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Influence of climate change on drought occurrence in catchments across the globe

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Drought events and related drought impacts on society and environment are expected to increase in severity due to changing climate. To reduce or to better adapt to these impacts, more knowledge about changes in hydrological drought characteristics (e.g. frequency, duration) in the far future is needed. In this study, effects of projected climate change scenarios on drought events in several catchments across the globe with contrasting climates and catchment characteristics were investigated. An ensemble forecast of five large-scale hydrological models run within the WATCH project was used to identify hydrological drought characteristics in the control period (1971-2000) and the future period (2071-2100). The variable threshold level method was applied to determine occurrence of drought events and associated characteristics. The model results were compared with observations of discharge from the GRDC database for the control period. For the future period, downscaled and bias-corrected data from three General Circulation Models (GCMs), A2 emission scenario, were used as forcing for the large-scale models. Besides changes in discharge regimes, changes in precipitation from each GCM, and changes in evapotranspiration from each hydrological model will be studied. These meteorological data will be included to identify impact of drought propagation and the relative contribution of different hydrological processes to changes in drought characteristics. A consistent framework of drought related metrics was used to determine if each individual ensemble member had a sufficient performance in the control period or should be excluded from the analysis for particular catchments in the future period. Each catchment had a different optimum of models to be included in the ensemble, because model results could show large differences with the observed data depending on climate and catchment characteristics. The results for the future period will be compared with the control period and relative changes in drought occurrence and severity will be quantified. It will be discussed to what extent future drought characteristics obtained in this study agree with a previous single model study that projected a decrease in drought occurrence and a strong increase in average drought duration for occurring drought events. Likely the largest decrease in drought occurrence will be found in cold climates whilst semi-arid climates show only a small decrease in drought occurrence. Although single model results showed drought occurrence will likely decrease globally, the severity will increase leading to severe impacts in already water scarce areas when adaptation measures are not implemented.