



The mega-heat wave of 2010 – implications for the future

New research has compared the hot summers of 2003 and 2010 in Europe. The results indicate that the extreme temperatures in 2010 affected an area that was about twice as large as the area affected in 2003. Climate change projections for Eastern and Western Europe suggest that such mega-heat waves will become more frequent in the upcoming decades.

Several publications by climate change scientists have indicated that increasing greenhouse gas (GHG) emissions will increase the variability of summer temperatures in Europe. This will result in more frequent, persistent and intense heat waves. According to these projections, in 2010, many Eastern European cities recorded extremely high daytime temperatures; for example, Moscow experienced daytime temperatures as high as 38.2°C (about 14°C above normal). This resulted in heat-related deaths, crop failure and an estimated economic loss of US\$15 billion. The research indicated that for Europe in 2010, there was a period of record-high temperatures in July which persisted until the second week of August. In many parts of Eastern Europe, weekly and seasonal mean temperatures were 12°C and 5°C above average, respectively.

It was estimated that more than two million km² (an area 50 times the size of Switzerland) registered unprecedented extremes in temperature for between 15 and 61 day averages. In comparison, the summer of 2003 was characterised by two extreme periods (one in mid-June and the other at the beginning of August). Nevertheless, the 2010 event was overall more extreme, both in terms of the temperature anomalies experienced and the spatial area that was affected. On average, the summer of 2010 was about 0.2 °C warmer for Europe than 2003. In 2003 the area experiencing record-breaking temperatures was nearly one million km².

The two heat waves are distinct, but they were close together which indicates that, in the history of hottest summers, the last decade stands significantly above any other ten-year period in the last 500 years. However, it should be noted that temperature records are only available from about 1750 and, for years previous to this, researchers used seasonal temperature reconstructions derived from tree rings, ice cores and historical documents, which are subject to uncertainties. Despite this, in about a quarter of Europe, the summers of 2003 and 2010 were probably the warmest since records began.

The researchers also investigated the likelihood of such extreme weather conditions in the future. Their analysis of regional climate scenarios for the periods 2020-2049 and 2070-2099 projected that by the end of the century, Eastern Europe may experience a 2010-type heat wave every eight years on average. Heat waves like that of 2003 may become the norm, i.e. they could occur every two years.

The exact changes in frequency depended on the model used for the projections, however, for all models there was a prediction that mega-heat waves will become more frequent, more intense and longer lasting. Given the recorded effects of the 2003 and 2010 events, these projections indicate the possibility of serious risks unless adaptive actions are taken.

Source: Barriopedro, D., Fischer, E.M., Luterbacher, J., Trigo, R.M. & García-Herrera, R. (2011) The Hot Summer of 2010: Redrawing the Temperature Record Map of Europe. *Science*. Doi: 10.1126/science.1201224

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