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Multi-scale analysis of hydroclimatic change in the Jinsha River basin, the Chinese drainage basin with the largest hydropower potential

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Although the hydroclimatic effects of flow regulation by individual impounded reservoirs have been often studied in the literature, the cumulative effects of cascading reservoir systems in large drainage basins are still not well studied or understood. Here we investigated hydroclimate change in a basin in southwestern China, the Jinsha river basin, and several of its aggregated subbasins, and studied the change that could be driven by reservoir impoundment and flow regulation. The basin has been subject to the construction of several impounded reservoirs, with many more to be constructed in the near future. First, three gridded databases were used to reduce the uncertainty of precipitation data. Actual evapotranspiration was calculated based on the water budget method and potential evapotranspiration was calculated based on satellite (MODIS) and station (CRU) data. Change in mean runoff, the coefficient of variation of daily runoff (CVR) and in relative potential and actual evapotranspiration (ET0/P and AET/P) were calculated and used as proxies of hydroclimatic change. Data on Normalized Difference Vegetation Index (NDVI) before and after the impoundment of the main reservoirs were used to identify factors other than flow regulation influencing relative actual evapotranspiration. Results showed that the impoundment of the two largest reservoirs resulted in a decrease in CVR and its variability and possibly an increase in AET in some of the subbasins, agreeing with previous research studying the impact of reservoirs on the regional hydroclimate. Furthermore, change in NDVI showed that besides flow regulation, change in forest cover might also explain some of the changes in basin evapotranspiration. Studies like this continue gathering evidence on the hydroclimatic effects of flow regulation and hydropower development in regulated basins.