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Global past, present, and future meteorological droughts

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In the past decades, drought was one of the most impacting natural disasters at global scale. Due to the projected global warming and the tendency towards drying of dry regions and wetting of wet regions, understanding which regions are likely to be the future drought hotspots is very important. We present a world drought climatology for the period 1951-2100, combining drought frequency and severity trends over 1951-2016 derived from a global dataset of drought events constructed on purpose together with drought projections for the 21st century based on two climate scenarios (RCP4.5 and RCP8.5). The analyses are based on two indicators, the Standardized Precipitation Index (SPI) and the Standardized Precipitation-Evapotranspiration Index (SPEI), computed at various time scales, from 3-month to 60-month accumulation. The indicators are based on precipitation (the SPI) and on precipitation and potential evapo-transpiration (the SPEI), the last variable derived by temperature data. To analyze past drought trends and events, we used monthly precipitation data from the Global Precipitation Climatology Centre (GPCCv7), and temperature and potential evapo-transpiration data from the Climate Research Unit dataset (CRUTSv4.01) of the University of East Anglia. To investigate future drought frequency, severity, and peak events, we used monthly precipitation and temperature data from 1981 to 2100 from 110 CORDEX (COordinated Downscaling Regional Experiment) simulations which represent the combinations between more than 15 General Circulation Models (GCMs) and15 Regional Circulation Models (RCMs). The spatial resolution of the outputs is 0.5°. A continuous increase in both frequency and severity of droughts from 1951 to 2100 is observed over Chile, Eastern United States, Mediterranean region, most of Africa, Central Asia, and Southern Australia. Oppositely, a continuous decrease is observed over high latitudes – in particular over Alaska and Northern Europe - and Northern Australia.