

## **Abstract**

The Helmand Transboundary River is the main drainage system in the southern part of Afghanistan and has a significant impact on the socioeconomic balance of the Sistan region in Iran. The persistent and intensifying hydrological drought causing the scarcity of water and depleted supplies for irrigation has been effective in reducing agricultural production and increasing migration in the Sistan region. For drought management, knowledge of factors affecting the development of hydrological droughts is essential. Due to the significant rise of drought in the Sistan region in recent decades, we quantified the drought characteristics throughout the basin to reveal the temporal and spatial pattern of drought in the Sistan Plain. The meteorological and hydrological droughts were reanalyzed based on the precipitation and streamflow records using the multi-month timescales during 1970–2006, a period of 37 years. To reproduce the river discharge to evaluate the hydrological drought, the distributed process-based hydrological model was first developed. The results indicate that the hydrological model performed quite well in both calibration and validation periods in the entire basin. The drought analysis represented that the trend of hydrological droughts in the Sistan Plain considerably changed in the last decade of the study period due to the increasing abstractions from the Helmand River associated with the rising evaporation, which have led to extending the severe drought of long duration in the Sistan area. This paper demonstrates the time taken for droughts to propagate from upstream to the Sistan region. Findings also reveal a strong relationship between hydrological and meteorological droughts in the Upper and Central Helmand River Basin. The effects of climate change on the river discharge and droughts was studied in the study area. According to results, the annual average of precipitation and monthly average of temperature will decrease and increase, respectively rather than the historical data, based on the climatic models and scenarios RCP4.5 and RCP8.5 and. The evaluation of river discharge under the effect of climate change shows the reduction of runoff in compare with the historical period. Also the frequencies and magnitudes of droughts will be increased in the future and the hydrological droughts will be intensifying more than the meteorological drought in the basin.

**Keywords:** Hydrological drought, Distributed hydrological model, Human activities, Drought propagation, Helmand River Basin



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