

Letters

Prolonged day darkness and extreme rainfall in Berkshire, 20 July 2007

In just under 15 hours on 19/20 July 2007, I recorded 81.1 mm of rainfall at my site in Stratfield Mortimer in central southern Berkshire. During the most intense phase of the storm, 21.0 mm fell in 30 minutes, 30.2 mm in 60 minutes and 58.3 mm in 3 hours. For comparison, the average monthly rainfall (1971–2000) for July at this site is only 39 mm. Rainfall intensities were the highest observed at this site in 20 years of records for all periods from 35 minutes to 48 hours.

The fall was split over two 0900–0900 UTC 'rainfall days' (19 July 25.8 mm, 20 July 55.3 mm), and as a result the rainday totals fell slightly short of both the highest July and all-month daily rainfall totals on an unbroken local daily rainfall record back to 1910 (for July, the record remains 55.6 mm in a thunderstorm on 25 July 1941, and the all-month highest 58.4 mm in a thunderstorm on 6 August 1982). The two-day total of 81.1 mm has been exceeded only once on the near-100-year record: on 14/15 September 1968, 91.0 mm was recorded. On this latter occasion the period of heavy rainfall spanned 36–48 hours, and it is therefore highly likely that the fall of 81 mm in 15 hours on 20 July 2007 represents the highest sub-24-hour rainfall total in this area within the past 100 years.

The event commenced with a short thunderstorm around 2115 UTC on Thursday 19 July; this gave a short period of heavy rainfall commencing suddenly at 2135 UTC and lasting for about 30 minutes. Further intermittent moderate rain thereafter settled into a period of steady moderate rain from around 0230 UTC. The main activity commenced a little after 0600 UTC with a bright flash of lightning accompanied by loud thunder at 0621 UTC. Conditions during the morning were more like November than July, with steady moderate rain becoming heavy and accompanied by very poor visibility, below 1000 m at times, and very low light levels. The rain built fairly steadily in intensity during the morning

(Figure 1). Thunder and lightning became more frequent and heavier from around 0730 UTC, frequent and heavy 08–11 h UTC; some of the lightning discharges were overhead and on several occasions the thunder was loud enough that buildings literally shook. Rainfall became intense and tropical in intensity from 1000 UTC, reaching its peak at 1100 UTC when, over a 5-minute period, it averaged 69 mm/h: 21.0 mm fell in the 30 minutes commencing 1035 UTC. The rainfall

depth-duration extremes for this storm at this site are summarised in Table 1. The rain began to ease off after about 1115, had ceased by 1230 and was followed remarkably quickly by patches of blue sky and then sunshine; the early afternoon was then sunny although the rest of the day remained cloudy and breezy but dry and cool, the maximum air temperature attained being only 16.6 °C.

Any account of this remarkable event

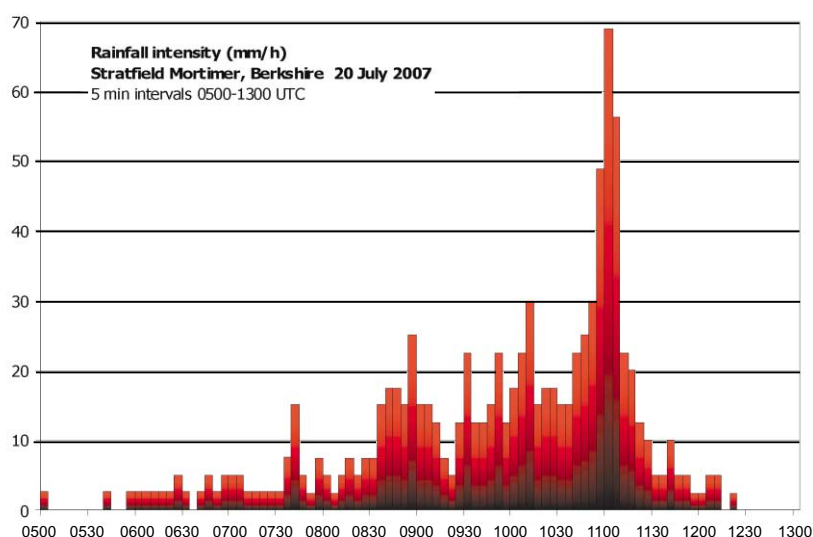


Figure 1. The variation of rainfall intensity at Stratfield Mortimer, Berkshire for the 8 hours commencing 0500 UTC on 20 July 2007; this is taken from a 0.2 mm tipping-bucket gauge logged at 5 minute intervals. (Observed values have been corrected to agree with the daily checkgauge readings following standard practice.)

Table 1

Short period rainfall depth-duration extremes – Stratfield Mortimer, Berkshire, 20 July 2007. All values recorded from 35 minutes to 48 hours represented the highest on 20 years of records at this site.

Period	Rainfall amount	Rainfall intensity mm/h	Time started
5 min	5.7 mm	69	1055 UTC
15 min	14.5 mm	58	1050
30 min	21.0 mm	42	1035
60 min	30.2 mm	30	1005
2 h	45.3 mm	23	0920
3 h	58.3 mm	19	0825
4 h	64.3 mm	16	0730
6 h	71.6 mm	12	0610
Event total: 15 h	81.1 mm	5.4	2135 UTC 19 July

would be incomplete without reference to the prolonged period of 'day darkness' during the morning. For the $3\frac{1}{2}$ hours commencing 0730 UTC, the mean global solar radiation on a horizontal surface averaged just 11 W/m^2 , falling as low as 4 W/m^2 at 0834, 0909 and 1030 UTC: these values are more typical of twilight illumination levels. Figure 2 shows 1 minute mean values of global solar radiation on 20 July 2007 at this site, and for comparison the record for 20 July 2006, exactly one year previously, a day with nearly 13 hours of almost unbroken sunshine. The values recorded during the period 0730 to 1130 UTC on 20 July 2007 are well below the 1% levels for a July morning, based on the record from Easthampstead, Berkshire, about 20 km east of here (Met Office, 1980), and indeed fall well below the minimum values recorded at that site during the 10 years ending 1975: for example, the hour commencing 0900 UTC on 20 July 2007 averaged only 9.9 W/m^2 at my site compared with the Easthampstead 1% value for the hour of 75 W/m^2 and the 10 year minimum there for that hour of 42 W/m^2 . The low light levels on this occasion have few parallels. The notable day-darkness event which affected large areas in south and south-east England on 6 August 1981 (Armstrong, 1983; Littlefair, 1984) saw similar near-zero values of global solar radiation at Easthampstead and Garston, Herts, although the lowest levels were not maintained for longer than 30 minutes or so. My own records show that the solar radiation level fell to zero twice in the hour 0900–1000 UTC during an intense thunderstorm here on 26 July 1995, with an hourly mean of just 6 W/m^2 , although once again this episode was not as prolonged as the July 2007 event.

The storm caused rapid and extensive runoff flooding locally. One major culvert burst in the village causing inundation to houses just 200 metres from this observer's property (Figure 3). The Foudry Brook (a subsidiary of the Kennet) quickly burst its banks, although flood prevention measures implemented by the Environment Agency the previous winter largely served their purpose and prevented more severe flooding. The level of the Foudry Brook rose to 53.1 m OD (Figure 4), its highest level in the 20 years since we moved to the village. It is very rare for the Brook to flood during the summer months – all of the previous flooding incidents in 20 years have been due to prolonged frontal rainfall events more typical of the winter months. The main road into the village was quickly inundated (Figure 5) and remained impassable for all but high-wheelbase vehicles for more than 36 hours. As the flood peak moved downstream, enormous flooding developed on both the Kennet and the Loddon and subsequently on the Thames. There was a second,

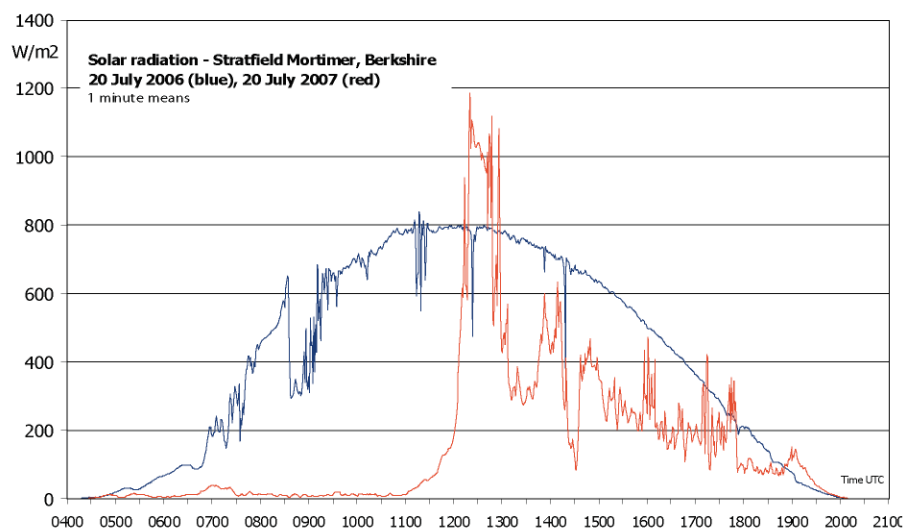


Figure 2. One-minute means of global solar radiation on a horizontal surface (units: W m^{-2}) at Stratfield Mortimer, Berkshire, on 20 July 2007 (red line) and on 20 July 2006 (blue line). The time axis is in UTC. The long period of day-darkness conditions from 0730 to 1100 UTC on 20 July 2007 is clearly evident.



Figure 3. Damage to culvert in The Street, Stratfield Mortimer, as a result of the 20 July 2007 storm. National Grid Reference SU (41) 671 642. (Photograph © Stephen Burt.)



Figure 4. The Foudry Brook in Stratfield Mortimer, normally a small stream, in full spate on 20 July 2007. This photograph was taken at 1932 UTC, seven hours after the rainfall had stopped. The water is 1.9 metres above normal midsummer level; the small inset photograph (taken in September 2002 prior to the installation of the gaugeboard) shows a more normal summer view in which the stream is barely visible. (Photograph © Stephen Burt.)



Figure 5. The main road into Stratfield Mortimer inundated by the Foudry Brook flood and impassable to traffic, 20 July 2007. This photograph was taken at 1938 UTC. (Photograph © Stephen Burt.)

higher, flood peak on the Thames in Berkshire on 24–25 July from floodwaters making their way downstream from the 20 July storms in Gloucestershire and Oxfordshire.

Instrumental note

For those interested, the rainfall totals were recorded using a standard 'five inch' check-gauge and two Didcot Instruments 0.2 mm tipping bucket gauges. The site is a registered Met Office rainfall site. Solar radiation is from a Kipp & Zonen CMP3 pyranometer. All electronic sensors are logged to a Campbell Scientific CR10X logger.

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DOI:10.1002/wea.151

References

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- Met Office.** 1980 Solar radiation data for the United Kingdom 1951–75. Met O 912

Manchester/Sheffield temperatures?

We write to ask if any readers can help us in identifying temperature records for the Greater Manchester and Sheffield areas. We already have data from Hulme, Ringway/Woodford, and Sheffield University. The data are for use within the EPSRC-funded SCORCHIO project (Sustainable Cities: Options for Responding to Climate Change Impacts and Outcomes), which is addressing urban heat island effects with case studies in Manchester and Sheffield.

If anyone is aware of any private weather stations or temperature records in Greater Manchester (and/or Sheffield) and would be prepared to make these available to us we would be most grateful. Please contact Dr Ann Webb ann.webb@manchester.ac.uk about data, or if you would like more details about SCORCHIO contact Claire Smith claire.smith-2@manchester.ac.uk

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DOI:10.1002/wea.197