Atmos. Chem. Phys. Discuss., 9, C7389–C7393, 2009
www.atmos-chem-phys-discuss.net/9/C7389/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modelling surface ozone during the 2003 heat wave in the UK" *by* M. Vieno et al.

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Received and published: 23 November 2009

We thank Prof. Alistair Lewis for his comments on our ACPD paper "Modelling surface ozone during the 2003 heatwave in the UK".

We agree that the definition of heat-wave is rather subjective and may vary with location despite its origins as a regional-scale anticyclonic weather feature. In our manuscript we have not defined the heatwave period explicitly. Perhaps the most appropriate heatwave definitions involve comparison with the usual temperatures for that locality. During the period in question, the Writtle site satisfied the definition of the UK Climate Impacts Programme (UKCIP) for a heatwave of a daily maximum temperature more than 3 C above the 1961-90 daily normal for $\geq$5 consecutive days (www.metoffice.gov.uk/climatechange/science/monitoring/ukcp09/available/annual.html).

The UKCIP grid cell including Writtle (easting 567500, northing 207500) 1961-1990 average daily max temperature for the first 15 days of August was $\sim$22 °C. Figure 1 (below) compares the actual UKCIP 1961-90 daily max for each day in August with the observed temperature at Writtle . Using the UKCIP data as our baseline data we find that the heatwave started on the 2nd and ended on the 13th according to the UKCIP definition. We now include this text in the revised manuscript.

For our paper, we assumed that the beginning of the heatwave was on the 4th of August and the end was on the 12th of August. Between these dates, observed and simulated daily max temperatures satisfied the above definition for a heatwave. These dates match closely the 5-11th Aug period defined as "heatwave" in the work of Lee et al. (Atmos. Environ. 40, 2006), 4-13th Aug based on analysis of the Central England temperature series in Johnson H, et al. (Euro Surveill. 2005), and 3-12th in Burt S. (Weather Volume 59, Issue 8, Date: August 2004, Pages: 199-208).

The peaks on the 6th 9th and 10th are indeed noteworthy during this period, but we contend that the extended period of several days would be regarded as a heatwave under the above definition of heatwave.

We note from Figure 9 of the ACPD paper that peaks in simulated isoprene concentrations were not confined to the 6th, 9th and 10th August.

The reported maximum change of ozone due to isoprene (5x scenario) is indeed 45 ppb which occurred on the 6th of August 2003 at 17:00, but when the ozone concentration was at its maximum at 15:00 this difference was 23 ppb (Figure 2, below). This values should be compared with the import sensitivity simulation which indicated that 85 ppb of peak ozone on this day was due to import.

Figure 9 of the ACPD paper shows that the isoprene concentrations simulated for a 3x emissions and 2x emissions scenarios are in better agreement than the 5x scenario for the 6th and 9th August, respectively. Therefore the change in peak ozone due to isoprene is likely to be less than 23 ppb. Components of ozone concentrations

attributed to import from outside the UK, dry deposition, and NOx plume effects were larger on the 6th and 9th of August than isoprene effect. On the 10th August the 5x scenario fits the observed isoprene concentrations better and the ozone attributable to isoprene emissions is around 30 ppb. Over the whole heatwave period (as defined above), it is only on the 10th August that isoprene emissions appear to be the dominant cause of elevated ozone concentrations. Perhaps the original text played down too much the importance of isoprene and its possible role in ozone formation on heatwave days and this will be altered in the revised manuscript.

Taken over an extended period and the whole UK, isoprene emissions had relatively modest effects on simulated UK ozone. However, the modelling suggests that isoprene may play a substantial role for the warmest day, when emissions are greatly enhanced. The large uncertainties in isoprene emission clearly affect model calculations, and call for improved inventories of this important compound.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 19509, 2009.

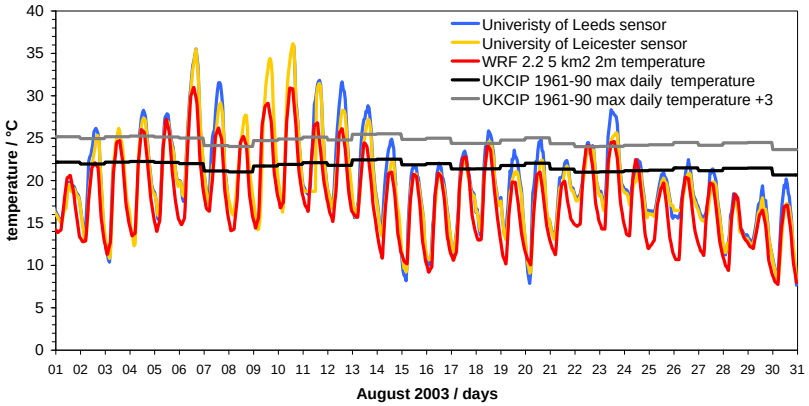

Fig. 1. Writtle surface temperature.

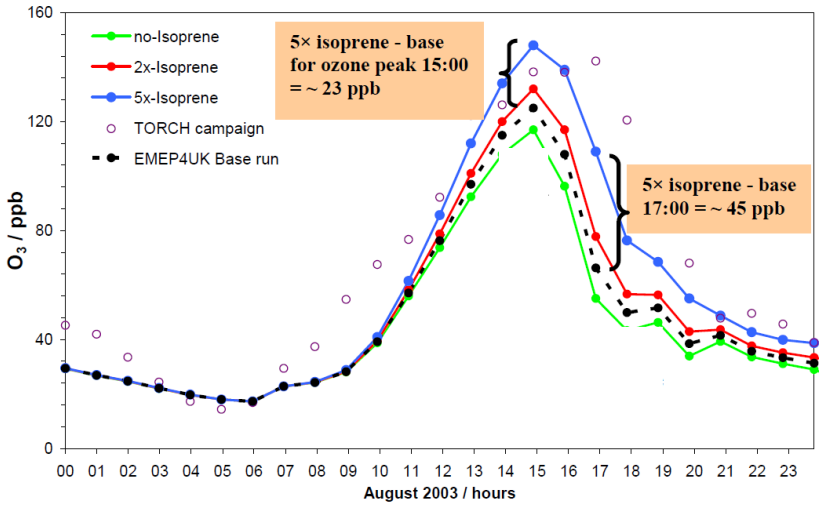

Fig. 2. 6th of August 2003 ozone concentration.