



Design extremes in a warming climate- A global assessment of changes in antecedent conditions preceding extreme rainfall events with warming temperatures

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Antecedent moisture of a catchment is an important variable that influences, amongst other things, the severity of floods that occurs in a catchment. While there exist several studies that evaluate changes in extreme precipitation as well as attribute such trends to global warming, an assessment of whether or not trends exist in antecedent moisture condition prior to such extreme rain has not been conducted. In this study, antecedent precipitation index (API), a weighted sum of precipitation preceding extreme events, is used as a surrogate measure of antecedent moisture to evaluate possible trends in different regions of the world. To this end, trends in annual API for tropical and extra-tropical regions as well as for each continent across the world are estimated as follows. First, a threshold precipitation is selected to obtain, on average, five extreme precipitation per year at each observation station using daily precipitation data across the world. Second, API at each of these extreme precipitation as well as exceedance probabilities of the API are determined. Finally, trends in the exceedance probabilities of the API together with the associated uncertainty are estimated for the tropics and extra-tropics as well as each continent of the world using the Thiessen polygon method. Estimation of trends based on exceedance probabilities of the API, rather than the API itself, allows to objectively compare trends across different observation stations and regions. We found a significant increasing API trend in Africa, Europe and Australia as well as Extra-tropics regions whereas significant decreasing trend being obtained in South America and the Tropics. The analysis in North America and Asia does not indicate any significant trend. Overall, this study reveals that significant trends exist in the antecedent moisture in many parts of the world, which needs to be considered in the estimation of design flood as well as planning and design of hydraulic structures.