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Investigating climate change effects on climatological droughts events modelled as multivariate phenomenon in Hessen, Germany

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Meteorological droughts, seen as a deficiency of precipitation in a certain period, may have large impacts on human activities and environment. As droughts are characterized by several variables, a better understanding is achieved by analysing it as a multivariate phenomenon. In the present study, we examine meteorological droughts by means of the standardized precipitation index (SPI) and derive from this drought duration and severity. The joint dependency of these characteristics is modelled by a copula function which relates their univariate distribution in a functional relationship. Recurrence intervals as a function of joint duration-severity model and marginal models are built. The analysis covers the observation period 1971-2000 as well as the near future 2021-2050. For this last period, we use downscaled regional climate model (RCM) projections from EURO-CORDEX for three representative concentration pathways (RCP 2.6, 4.5 and 8.5). Comparison between these two periods is carried out to examine the variation in the pattern and the magnitude of drought events in the Fulda catchment, Germany. Results suggest changes in the duration-severity relationships for the different return periods given by changes in the pattern as well as in the magnitudes of duration and severity. These changes depend on the RCM and the RCP considered. We found strong variability in the number of drought events with an increase of up to 4 events and a decrease of up to 8 events comparing future with a present period. Concentration pathway RCP 8.5 shows a clear negative tendency in the number of events, but also more severe events. In this scenario, projected severity increased up to 40% and duration up to 20% by higher return periods which occur in most of the cases were analysed.

Biography

Alejandro Chamorro has a major in Fluid Dynamics and Hydrology. He is working in the University of Giessen, Germany, and is Guest Lecturer in the topics of Atmosphere Dynamics and Hydrology. Currently he is investigating the dynamics of unusual and extreme hydro-climatological events in the context of climate change. Temporal appearance-disappearance patterns as well as drought characterization in several regions are studied for the historical and projected (future) period. In the present study, the changes in the patterns of drought structure are investigated considering various RCM and RCP.

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