



SET OF STUDIES
on impacts of the 2018
SEVERE DROUGHT
and heatwave in Europe
facilitated by **ICOS**
research infrastructure
– FROM SITE TO CONTINENTAL SCALE

ICOS

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Integrated
Carbon
Observation
System

ICOS, the Integrated Carbon Observation System, has enabled a set of studies showing how nature and crops in Europe respond to extremely dry conditions. The results published in Philosophical Transactions B are significant since such extreme droughts will likely happen much more frequently in the future. The results were achieved extremely fast thanks to ICOS long-term high-quality data that allows for reaching scientific results faster than in traditionally conducted studies.



[ACCESS THE STUDIES](#)

Open the free ICOS Carbon data portal

“We had open data exchange during process, resulting in the unique data sets openly available through ICOS Carbon Portal.”

Alex Vermeulen, co-organiser of the study and Director of the ICOS Carbon Portal

ICOS Carbon Portal offers free access to high-quality and standardised greenhouse gas data, as well as to scientific and educational products and services. The Carbon Portal is a ‘one-stop shop’ for all ICOS data products.

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DROUGHT AND OTHER MAIN DATA SETS ON ICOS CARBON PORTAL

The 2018 summer had the largest ever area in **Europe under extreme drought**. Temperature records were broken in many regions of Central Europe and the UK, fires broke out in the Nordic countries, and several countries were affected by crop failures.

The 17 study results recently published in a special issue of Philosophical Transactions B show how vegetation in Europe responds to drought, i.e. how the exchange of carbon between the vegetation and atmosphere is affected. The studies cover areas from Spain to Sweden and Finland, and from the Czech Republic through Germany, France and Belgium to the Netherlands and the UK. The drought studies **provide crucial knowledge** when trying to minimise the negative effects of the climate change.

The scientists participating in the research effort cooperated extremely well, gathering a vast amount of data, points out Alex Vermeulen, co-organiser of the study and Director of the ICOS Carbon Portal: “We had open data exchange during process, resulting in the unique data sets openly available through ICOS Carbon Portal”.

THE FIRST DATA SETS WERE AVAILABLE ALREADY WITHIN 6 MONTHS SINCE STARTING THE INITIATIVE.

This all was possible thanks to the existing infrastructure and data of ICOS, the Integrated Carbon Observation System, which continuously measures important climate variables over 140 stations across Europe. The long-term high-quality data provided allows for reaching scientific results faster than in traditionally conducted studies.

Open Access drought study articles

Naomi E Smith et al.,

Spring enhancement and summer reduction in carbon uptake during the 2018 drought in northwestern Europe.

<https://doi.org/10.1098/RSTB.2019.0509>

Christian Rödenbeck, Sönke Zaehle, Ralph Keeling and Martin Heimann,

The European carbon cycle response to heat and drought as seen from atmospheric CO₂ data for 1999–2018.

<https://doi.org/10.1098/RSTB.2019.0506>

Rona L Thompson et al.,

Changes in net ecosystem exchange over Europe during the 2018 drought based on atmospheric observations.

<https://doi.org/10.1098/RSTB.2019.0512>

Damien Beillouin et al.,

Impact of extreme weather conditions on European crop production in 2018.

<https://doi.org/10.1098/RSTB.2019.0510>

Anders Lindroth et al.,

Effects of drought and meteorological forcing on carbon and water fluxes in Nordic forests during the dry summer of 2018.

<https://doi.org/10.1098/RSTB.2019.0516>

Janne Rinne et al.,

Effect of the 2018 European drought on methane and carbon dioxide exchange of northern mire ecosystems.

<https://doi.org/10.1098/RSTB.2019.0517>

Natalia Kowalska et al.,

Analysis of floodplain forest sensitivity to drought.

<https://doi.org/10.1098/RSTB.2019.0518>

Franziska Koebsch et al.,

The impact of occasional drought periods on vegetation spread and greenhouse gas exchange in rewetted fens.

<https://doi.org/10.1098/RSTB.2019.0685>



Other drought study articles

Wouter Peters, Ana Bastos, Philippe Ciais and Alex Vermeulen,
Introduction: A historical, geographical and ecological perspective on the 2018 European summer drought.

<https://doi.org/10.1098/rstb.2019.0505>

Ana Bastos et al.,
Impacts of extreme summers on European ecosystems: a comparative analysis of 2003, 2010 and 2018.

<https://doi.org/10.1098/RSTB.2019.0507>

Michael Ramonet et al.,
The fingerprint of the summer 2018 drought in Europe on ground-based atmospheric CO₂ measurements.

<https://doi.org/10.1098/RSTB.2019.0513>

Alexander Graf et al.,
Altered energy partitioning across terrestrial ecosystems in the European drought year 2018.

<https://doi.org/10.1098/RSTB.2019.0524>

Zheng Fu et al.,
Sensitivity of gross primary productivity to climatic drivers during the summer drought of 2018 in Europe.

<https://doi.org/10.1098/RSTB.2019.0747>

Tarek S El-Madany et al.,
Drought and heatwave impacts on semi-arid ecosystems' carbon fluxes along a precipitation gradient.

<https://doi.org/10.1098/RSTB.2019.0519>

Mana Gharun et al.,
Physiological response of Swiss ecosystems to 2018 drought across plant types and elevation.

<https://doi.org/10.1098/RSTB.2019.0521>

Louis Gourlez de la Motte et al.,
Non-stomatal processes reduce gross primary productivity in temperate forest ecosystems during severe edaphic drought.

<https://doi.org/10.1098/RSTB.2019.0527>