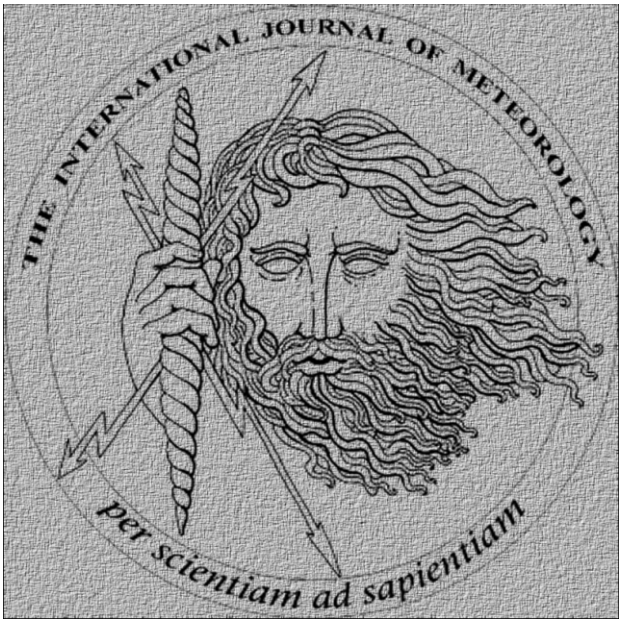
TORRO
THUNDERSTORM DIVISION REVIEW FOR BRITAIN AND IRELAND 2017

also incorporating the Thunderstorm Census Organisation (TCO) annual survey



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Abstract

Based on 'thunder heard days', widespread thunderstorm outbreaks and reports of lightning damage, 2017 was another 'quiet' year for thunderstorms.

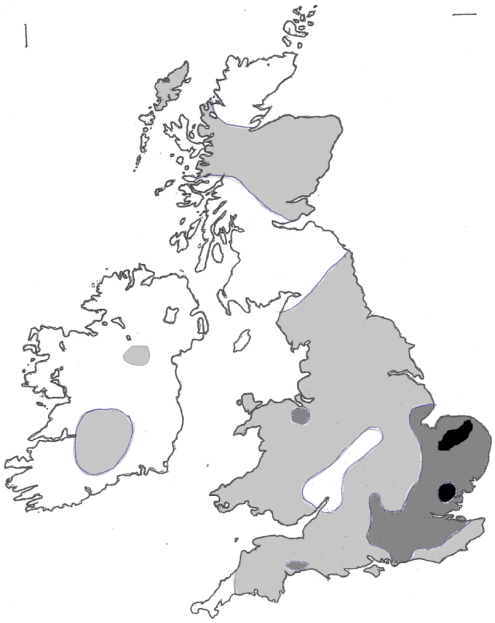

Figure 1: Thunder days in 2017. Black = 15–19 days, dark grey = 10–14 days, light grey = 5–9 days, white = under 5 days.

Figure 2: Mean number of thunder days 1981–2010. Black = 15–19 days, dark grey = 10–14 days, light grey = 5–9 days, white = under 5 days.

1 Overview

Thunder day totals for 2017 are mapped in Figure 1, with a map of the 1981–2010 means for comparison in Figure 2, and are also presented, for selected stations with long term averages (mostly 1981–2010) in Table 1. The usual caveats apply with respect to the interpretation of maps of thunder frequencies such as the distribution of observers, the number of observations based on a 24-hour watch and the impact (arguably an increasing one) of background noise. Prichard (1985, 2016) and Webb (2014) discussed various issues associated with this statistic. Overall, annual thunder day totals in 2017 were mostly well below average.

Prichard (1986) studied the *Daily Weather Report*[1] to identify dates of widespread thunder over England and Wales from 1946 to 1985; this was based on the proportion of synoptic stations in the publication which reported thunder. More recently, there has been increasing automation of synoptic stations with, consequently, less data on thunder available from such sources. However, a comparable identification of the geographical extent of thunder can be made by using a combination of reports from voluntary observers (and available synoptics) and the distribution of sferics. The most readily available sferics archive is from *Blitzortung.org*[2]. Met Office ATD sferics data[3] (Elsom et al, 2018), available via *Netweather*, has also been checked for dates referred to below. Days of 'widespread' thunder have been identified as occasions when thunder is estimated to have been audible across at least 25% of the UK land area. However, there will inevitably be some uncertainties and borderline cases. Moreover, some

[1] *Daily Weather Reports* are now available from the Met Office digital archive at: https://digital.nmla.metoffice.gov.uk/archive/

[2] http://en.blitzortung.org/archive_data.php (accessed May 2018).

[3] https://www.metoffice.gov.uk/learning/storms/thunder-and-lightning/lightning (accessed 14 Jan 2019)

instances will have involved extensive overhead activity (such as with an MCS) whereas other days will have been 'showery' in nature, when a considerable proportion of observers hear just distant thunder.

Based, broadly, on the aforementioned sources and criteria, the mean annual total of widespread thunder days for the whole UK for the 20 years from 1996 to 2015 was 14 days. Thunder could be described as widespread over the UK on 8 days in 2017 (subject to future review) and this evident 'deficit' partly explains the corresponding shortfall of 'thunder days' at individual locations in 2017.

2 Reported incidence of overhead storms and lightning damage in 2017

Overhead thunder is defined as electrical activity reported by an observer to be at a distance of 5km or less, or 'lose'. Observations of overhead thunder and the duration of thunder are given for selected locations in Table 2. The reported significant lightning incidents (assumed to be only a proportion of the total and subject to future review) totalled 86. The seasonal distribution of reported lightning incidents and damage is shown in Table 3. The tally of reported incidents was below average (Figure 3). There was only one incident (reported so far) involving a person being struck. However, this incident on 27 May resulted, sadly, in a fatality when lightning struck a 60-year-old man on Fynn Valley Golf Course in Suffolk; he later died in hospital. Elsom and Webb (2017) analysed the incidence of lightning fatalities by activity over the most recent 30 years (1987–2016) and found that 72% occurred in association with sports and leisure activities. The 2017 annual count of lightning incidents also included 65 which involved strikes on buildings (mostly domestic homes) and, of these, 49 caused appreciable damage and/or started fires.

3 Severe thunderstorms and damaging hail in 2017

27 May

Three active areas of thunderstorms affected different areas of Great Britain through the calendar day (Prichard, 2017). There was a fairly classic sequence for a thundery plume and 'breakdown', with high pressure over the North Sea on 25–26 May drawing hot air a long way northwards; temperatures reached 29.4^{o}C at Lossiemouth, on the Moray Firth, on the 26th. A shallow depression then drifted northwards from Biscay into southwest England ahead of a cold front over western Ireland which, in turn, swung northeast and then north on the 27th. The first thunderstorm outbreak affected southwest England and South Wales in the early morning with spectacular electrical displays and several lightning damage incidents. The second major pulse affected Kent and East Anglia later in the morning (when the fatal golf course lightning incident occurred near Ipswich). By early afternoon, a severe outbreak of storms broke out over the north Midlands and moved on to affect northern England and southern Scotland, with locally damaging hailfalls in the Leeds and Durham areas (see Table 4).

18–19 July

The most outstanding thunderstorm episode of 2017 occurred on 18–19 July, albeit mostly restricted to England and Wales (Figure 4, Figure 5). A warm front lay from the Mersey to the Humber at 00 UTC on 19 July, the leading edge of a 'plume' (see below). At low levels, a broad trough of low pressure over northern France and the English Channel was moving northwards. At 500hPa, a major trough extended from just west of Ireland to Biscay. The severe thunderstorm activity was elevated and associated with large-scale destabilisation of the plume at mid levels. This instability is evident in the Brest radiosonde which shows, above a marked warm nose, 'free convection' from 650hPa up to the tropopause and also a near saturated layer around 600hPa with a dry layer above around 500hPa; this is a typical vertical pro-

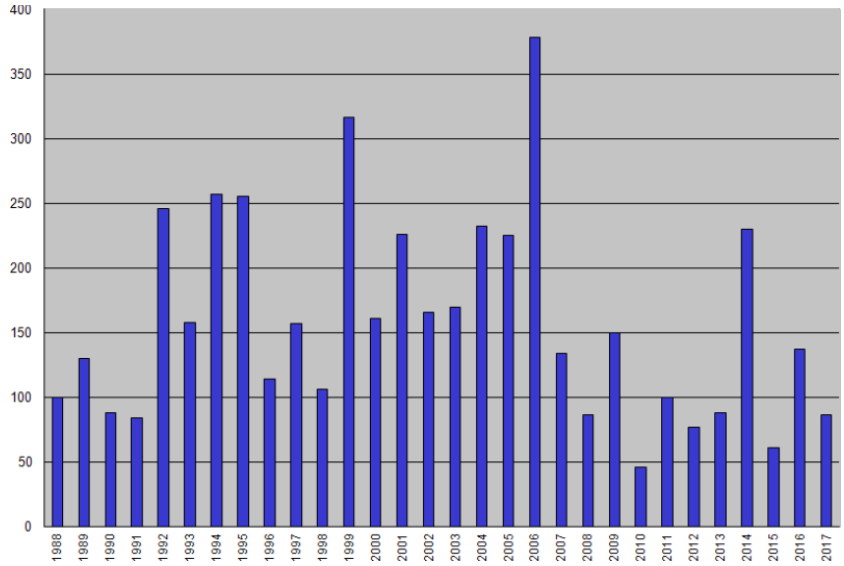

Figure 3: Significant lightning incidents by year, including 2017. Significant lightning incidents refer to people or animals directly or indirectly struck, houses and other buildings struck, trees struck and damaged, and strikes causing an electricity supply cut over a large area.

file for an elevated plume or *Elevated Mixed Layer* (EML).

The intense convection generated at least three large Mesoscale Convective Systems (MCSs) (Smart, D – pers. comm.). The first affected southwest England during the afternoon and 105mm of rain fell at St Keverne, Cornwall, 3km north of Coverack. This was associated with what has become known as *The Coverack Storm*. A weather observer in Coverack recorded 31mm of rain before his rain gauge was smashed by hail. Estimates of 150–170mm were made from two buckets left out in the centre of the storm and the use of dual polarisation radar (to distinguish hail from rain) enabled these falls to be verified by radar estimates, the latter indicating peak rainfalls of between 165mm and 201mm within 3 hours (Jewell and Best, 2018; JBA Consulting, 2018). Photographs confirm hailstones up to at least 20mm diameter (which dented a van) fell during the storm and the hail was intense enough to form heaps. People dealing with the storm impact at a local shop experienced bruising from the hailstones.

Other heavy falls on 18 July were largely associated with the second MCS, which crossed central south England and East Anglia (Figure 9) from the evening into the early hours of the 19th. Daily precipitation falls included 53mm at Twyford (Hants), 51mm at Widford (Herts) and 49mm at Balsham (Cambs). At Reading University, 45mm was recorded for the rainfall day of which 35mm fell in 45 minutes during the most intense period of the evening thunderstorm. Hailstones of 30–40mm diameter fell in and around Linton, Cambridgeshire (Table 4 and Figures 7 & 8).

Severe hail, size 20mm diameter or more and intense enough to cause noticeable plant and crop damage, was reported on six days in 2017. On at least three days, hail up to at least 30mm across was observed, sufficient to dent vehicles and damage outbuildings. The chief incidents are summarised in Table 4. All the reports currently known were quite localised, with no 'hail swaths' of significant length. Moreover, there were no reports of 'giant' hail (50mm+ diameter) in 2017, so damage was not of the magnitude of the supercell storms of 28 June 2012 and 1 July 2015 (Clark et al, 2018).

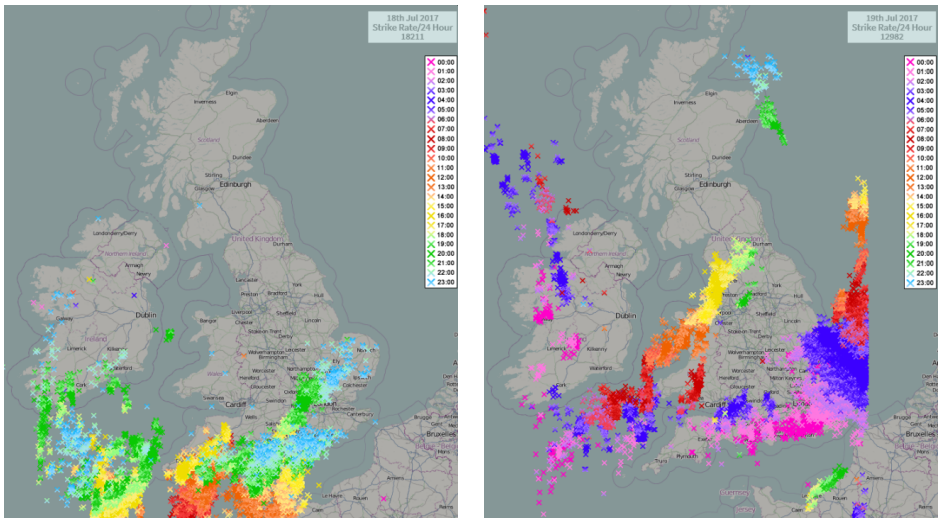

Figure 4: 24-hour Met Office ATD Sferics plots for (a, left) 18 July 2017 and (b, right) 19 July 2017. Courtesy *Netweather*; original data Crown copyright Met Office, 2017.

Figure 5: Lightning striking to the sea, taken from Bournemouth, Dorset 19 July 2017. © Matt Clark 2017.

Figure 6: One of the large hailstones which fell at Oakham, Rutland on the evening of 6 July 2017. © Richard Adams 2017.

Figure 7: Hailstones up to 40mm diameter, Linton, Cambs around 00 UTC on 19 July 2017. © Matt Stratfold 2017.

Figure 8: Hailstones larger than a 50 pence piece, Balsham Road, Linton, Cambs 19 July 2017. © Mark Baddeley 2017.

4 Historical perspective

2017 was another relatively 'quiet' year for thunderstorms, on the basis of 'Thunder heard days', thunderstorm hours (more limited data) and reports of lightning damage. Moreover there were no very extreme hail events with hail 50mm diameter or more as occurred for instance on 1 July 2015.

Acknowledgements

Special thanks to: Matt Clark (Met Office) and Paul Brown for radar and sferics data; to the late Derek Elsom for reading the draft review with helpful suggestions; also David Smart (UCL) for links to additional radar, satellite and radiosonde data for the 18–19 July 2017 event. Some rainfall data has been sourced from the Climatological Observers Link (COL) and the Met Office Land Stations database (via BADC). Sincere thanks are again due to all TORRO and other (e.g. COL, WON, also UKWW internet forum) observers who have contributed information on thunderstorms and associated severe weather in 2017. New thunderstorm observers are always welcome. Further details of reporting are available from Jonathan Webb.

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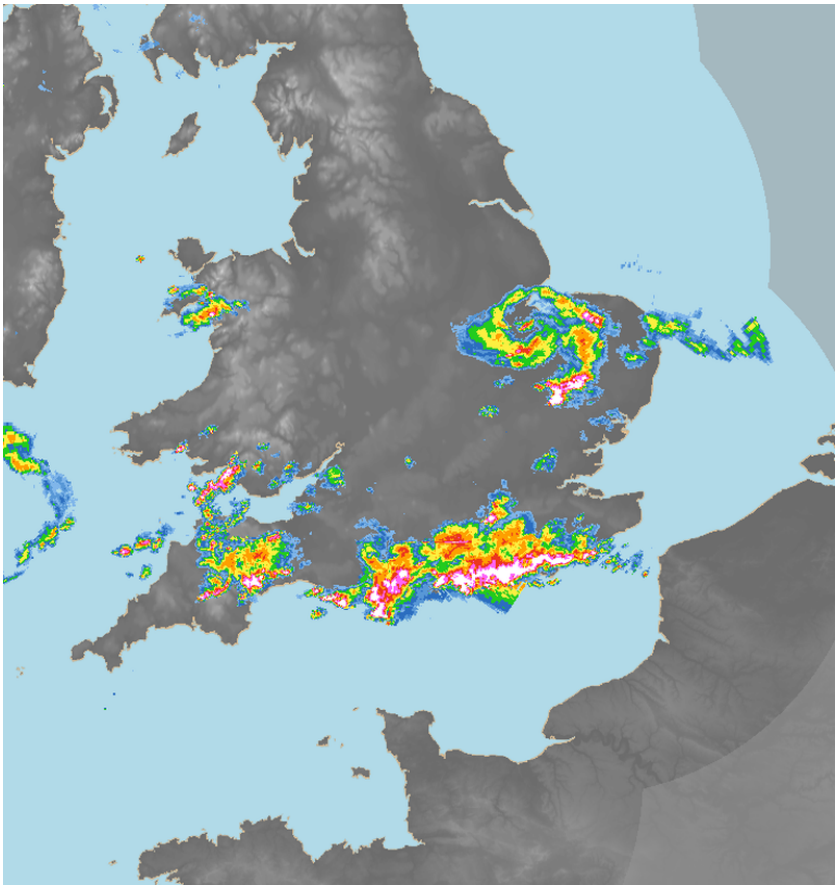

Figure 9: Met Office composite radar, England and Wales, 00 UTC on 19 July 2017. Note the spiraliform Mesoscale Convective Vortex (MCV) over the Fenland and East Anglia; the white echoes on the southeast edge of this swirl are consistent with the very large hail falling at the time on the Cambridgeshire/Hertfordshire border (see Figures 7 and 8). At the same time, the third Mesoscale Convective System (MCS) of the day can be seen developing from the cluster of intense thunderstorms extending from east Dorset to Sussex.

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Tables

STATION	COUNTY	2017 total	Average 1981–2010 (unless otherwise stated)	Diff +/-
Calthorpe	Norfolk	16	18 (1987-2015)	-2
Bury St Edmunds	Suffolk	16	18 (2001-2015)	-2
Claygate	Surrey	15	18 (2005-2014)	-3
Oxford	Oxon	11	12	-1
Wokingham	Berkshire	9	16	-7
Waddington	Lincs	9	15	-6
Woodlands St Mary	Berkshire	8	12 (1990-2009)	-4
Guernsey Airport	Chan Isles	8	12	-4
Carlton-in-Cleveland	N Yorkshire	8	13	-5
Ardpatrick, Co Limerick	Ireland	7	11 (1991-2005)	-4
Stornoway (town)	Western Isles	6	4 Stornoway airport 1950-1999	2
Brize Norton	Oxfordshire	6	10 (1971-2000)	-4
Lymington	Hampshire	6	9 (1986-2013)	-3
Stony Stratford	N Bucks	5	14 (1986-2010)	-9
Llangyndeyrn, Carmarthen	Dyfed	5	11 (2001-2015)	-6
Llansadwrn	Anglesey	5	7	-2
Knockroe, Co Monaghan	Ireland	5	6 (2006-2015)	-1
Great Malvern	Worcs	4	10	-6
Drumburgh	Cumbria	4	8 (2001-2010)	-4
Ebbw Vale	Gwent	4	8 (1988-2010)	-4
Velindre	Powys	3	10	-7
Fair Isle	N Isles	3	6 (1975-2000)	-3
Straide, Co Mayo	Ireland	3	9 (2001-2015)	-6
Camborne	Cornwall	2	8 (St Mawgan)	-6
Cosby	Leics	2	13	-11
Elderslie	Renfrew	2	6	-4
Dun Laoghaire, Dublin	Ireland	1	8 (2001-2010)	-7
Ronaldsway	Isle of Man	1	4	-3
Eskdalemuir	Dumfries	1	7	-6

Table 1: Thunder days in 2017 at selected locations.

Station (County)	**Thunder days/(Overhead thunder days)**	**Storm hours 2017**	**Comparative notes ref thunder duration**
Oxford (Oxon)	11 (3)	12	Mean 2002-2016 was 19 hours (mean t hours at Brize Norton 1971-1983 were 24)
Bury St Edmunds (Suffolk)	16 (6)	28	Mean t hours 2002-2016 were 29 (Wattisham 1971-1983 mean was 34)
Llangyndeyrn (Carmarthen)	5 (0)	9	Meant t hours 2006-2015 were 22
Knockroe, Monaghan (Ireland)	5 (2)	9	Mean t hours 2007-2016 were 10
Carlton-in-Cleveland (N Yorks)	8 (4)	12	Mean hours 2002-2016 were 23 (mean t hours at Leeming 1971-1983 were 22)
Elderslie (Renfrew)	2 (2)	2	Mean t hours at Abbotsinch 1966-1980 were 16 (Elderslie 2002-2016 = 8)

Table 2: Duration of thunder and number of hours of thunder heard 2017.

Date	**Max.Diam, mm***	**Severity rating (Severe, H3+, in bold**	**Locations affected**
27 May 2017	20-25	**H3**	Durham
27 May 2017	20	H2	Halton Moor (West Yorkshire)
02 June 2017		H2	Orpington (Kent)
06 July 2017	25-30	**H3**	Oakham (Rutland), see Figure 6
18 July 2017	20-30	**H4**	Coverack (Cornwall)
19 July 2017	40	**H4**	Hadstock > Linton (Cambs), see Figures 7&8
19 July 2017	15-20	H2	Ashford (Kent)
01 August 2017	25	H2-3	Alderley Edge (Cheshire)
05 August 2017	10-15	H1-2	Solihull (West Midlands)
01 September 2017		H1-2	Hythe (Kent)

Table 3: Significant hailstorms (H2 intensity and/or hail max 20mm diameter or more) in 2017. Note: the severity rating and hail swath details are based on current information and may (in the context of TORRO's ongoing research) be subject to future review.

January	0
February	0
March	0
April	0
May	23
June	9
July	33
August	16
September	4
October	1
November	0
December	0
Total	**86**

Table 4: Reported lightning incidents in Britain and Ireland by month, 2017.