The title (العنوان):

Regional flood frequency analysis in North Africa

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Abstract : The Maghreb countries located in North Africa are strongly impacted by floods, causing extended damage and numerous deaths. Until now, the lack of accessibility of river discharge data prevented regional studies on potential changes in flood hazards or the development of regional flood frequency estimation methods. A new database of daily river discharge data for 98 river basins located in Algeria, Morocco, and Tunisia, has been compiled, with an average of 36 years of complete records over the time period 1960–2018. A peaks-over-threshold sampling of flood events is considered first to detect trends in the annual frequency and the magnitude of floods. The trend analysis results revealed no significant changes in flood frequency or magnitude at the regional level, with only a few spurious trends due to isolated extreme or clustered events. An envelope curve relating maximum floods for a range of catchment areas in North Africa has been developed, for the first time in this region with such a large database. Then, regional estimation methods for flood quantiles were compared. The regional estimation from multiple catchment characteristics (including soil types, land use, elevation, and geology) was performed by comparing two multiple linear regression methods, Stepwise regression and Lasso regression, and a machine learning algorithm, Random Forests. Results indicate a better performance of the Lasso regression to estimate flood quantiles at ungauged locations, with mean absolute relative errors close to 50 % and relative bias close to 20 %. The most relevant catchment predictors identified by the regression models are the topographic wetness index, which provides better estimates than catchment area, but also altitude, mean annual rainfall, and soil bulk density. The results of this study could be useful to improve operational procedures for sizing hydraulic structures at ungauged sites.

Key words : flood frequency analysis ; North Africa

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