland watersheds, which is of great significance for understanding runoff variation, ecohydrological processes, and wetland shrinkage in the SRYR.

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Table 1 Basic parameters and installation information.docx available at <https://authorea.com/users/339151/articles/643390-spatiotemporal-variations-of-groundwater-level-and-gully-impact-in-two-peatland-watersheds-in-the-source-region-of-the-yellow-river>