

## Impacts of Climate and Land Cover-Land Use Changes on Flood Characteristics in Gorganrood Watershed (Northeastern Iran), 1973-2014

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This study evaluated the effects of changes in climate and land cover-land use (LCLU) on flood intensity and frequency in the Gorganrood Watershed (GW) located in the northeast of Iran during recent decades. For this purpose, hydroclimatic (precipitation, temperature and river discharge) time series recorded at nine different stations placed in GW during 1973-2014 were applied. Flood characteristics (in terms of mean, maximum and number of peaks) at five discharge stations sited in the outlet of GW sub-basins were determined using the Peak-Over-Threshold (POT) method to daily specific discharges, which were considered to remove the effect of different size of sub-basins. The study period was divided into three 14-years segments (1973-1986, 1987-2000 and 2001-2014) based on satellite LCLU maps produced for 1973, 1986, 2000 and 2014. In GW, both flood intensity and frequency increased, climate became wetter and warmer, and LCLU mostly converted from rangeland to farmland, during recent decades. Precipitation and temperature also increased in all five sub-basins of GW over time, while farmland increases caused rangeland and forest areas to decrease. Such changes in climate and LCLU resulted in more intense and frequent floods in these sub-basins. Only exception refers to Haji Ghushan sub-basin in which mean and number of peaks were at the lowest level during the second 14-years segment (1987-2000). However, correlation analyses identified that flood intensity and frequency in GW and its sub-basins were strongly connected to their LCLU conversions, but moderately to observed wetter and warmer climate. Such findings provide a scientific basis for environmental decision makers and their relevant stakeholders to develop adaptation and mitigating strategies for sustainable water resources management in flood prone areas, like GW, under continuing climate and LCLU changes.

Key words: Climate change, land use-land cover, flood characteristics, peak-over-threshold, Iran