

Drought and heatwaves in Europe: historical reconstruction and future projections

Luis Samaniego (1), Stephan Thober (1), Rohini Kumar (1), Olda Rakovec (1), Eric Wood (2), Justin Sheffield (2), Ming Pan (2), Niko Wanders (2), and Christel Prudhomme (3)

(1) Helmholtz Centre - UFZ, Department Computational Hydrosystems (CHS), Leipzig, Germany (luis.samaniego@ufz.de), (2) Department of Civil and Environmental Engineering, Princeton University, United States, (3) NERC Centre for Ecology and Hydrology, Wallingford, United Kingdom

Heat waves and droughts are creeping hydro-meteorological events that may bring societies and natural systems to their limits by inducing large famines, increasing health risks to the population, creating drinking and irrigation water shortfalls, inducing natural fires and degradation of soil and water quality, and in many cases causing large socio-economic losses. Europe, in particular, has endured large scale drought-heat-wave events during the recent past (e.g., 2003 European drought), which have induced enormous socio-economic losses as well as casualties.

Recent studies showed that the prediction of droughts and heatwaves is subject to large-scale forcing and parametric uncertainties that lead to considerable uncertainties in the projections of extreme characteristics such as drought magnitude/duration and area under drought, among others. Future projections are also heavily influenced by the RCP scenario uncertainty as well as the coarser spatial resolution of the models.

The EDgE project funded by the Copernicus programme (C3S) provides an unique opportunity to investigate the evolution of droughts and heatwaves from 1950 until 2099 over the Pan-EU domain at a scale of $5 \times 5 \text{ km}^2$. In this project, high-resolution multi-model hydrologic simulations with the mHM (www.ufz.de/mhm), Noah-MP, VIC and PCR-GLOBWB have been completed for the historical period 1955-2015. Climate projections have been carried out with five CMIP-5 GCMs: GFDL-ESM2M, HadGEM2-ES, IPSL-CM5A-LR, MIROC-ESM-CHEM, NorESM1-M from 2006 to 2099 under RCP2.6 and RCP8.5.

Using these multi-model unprecedented simulations, daily soil moisture index and temperature anomalies since 1955 until 2099 will be estimated. Using the procedure proposed by Samaniego et al. (2013), the probabilities of exceeding the benchmark events in the reference period 1980-2010 will be estimated for each RCP scenario.

References

1. <http://climate.copernicus.eu/edge-end-end-demonstrator-improved-decision-making-water-sector-europe>
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3. Samaniego, L., et al. 2016: Propagation of forcing and model uncertainties on to hydrological drought characteristics in a multi-model century-long experiment in large river basins. *Climatic Change*. 1-15.