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Quantitative assessment of check dam system impacts on catchment hydrological response - a case in the Loess Plateau, China

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The purpose of this study is to investigate the impact of check dams on catchment hydrological response in a small catchment on the Chinese Loess Plateau by applying a GAST (GPU Accelerated Surface-water and Transport model) numerical model at 2 m resolution DEM. The results showed that check dams significantly increase the so-called runoff lag times (lag to generation, lag to peak and lag to end of runoff) at the channel outlet compared to catchments without check dams. Furthermore, the peak runoff discharge at the catchment outlet without check dams decreased by 93.0% compared to with check dams. The total outlet discharge, surface water stored, and infiltration were respectively 20.1%, 74.9% and 5.0% of the total precipitation in the check dam catchment, while 75.4%, 22.6% and 2.0% in the system without check dams. Installation of check dams also altered the spatial water distribution of maximum discharge, moving the occurrences of maximum discharge further upstream and, thus, increasing safety downstream. Channel connectivity was found to have a direct relationship with peak discharge and with discharge volume at the basin mouth. In conclusion, implementing check dams significantly and effectively mitigated flood processes and increased runoff infiltration upstream.