Record Warm Summer in Western Europe in 2003

European record temperatures

The 2003 summer (June-August, JJA) over western and central Europe was the warmest ever recorded (Figure 1). Over a large swathe of the western part of the continent, records were broken in all three months, not just for monthly averages but also for daily extremes and the lengths of spells above thresholds. The anomalous summer was centred over Switzerland, France, southern Germany and northern Italy.

A German national series, which extends back to 1761, gives the JJA summer of 2003 a value 3.4ºC above the 1961-90 average and 1.1ºC warmer than the previous warmest summer in 1947 (Schönwiese *et al*., 2004). Long documentary data from Switzerland and neighbouring countries have enabled Luterbacher *et al*. (2004) to estimate that the JJA summer in 2003 was the warmest since at least 1500, exceeding the previous hottest summer in 1757 by 0.3ºC.

Local-scale record temperatures

Many locations in France, Switzerland, northern Italy and southern Germany recorded temperature anomalies in all three summer months in excess of 5ºC. Although June experienced the record anomalies, temperatures broke absolute records at many locations in the first half of August. In southern and eastern France, 29 sites recorded temperatures in excess of 40ºC during the first half of August, with the record value being 42.6ºC at Orange in the Vaucluse Department in the Rhône Valley. For France this was not a record, this still stands at 44.0ºC at Toulouse on August 8, 1923 (http://metoenew.free.fr/evenements/canicule_aout2003.htm). Switzerland and northern Italy also recorded over 40ºC at a number of locations. In Germany, 40.2ºC was recorded at Karlsruhe on the 9th and 13th of August, 2003, but this did not break

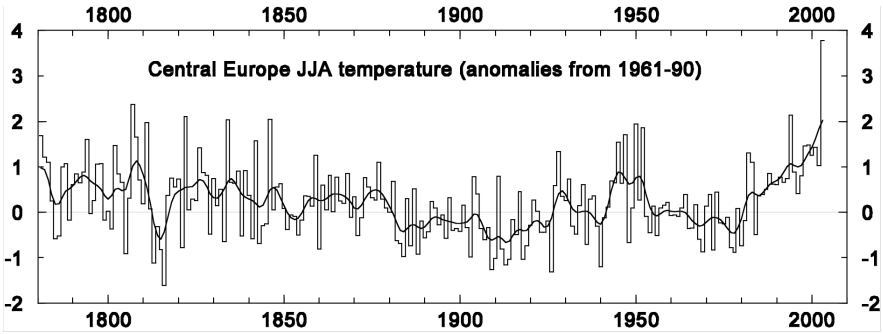

Figure 1: Average summer temperatures for JJA for 1781-2003, for central Europe defined by 35º-50ºN by 0-20ºE. The extension of the gridded database prior to 1851 is discussed in Jones *et al*. (2003). All data are expressed as departures from the 1961-90 period.

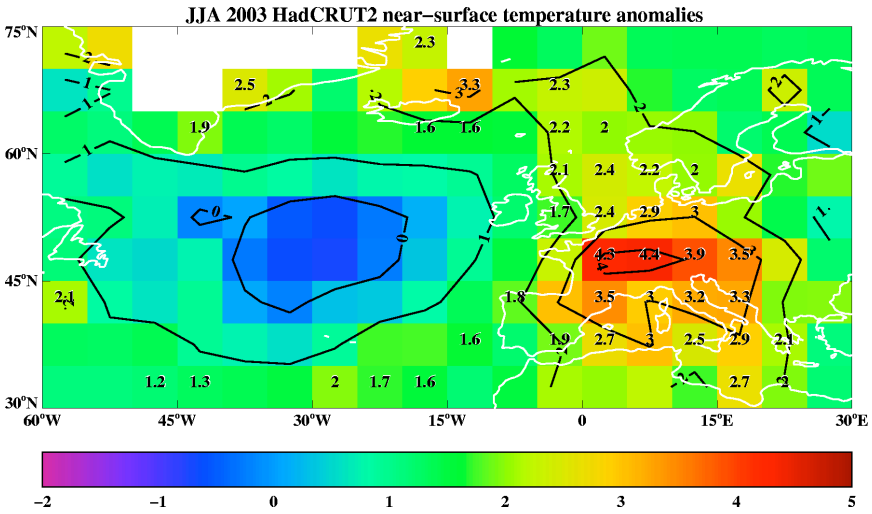

Figure 2: Average June-to-August surface temperature anomalies for 2003, based on the HadCRUT2 dataset (Jones and Moberg, 2003). 5º grid boxes with temperature anomalies indicate that this JJA season was the warmest in the entire record, which over the majority of this region extends back to the mid-19th century.

the German record which was recorded on July 27, 1983 at Gärmersdorf in northeastern Bavaria (Schönwiese *et al*. 2004). North of the record breaking warmth, the U.K. recorded its first temperature above 100ºF (37.8ºC) at a number of locations around London on August 10.

Although absolute records were only broken in a few locations, the most dramatic feature of the summer was the warm nights, particularly during the first half of August. At Paris, for example, the temperature did not drop below 23ºC between August 7 and 14. The warmest ever night temperature was recorded in Paris on the night of August 11/12 with 25.5ºC (http://metoenew.free.fr/evenements/canicule_aout2003.htm). In Germany, the warmest ever night was recorded at Weinbiet (Rhine valley) on August 13, when the mercury did not drop below 27.6ºC (Schönwiese *et al*., 2004). Similar record-breaking night-time temperatures were recorded in Switzerland and northern Italy.

Impacts of the Heat Wave

A number of the extensive and severe impacts of the heat wave are outlined in a section on 'Hot Summer in Europe - The future has already begun' in Munich Re (2004).

Examples of impacts in three specific areas are given below.

a) Increased mortality in France

The anomalous warmth of the first half of August, particularly of the night-time temperatures led to 15,000 excess deaths in the month (see Besancenot, 2003), compared to the three previous Augusts (2000-2002). Figure 3 shows the excess deaths gradually increasing during the first 12 days of the month, peaking at about 2000 per day on the 12th and 13th of August. Excess deaths reduced dramatically after August 14 with a near 5ºC reduction in minimum temperatures. The elderly were most affected, with a 23% increase in deaths in the 45-54 age range, 29.1% for 55-74 year olds, 70.1% for 75-94 and 121.8% for over 95. Excess deaths were evident across the whole of France, but the numbers were largest within 100km of Paris, and largest of all within the Greater Paris region.

b) Glacier retreat in the Swiss Alps

The summer warmth caused dramatic retreats of many Swiss glaciers. Preliminary estimates suggest that the summer led to a summer ablation value that was ten times the amount of an average summer. The Italian Glaciological Committee estimates that the country's glaciers are 20% smaller than they were in 1987 and that Alpine glaciers in general have lost 40% of their volume in the past century. Switzerland is estimated to have lost 7-8% of its glacier ice in the 2003 summer alone. The increased meltwater may help hydroelectric power stations in the short term, but even this will gradually begin to reduce as glaciers get smaller and can only survive on the highest mountains.

c) Power plant operation

Problems with power plant cooling systems were encountered due to the shortage of water and heated rivers.

French victims of the heat wave, August 2003.

Portuguese forest fire fighters, August 2003.

For example, the German nuclear power plants of Philippsburg on the Upper Rhine and Neckarwestheim on the Neckar River had to reduce their power generation by 20% on 6 August for several days due to the high river water temperatures of (>26°C) and hence of the cooling water. The small nuclear power plant of Obrigheim on the Neckar River was completely turned off due to insufficient cooling water. There was a real danger of a black out in parts of Germany at this time. Several power plants obtained special permission from the German water resources management administration to exceed the limits of cooling temperatures to which they are restricted by law.

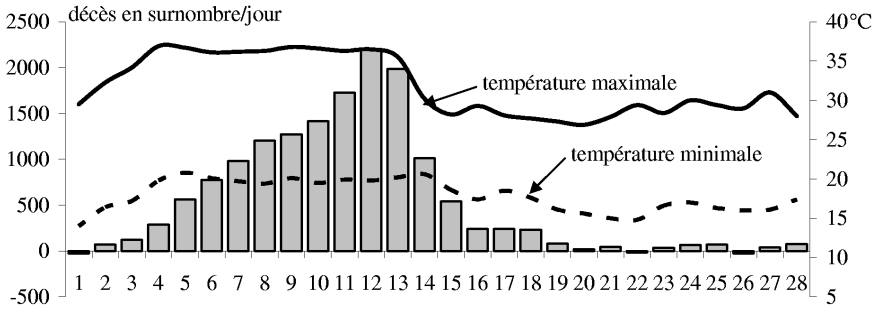

Figure 3: Daily number of excess deaths in France during August 1-28, together with average French maximum and minimum temperatures. The death number is expressed as a departure from values estimated for 2000-2002. Figure from Besancenot, 2003.

References and further reading

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