Geophysical Research Abstracts
Vol. 20, EGU2018-14390-2, 2018
EGU General Assembly 2018

Non-stationarities in observed and projected streamflow extremes for upper Euphrates basin

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Under changing climate, the probabilities of hydroclimatological extremes can no more be assumed as stationary. Due to non-stationary climate conditions, we may observe increasing/decreasing trends or a random shift in extreme events. These changes in probabilities may lead to the changes in return periods and return levels of streamflows. In this study, we have studied the impact of non-stationarities on eight sub-basins of upper Euphrates basin. In order to evaluate the impacts of non-stationarities on these stations, stationary and non-stationary forms of GEV (generalized extreme value distribution) and gumbel and normal distribution functions are applied for different return levels of stream flow extremes. Then differences in return levels for both cases (with and without non-stationarity) are analyzed throughout upper Euphrates basin. A non-stationarity impact (NSI) index is formulated to represent the results of non-stationarity analysis on regional scale. Future effects from non-stationarity are also assessed using hydrological modeling for four selected sub-basins. HBV-light was calibrated in semi-distributed form where the sub-basins were divided into different elevation and vegetation zones. Ensemble climate model projections of temperature and precipitation from CORDEX were used as the inputs to simulate the projected flows. It was found that the non-stationarity has important effect on determining the return levels for observed and projected streamflows.