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The 2018-2019 European drought sets a new benchmark over 250 years

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XEROS

eXtreme EuRopean drOughtS: multimodel synthesis of past, present and future events

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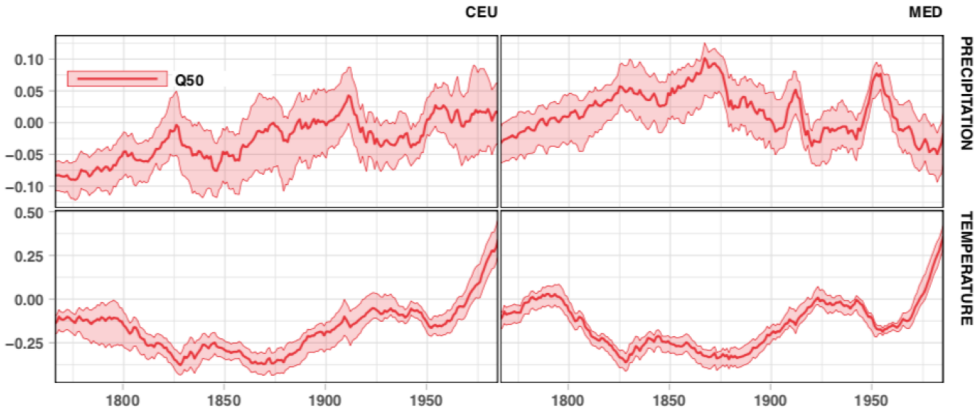
Introduction

- The 21st-century droughts in Europe are regarded as exceptionally severe and negatively affecting a wide range of socio-economic sectors.

- Main drivers: **increase in temperature** (CEU & MED) together with a lack of precipitation (especially in MED) during the spring/summer months:

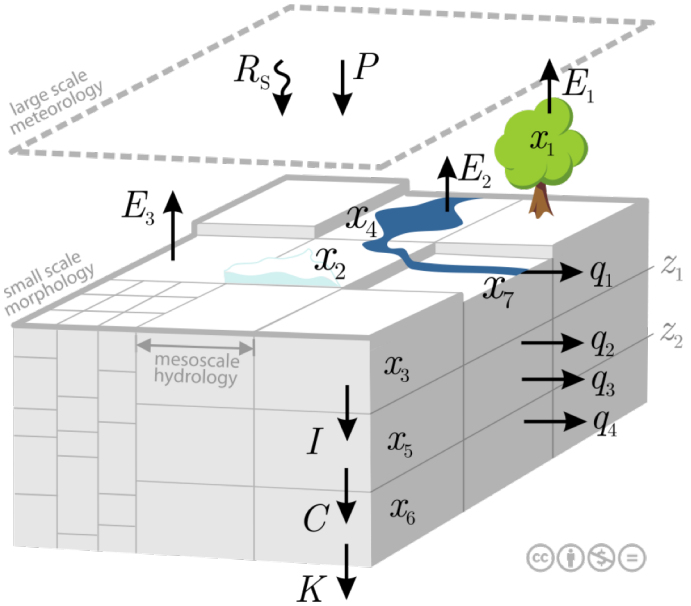


Source: Hanel et al. (2018), SREP

- **We synthesize a space-time evolution of soil moisture droughts in the period of 1766-2019**.

Methods

- Simulate **soil moisture** (SM) with the mesoscale Hydrologic Model (mHM) forced using several bias-corrected meteorological merged products (Hanel et al. (2018), SREP) – covering entire Europe until end of 2019.
- Estimate quantile-based **soil moisture index** (SMI) based on a 254-year long monthly dataset, which is estimated with a kernel density approach (Samaniego et al., 2018, NCC)
- Perform a **spatio-temporal clustering algorithm** to track droughts through space and time along their evolution, for a given threshold of **SMI<0.2** (Samaniego et al., 2018, NCC)
- Estimate drought statistics such as **areal extent, duration, intensity** for all identified soil moisture drought events.



Source: ufz.de/mhm and git.ufz.de/mhm

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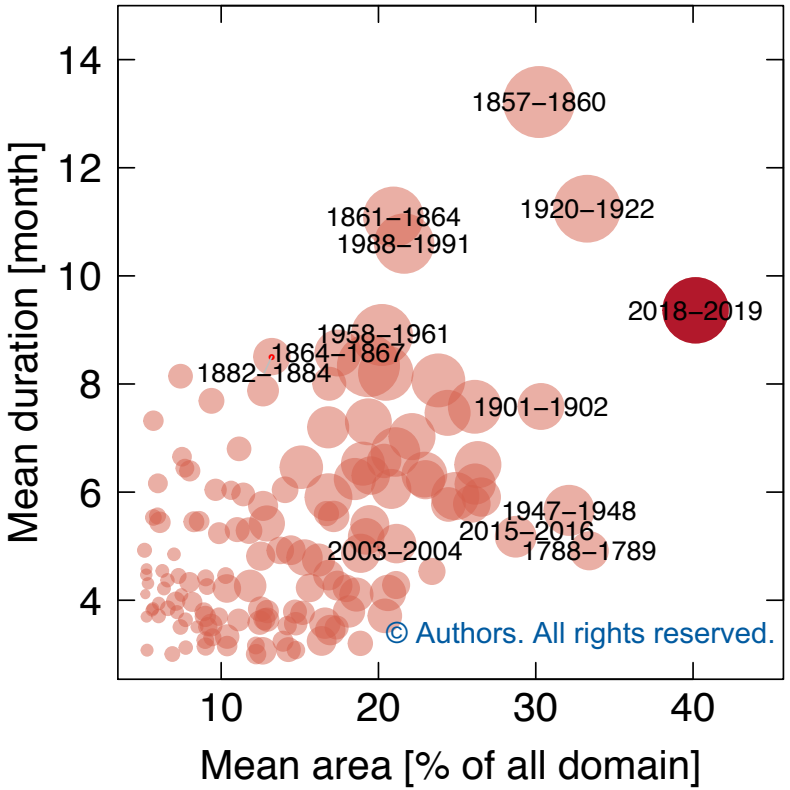
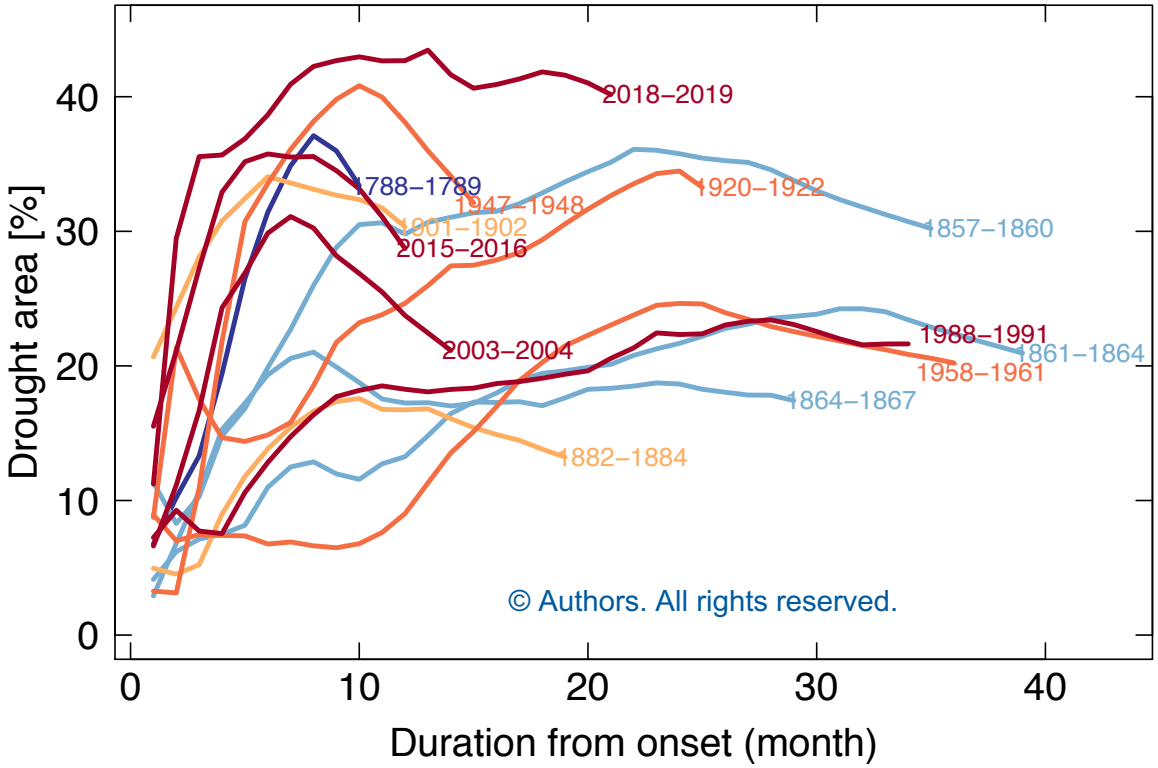
Results: aggregated

- In terms of total drought magnitude (bubble size), the ongoing recent **2018-2019 drought is ranked as the most extreme**, together with 1920-1922, 1857-1860 events.
- The 2018-2019 event **exhibits the largest average drought area** covering over 40% of the study domain
- The average duration ranks as the fifth, but it's still ongoing and propagates further into 2020.

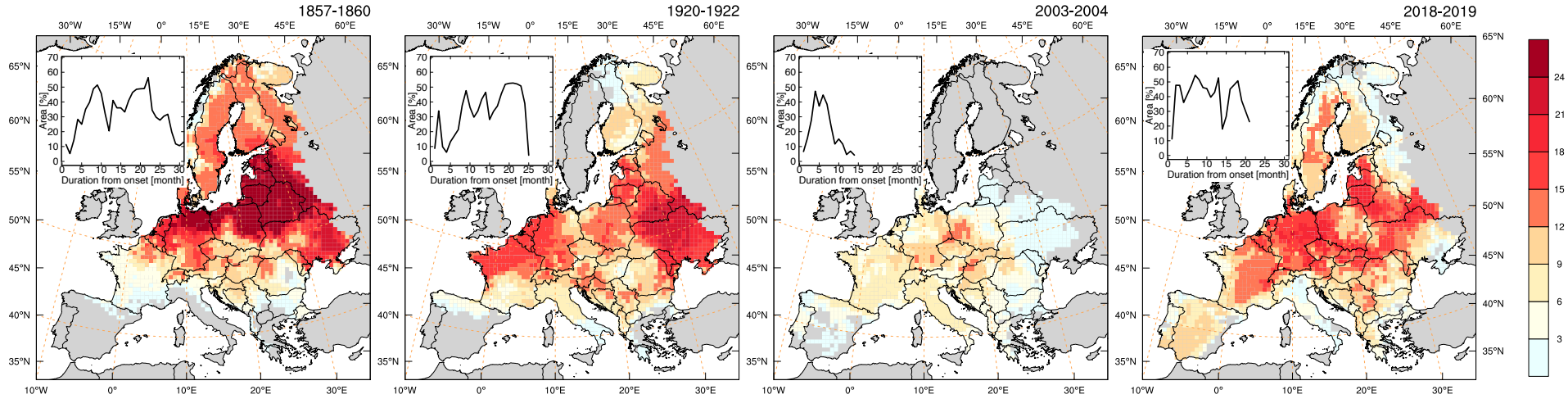


Results: temporal aspect



- Figure shows the temporal evolution of average drought area for the largest soil moisture drought clusters across entire Europe.
- All these exceptional droughts were initiated in spring primarily as a result of compounding effects of low precipitation and high temperatures leading to extreme soil water deficits.

Results: spatial aspect



- Maps show the spatial extent of the three most severe soil moisture droughts (1857-1960, 1920-1922, 2018-2019) + the 2003-2004 drought, in terms of **total drought duration**.

- **Our analysis reveals that the 2018-2019 event is a new European drought benchmark replacing the well-documented 2003 European drought and all droughts prior 2000!**

Thank You!

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