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Science for Environment Policy

Dry soils exacerbated 2006 heatwave in Northern France

Dry soils and a lack of cloud cover help explain a major heatwave in France, concludes new research. The study indicates that the two drivers were separate, unlinked events that came together at the same time to worsen the 2006 heatwave. Its findings could allow heatwaves to be predicted more accurately to protect public health.

Understanding and predicting heatwaves is increasingly important for safeguarding public health. This is especially because climate change's effects in Europe are expected to make heatwaves more frequent and intense in the future. The European heatwave of August 2003 is estimated to have caused more than 20 000 premature deaths across Europe, including almost 15 000 in France, 3 100 in Italy and 2 000 in the UK.

This study explored the contribution of atmospheric weather patterns, clouds and local soil moisture levels to the July 2006 heatwave in Northern France. Previous studies have suggested that these factors played a role in this heatwave's development.

These earlier studies were based on regional computer simulations and statistical analyses. However, such models can have a limited ability to simulate heatwaves and can overestimate certain factors, such as how heat moves between the air and ground, or how soil moisture levels change in summer months.

To help address these issues, this new study used geophysical and weather observations from ground and satellite-based monitors, in addition to computer simulations.

The researchers compared the observation data with the simulation results, with and without the different influencing factors. This allowed them to identify the relative contributions of each factor to the heatwave.

The researchers found that a 'blocking high' weather pattern was present at the start of the heatwave. This is a large area of high pressure (low wind) and low cloud cover which can remain in place for days or weeks and extends periods of fair weather. This was followed by an 'Atlantic Low' weather system, which brought in air from warmer southern areas during the heatwave.

However, the blocking high alone was not enough to explain the size of the heatwave in its early stages. The observations indicated a lack of local low-altitude cloud cover. The computer simulations indicated that this lack of low clouds was associated with very dry soil that also contributed to the heatwave's intensity, by around 4°C, during its first five days before the Atlantic Low developed.

Drier soil contains less moisture to evaporate and carry heat away from the ground. Surface temperatures therefore increase, leading to fewer shading clouds and less rainfall.

The dry soils and weather patterns did not appear to be caused by one another, but both needed to occur at the same time in order to explain the magnitude of the 2006 heatwave.

This study also confirms that drier soils are related to lower precipitation in the winter and spring, meaning that it is possible to predict conditions of drier soils to some degree.

The approach outlined in this study may be adapted for other regions and could be useful for predicting future heatwaves. This would allow for better forward planning by emergency and healthcare organisations.

26 February 2015
Issue 405

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Source: Chiriaco, M., Bastin, S., Yiou, P., *et al*. (2014). European heatwave in July 2006: Observations and modeling showing how local processes amplify conducive large-scale conditions. *Geophysical Research Letters* 41, 5644–5652. DOI:10.1002/2014GL060205

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