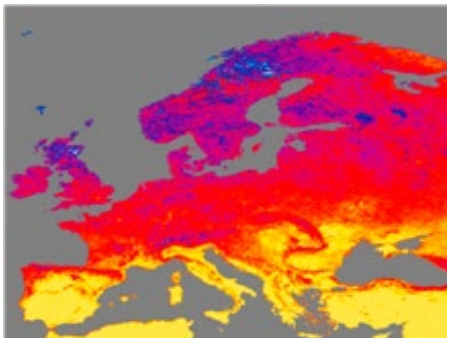
Walker Institute
for Climate System Research

Improving predictions of extreme events

Walker Institute research

The impacts of climate are often felt through extreme events



Some of the most significant impacts of climate are felt through extreme events like droughts, floods and storms. Such extreme events remain a challenge for climate models to predict.

Development of high resolution climate models, which can represent hurricanes and storms more realistically, are improving our ability to forecast changes in the frequency and severity of extreme events under climate change. Through improved understanding of the processes that cause extreme events, we can also improve prediction of these events.

Higher resolution climate models

We are undertaking pioneering research to develop climate models with higher resolution and improved physical processes. We collaborate closely with the Met Office and the National Centre for Atmospheric Science in this work.

Our research shows that higher resolution models are better at simulating regional climate and weather systems such as mid-latitude storms and hurricanes. High resolution climate simulations and observational studies are helping to improve seasonal forecasts and climate change projections both of the mean climate and climate extremes.

Hurricanes

The new class of high resolution climate models are capable of credibly representing tropical cyclones (or hurricanes). Numbers and location of storms, their tracks and the regions of storm development and decay are represented more realistically as the resolution of climate models is increased. Importantly, with higher resolution, climate models begin to represent some of the most severe and damaging storms.

As climate models begin to have enough resolution to simulate the evolution of small-scale weather events in a global climate context, the simulations become increasingly applicable to the assessment and prediction of weather-related risk – from seasonal to multi-decadal time-scales.

As an example, we are working with Willis Reinsurance to use these models to assess weather and climate related risk.

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Extreme seasons

In recent years Northern Europe has experienced several extreme seasons, such as the heat wave of 2003 and the UK summer flooding of 2007 and 2012. These seasons are often the result of unusual but persistent atmospheric flow patterns on very large scales. At the Walker Institute we investigate why such persistent flow patterns occur and whether they can be predicted seasons or decades ahead.

Analysis of the UK summers of 2007 and 2012 shows that the high level jet stream over the Atlantic was displaced south of its usual position and the storms which normally pass north of Scotland were instead directed straight at Southern England.

Flooding

Predictions of future climate change suggest that during winter months we could experience more frequent heavy rainfall and so an increased risk of flooding over central and northern Europe. Predictions also suggest drier summers.

Predicting rainfall changes, particularly when we start to zoom in on areas the size of the UK, remain a challenge for climate models. Our high resolution models will lay the foundations for improved predictions of the changing risks from extreme events.

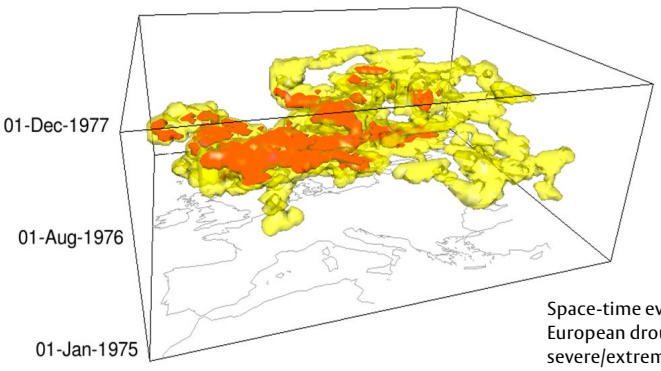
Drought

Drought accounts for 75% of all European natural catastrophe losses (EC, 2007; SwissRe, 2008). Modern water supply infrastructure has reduced direct mortalities yet the societal impacts of water scarcity remain.

We are investigating the space-time structure of drought which will lead to improved methods for diagnosing and validating drought within our climate models.

The 1975-77 European drought was centred over mid-western Europe around the summer of 1976. Our analysis shows it was linked with earlier events in the south and later events over Scandinavia.

Using state of the art climate models we are also investigating how droughts might change in the future – not just in Europe, but across the globe.



Space-time evolution of the 1975-77 European drought. Yellow/red indicates severe/extreme drought.

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This research is carried out by a range of staff within the Department of Meteorology and the Climate Directorate of the National Centre for Atmospheric Science.

Find out more:

www.walker-institute.ac.uk/research/predicting/extremes.htm

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