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Assessment of climate change consequences on Probable Maximum Flood in a basin scale, southwestern Iran

Theoretically, Probable Maximum Flood (PMF) is the largest flood that the most severe meteorological and hydrologic conditions may produce in a given area. It is often used as a design criterion for proposed dams and similar hydraulic structures on rivers. However, the criterion typically assumes climatic stationarity; utilizing a static design value known as Probable Maximum Precipitation (PMP) to calculate PMF. In this research, the mentioned assumption is relaxed and climate change impact on PMF calculation in Chenar-Rahdar river basin, southern Iran is investigated. HadCM3 and CGCM3, as the two commonly used Global Circulation Models (GCMs), were employed under A2 emission scenario. Utilizing three statistical downscaling methods, namely Change Factor (CF), Statistical Downscaling Model (SDSM), and Long Ashton Research Station Weather Generator (LARS-WG), precipitations over the basin were downscaled to 24-hr rainfalls for the future period of 2011–2040 (2020's). Then, statistical approaches were undertaken to estimate PMP with different return periods for the base (1971-2000) and the future periods. HEC-HMS, coupled with ArcGIS, was utilized to develop a rainfall-runoff model for the basin, which was calibrated for five and validated for two observed floods. Results showed that, for both GCMs, all three downscaling methods projected increasing trends with respect to the base period in extreme flood events over the basin.

Keywords: Probable Maximum Flood (PMF), Climate Change, Basin Scale, Global Circulation Models, Downscaling methods