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Projections of African drought extremes in CORDEX regional climate simulations

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We investigate trends in drought extremes for different climate regions of the African continent over a combined historical and future period 1951-2100. Eight CMIP5 coupled atmospheric global climate models (CanESM2, CNRM-CM5, HadGEM2-ES, NorESM1-M, EC-EARTH, MIROC5, GFDL-ESM2M and MPI-ESM-LR) under two forcing scenarios, the relative concentration pathways (RCP) 4.5 and 8.5, with spatial resolution varying from about 1º to 3º are downscaled to 0.44º resolution by the Rossby Centre (SMHI) regional climate model RCA4. We use data from the ensuing ensembles of CORDEX-Africa regional climate simulations to explore three drought indices namely: standardized precipitation index (SPI), moisture index (MI) and difference in precipitation and evaporation (P-E). Meteorological and agricultural drought conditions are assessed in our analyses and a climate change signal is obtained for the SPI by calculating gamma functions for future SPI with respect to a baseline present climate.

Results for the RCP4.5 and RCP8.5 scenarios are inter-compared to assess uncertainties in the future projections. We show that there is a pronounced sensitivity to the choice of forcing GCM which indicates that assessments of future drought conditions in Africa would benefit from large model ensembles. We also note that the results are sensitive to the choice of drought index. We discuss both spatial and temporal variability of drought extremes for different climate zones of Africa and the importance of the ensemble mean. Our study highlights the usefulness of CORDEX simulations in identifying possible future impacts of climate at local and regional scales.