The Spatio-Temporal Variation Characterization of Ecological Drought in the Yangtze River Source Region, China Using a Standardized Water Supply-Demand Index

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Abstract

It is important for drought risk assessment and sustainable development of water resources on the basis of understanding the spatio-temporal characteristics of drought and return period. This study introduced a new drought index, standardized supply-demand water index (SSDI), and a run theory which are applied to identify ecological drought events and parameters (e.g. duration, severity, peak and coverage area) in the Yangtze River Source Region (YRSR). And the bivariate probability and return period were calculated via 2-dimensional joint copula to investigate the drought-prone regions. The results indicate that: (1) Compared with traditional meteorological drought index, the SSDI is reliable and can reflect the comprehensive characteristics of the ecological drought information more easily and effectively; (2) The YRSR had witnessed the most severe drought episodes in the periods of late-1970s, mid-1980s and mid-1990s, but the SSDI showed a wetting trend since mid-2000s. And droughts in the Southern YRSR were relatively more severe with longer drought duration; (3) In most areas of Togton River Basin and Dam River Basin, the severe ecological drought events happened more frequently; (4) Drought duration and severity in the YRSR were more susceptible to temperature when the temperature rise were above 1.0°C. The average drought duration and severity increased by 20.7% and 32.6% with a temperature rise of 1°C.

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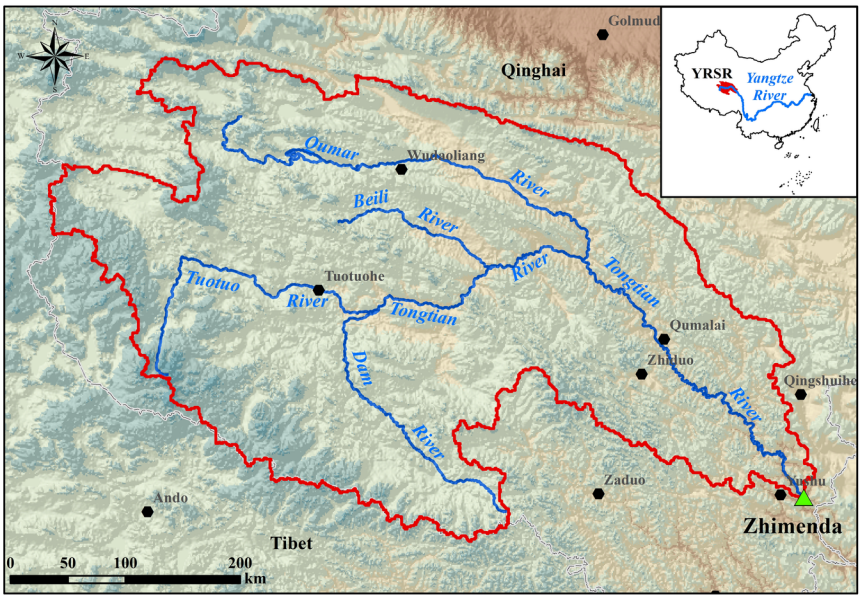
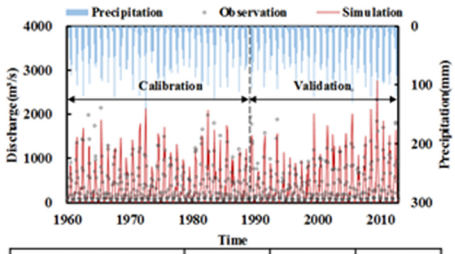


Num. of sub-basins: 119

Threshold drainage area: 80 km²

Num. of Hydrological response units:265



Period	E_{NS}	R^2	RE(%)
Calibration (1960 to 1990)	0.81	0.84	-6.8
Validation (1991 to 2012)	0.84	0.87	-8.8