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Spatial variations in saturated zones at the soil–bedrock interface

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Recent studies have suggested that the spatial variations in saturated zones at the soil-bedrock interface have great implications for the nonlinear rainfall–runoff responses and the amount of subsurface stormflow. To clarify the spatial and temporal variations in saturated zones at the soil–bedrock surface, we measured soil pore water pressure at the soil–bedrock interface by tensiometers and observed the expansion patterns of saturated zones during the precipitation and recession periods in a small and steep headwater catchment. Soil depth surveyed by simplified penetration test extensively ranged from 0.5 m to 5 m in the catchment. Our results showed that the subsurface saturation at the soil-bedrock interface expanded along a specific pathway which was not consistent with the bedrock hollow. In some storm events, the saturated zone generated earlier at the upslope site than downslope site in the catchment. There was a positive correlation between soil depth and the response time from the beginning of precipitation to the occurrence of the subsurface saturation. It indicated that soil depth would influence the response time of subsurface saturation due to vertical rainwater infiltration. In addition to the results above, we could further suggest that the spatial patterns and temporal variations in subsurface saturated zones were controlled by both bedrock topography and soil depth.