

Projected seasonal meteorological droughts over Europe until 2100

Jonathan Spinoni, Jürgen Vogt, Gustavo Naumann, Paulo Barbosa, and Alessandro Dosio
European Commission, Joint Research Centre (JRC), 21020 Ispra (VA), Italy

In the last decades, droughts have become increasingly recurrent and intense over large areas of Europe. Due to the projected temperature increase and longer dry periods, meteorological droughts are expected to become more frequent and severe in the next decades, potentially causing relevant impacts in many economic sectors and the environment. To investigate future drought patterns over Europe, we computed a combined indicator based on the Standardized Precipitation Index (SPI), the Standardized Precipitation-Evapotranspiration Index (SPEI), and the Reconnaissance Drought Indicator (RDI). All indicators were computed at a 3-month accumulation period to focus on seasonal droughts using temperature and precipitation from an ensemble of eleven bias-adjusted simulations from the EURO-CORDEX experiment as input data. The combined indicator focuses on the predominance of drought conditions over normal conditions and was applied to obtain frequency and severity of drought events at 0.11° spatial resolution over Europe from 1981 to 2100. The analysis was performed for two representative concentration pathways (RCP), the moderate emission scenario RCP4.5 and the extreme RCP8.5. Excluding winter droughts, which are likely to be less frequent and severe over Central and Northern Europe for both scenarios, the other seasons show increased drought frequency and severity over entire Europe, markedly larger as the century passes especially under the RCP8.5. The largest increases are projected for spring droughts over the Iberian Peninsula and North-Eastern Scandinavia and for summer droughts over Western Europe. Under the RCP8.5, at least six out of eleven simulations project a statistically significant positive trend from 1981 to 2100 of drought frequency for the Mediterranean area, the Iberian Peninsula, and Turkey. On an annual scale, most simulations project a continuous increase of both drought frequency and severity for entire Europe, excluding Iceland and Central-Eastern Europe. The outcomes of this study will also help to estimate the likely impacts of future droughts.