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Effects of Water Storage and Demand on Hydrological Drought Propagation in Upstream and Downstream Areas

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A b s t r a c t

Anthropogenic factors contribute to the uneven distribution of hydrological droughts and differences in the duration and magnitude of hydrological drought in upstream and downstream areas. This study assesses how reservoir storage and water demand intensify or mitigate hydrological drought in the Shaying River basin in China. The study uses "downstreamness" as a concept to show the effect of a reservoir network on hydrological drought. For the period 1990–2018 we show that when water storage is unequally distributed between upstream and downstream areas the spatial distribution of hydrological drought also differed across upstream and downstream regions. Moreover, water demand also clearly influenced hydrological drought. Furthermore, we show a significant decreasing trend of water storage and outflow in studied reservoirs while the rates of precipitation and evaporation did not indicate a significant decreasing trend. This finding clearly shows the dominant role of human activities in intensifying hydrological drought and how this is distributed between upstream and downstream parts of a river basin. As such, this study provides useful insights that can support policymakers in formulating and evaluating drought and water policies at the river-basin scale, thus targeting solutions for both upstream and downstream areas.

Keywords: hydrological drought, reservoir operation, water demand, downstreamness, Mann-Kendall test, human activities.

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