

Exceptional warmth, September 2016

A brief heatwave from 12 to 15 September brought exceptionally high temperatures to south-east England, accompanied by some torrential downpours causing flash flooding.

On 13 September, Gravesend (Kent) recorded 34.4 °C, the UK's highest temperature of the year and the highest September temperature since 1911; this value being around 14 °C above the long-term average. Daily minimum temperatures for 14 September were also exceptionally high, at a few locations exceeding 20 °C.

The heat was associated with a southerly flow of air from France and Spain, with the humidity leading to thunderstorms bringing intense downpours and causing flash-flooding. Several locations recorded hourly totals exceeding 30mm.

Impacts

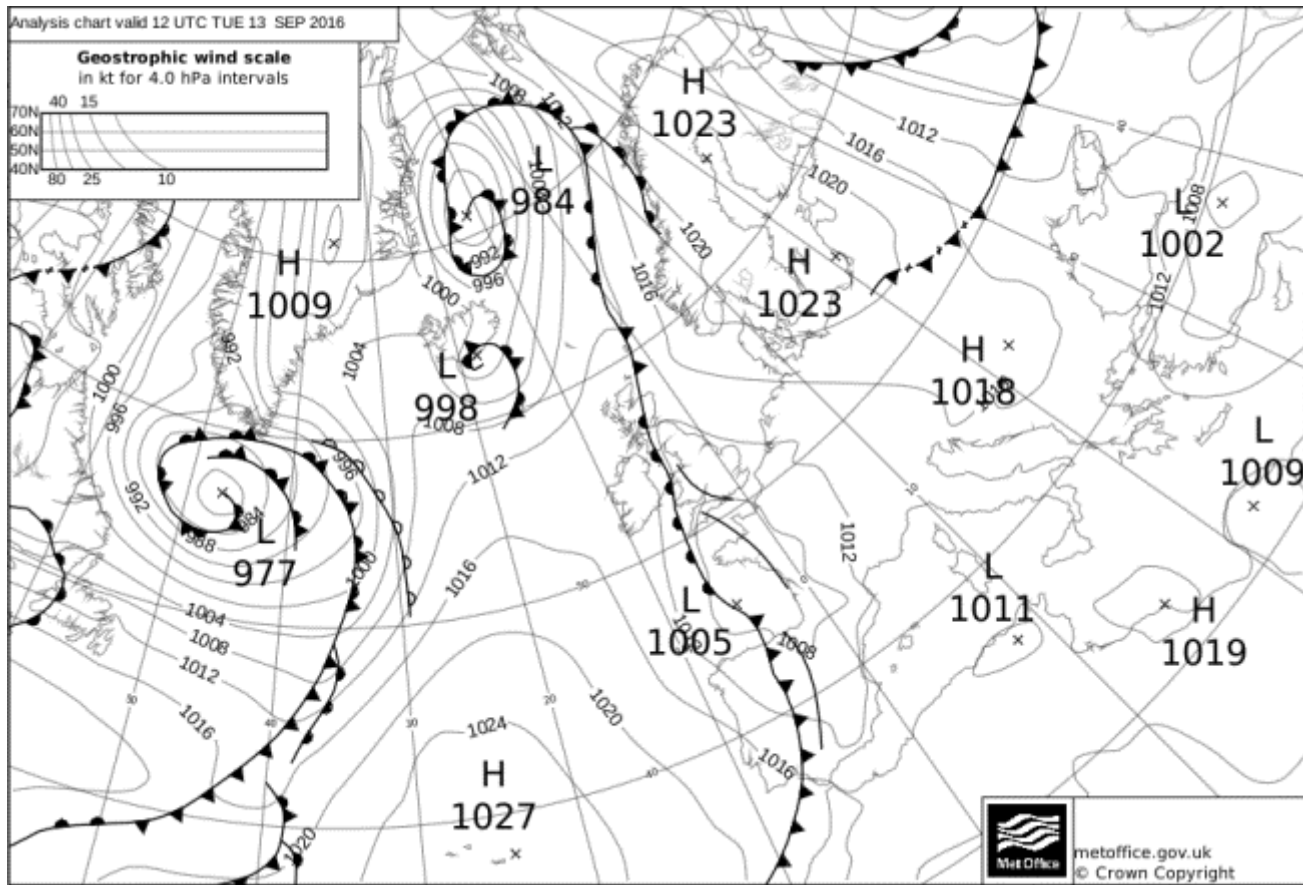
While many in eastern England enjoyed unseasonably hot weather on the UK's beaches, elsewhere flash flooding resulted in significant weather impacts. Overnight 13 to 14 flooding affected parts of west Cornwall and severe thunderstorms also affected the south Pennines. In the early morning of 16th there were further torrential downpours across southern England causing travel disruption to roads and railways, multiple lightning strikes and flooding at Wallingford Hospital, Oxfordshire. A train derailed in a landslip near Watford Junction, injuring two people.

The image below shows lightning strikes from a thunderstorm overnight 13 to 14 September at Hebden Bridge, West Yorkshire. Image courtesy fotohebdn.

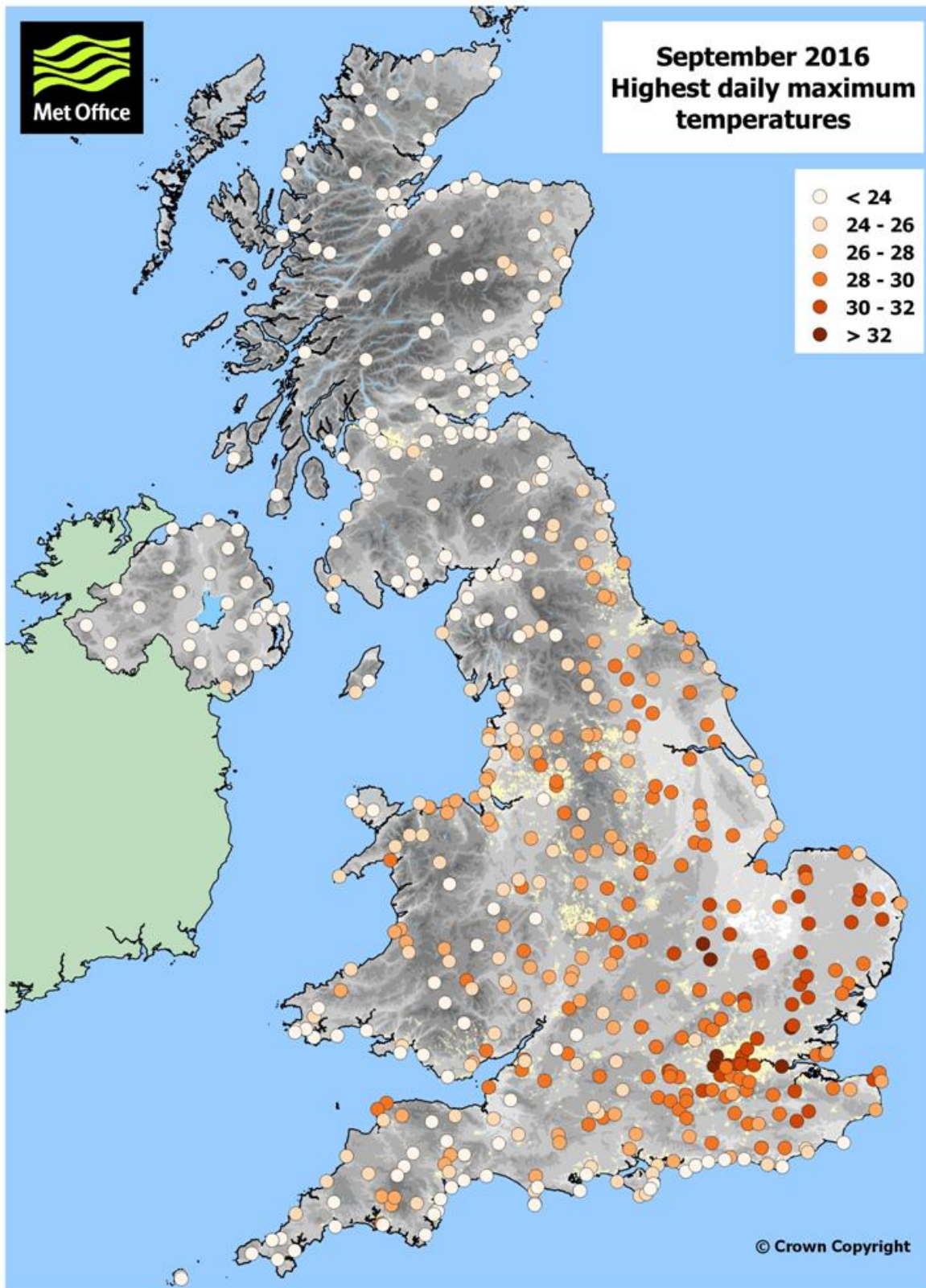


Weather data

The analysis chart below at 1200 GMT 13 September shows the UK in a light southerly flow bringing hot, humid air from France and Spain to eastern areas, with weather fronts bringing torrential downpours further north and west.



The map below shows the highest temperatures reached during September 2016 at UK weather stations. On 13 September temperatures exceeded 30 °C across much of East Anglia and Kent, with 34.4 °C at Gravesend (Kent), 33.5 °C at Kew Gardens (Greater London) and 32 °C reached at Writtle (Essex), Bedford and Cambridge.

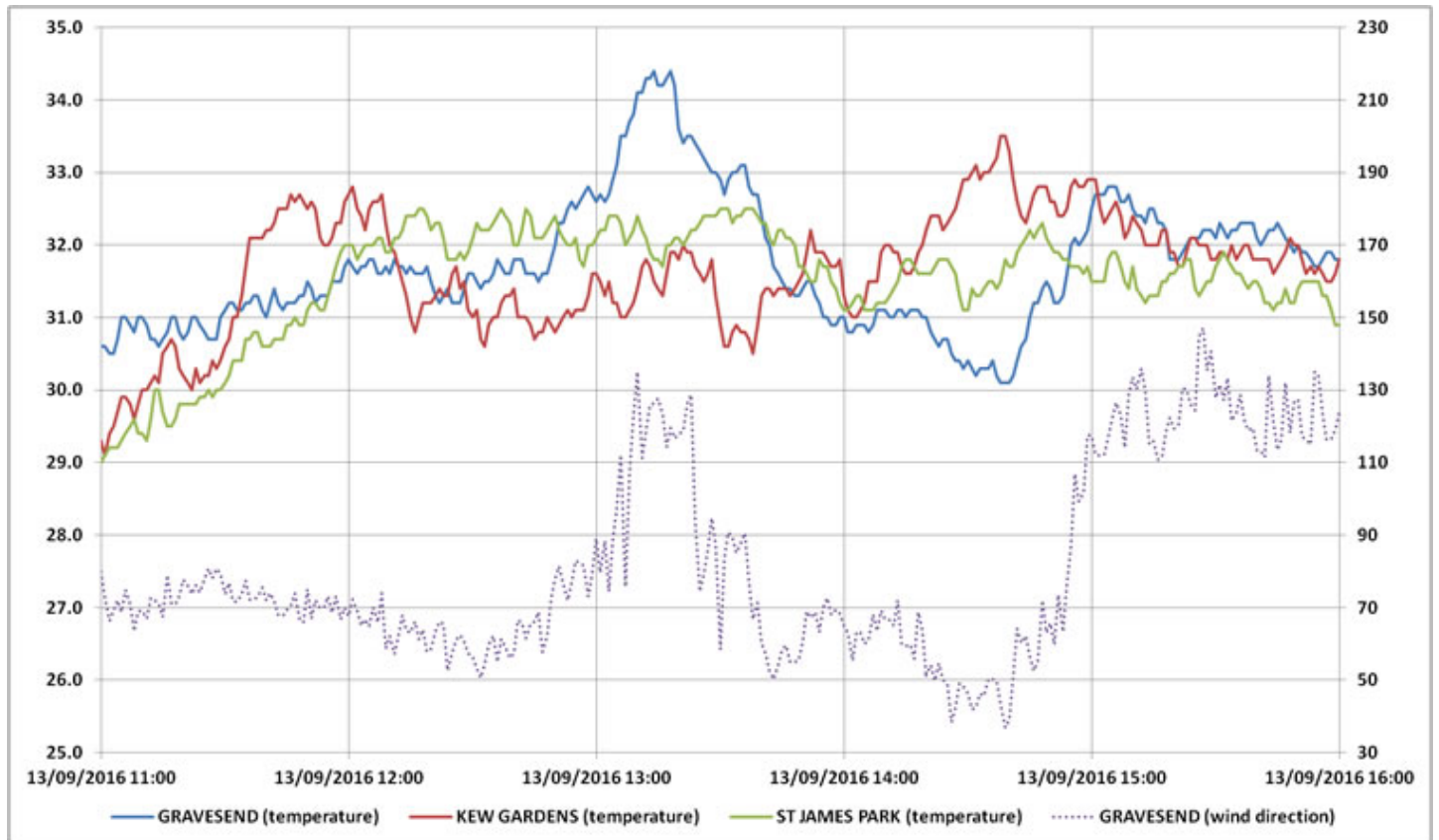


The chart below compares hourly air temperatures recorded at two locations in Kent, Gravesend and Manston from 11 to 17 September 2016. The 1981–2010 long-term average daily maximum and minimum temperatures for September for these two stations are shown as hatched lines. Both stations exceeded 30 °C on the 13th, with maxima for Manston slightly lower than Gravesend due to the former's coastal location in the far east of Kent. In contrast, daily minimum temperatures at Manston held up higher than Gravesend and remained over 20 °C on 14th (sea surface temperatures being near their maximum at this time of year).

Hourly air temperatures within SYNOP messages are recorded at 10 minutes to the hour; at Gravesend the hourly SYNOP at 1300 GMT was 32.0 °C and at 1400 GMT it was 31.4 °C, and yet the maximum temperature at this station which occurred at 1318 GMT was 34.4°C. Why was this so much higher?

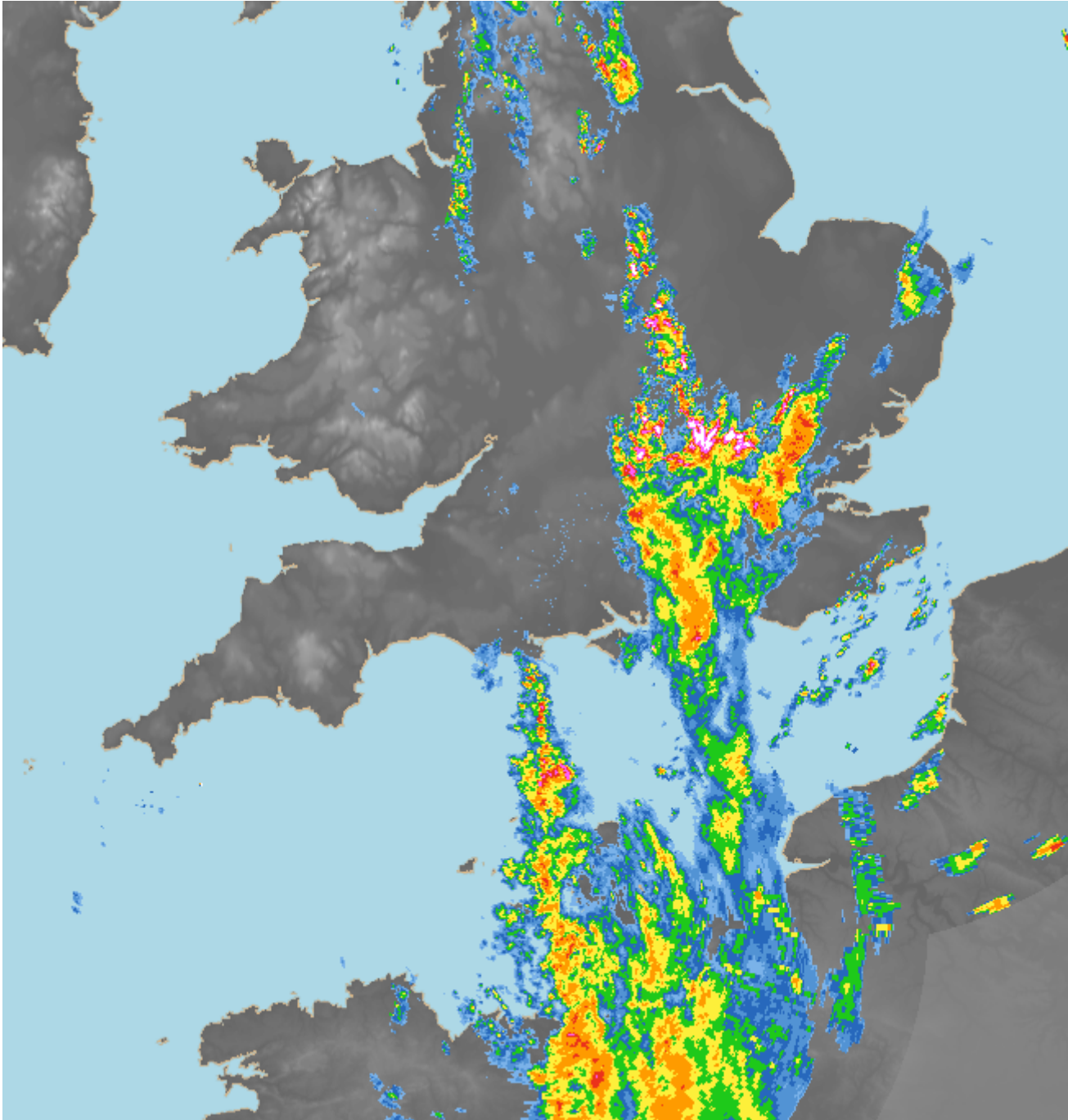
The chart below compares minute-resolution air temperatures at Gravesend, Kew Gardens and St James's Park, together with wind direction at Gravesend. The temperatures at these three stations agree well, but with a notable peak at Gravesend between 1300 and 1400 GMT. This peak coincided with the wind direction veering from around 70° to 120°. Since Gravesend is located in the Thames Estuary this would have led to a longer land-track for the airflow and associated increase in temperature, which subsequently fell back when the wind direction changed again. There was a similar increase again just before 1500 GMT. The location of St James's Park and Kew Gardens in central and south-west London meant that temperatures at these stations were not similarly affected.

The recording of minute-resolution data helps enable analyses of this type which would not be possible with hourly resolution data alone; in a similar analysis the temperature of 36.7 °C at Heathrow [on 1 July 2015](#) was linked to a short gap in cloud cover at this location. These investigations help explain the subtle local-scale variations seen in observed data.

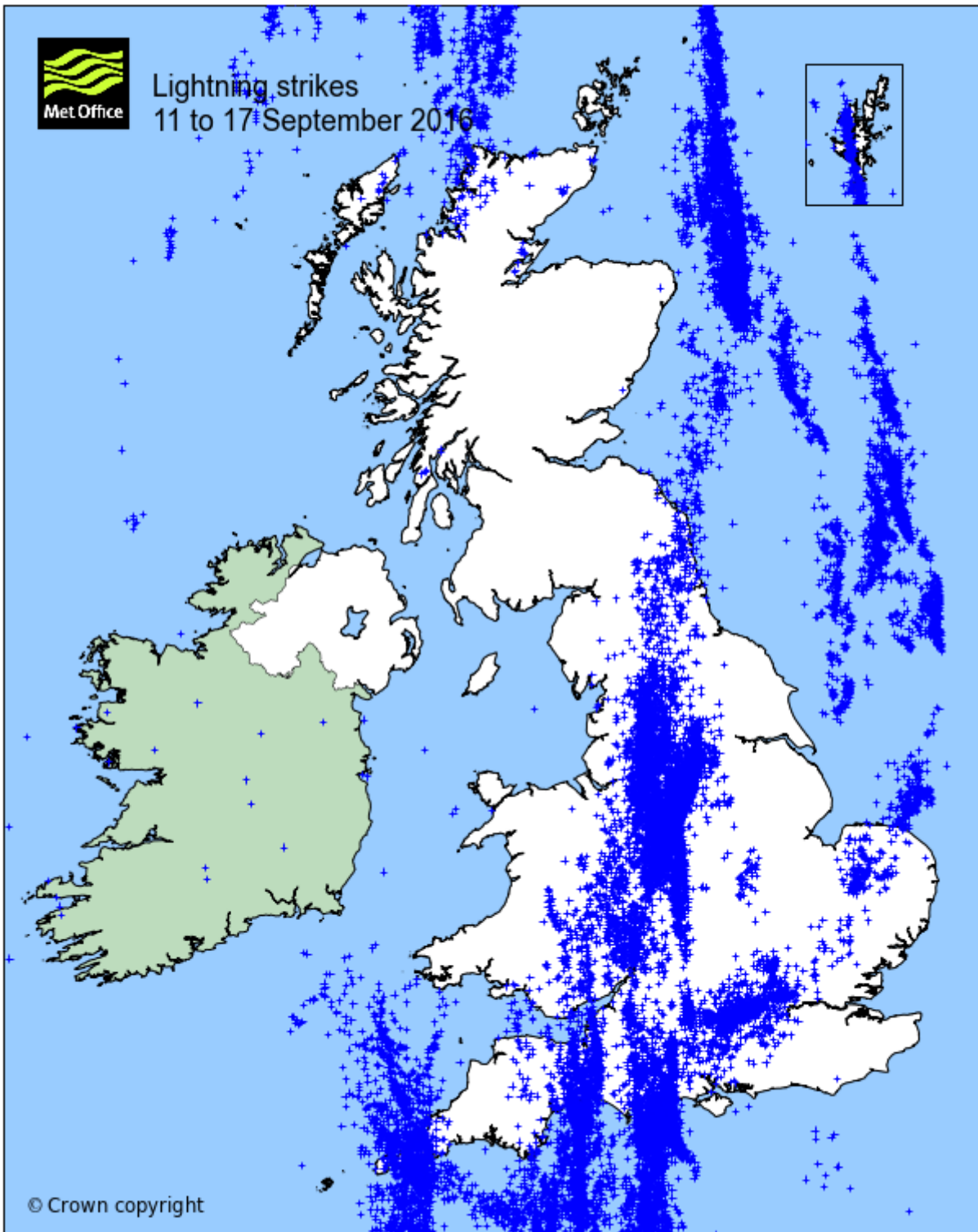


The rain-radar image below at 1900 GMT 13 September shows torrential downpours across the south Pennines. 34.2mm was recorded in one hour to 1900 GMT on 13th at Lothersdale (West Yorkshire). *White areas in this and the following map indicate rainfall intensity exceeding 32 mm per hour indicative of torrential downpours.*

The rain-radar image below at 0600 GMT 16 September shows further torrential downpours across parts of southern England. 31.6mm was recorded in one hour to 0300 GMT at Swanage (Dorset) and 55.8mm was recorded in one hour to 0400 GMT at West Ilsley (Berkshire).



The map below shows lightning strikes recorded across the UK from 11 to 17 September. *These include both cloud-to-cloud and cloud-to-ground strokes.*



Historical context

It is not particularly unusual for temperatures to reach 30 °C in September in the UK. The last time this happened was 2013 when 30.2 °C was recorded on 5th at Writtle (Essex) and Frittenden (Kent), and we might typically expect 30 °C during one or two Septembers per decade. However, it is much more unusual for temperatures to exceed 32 °C; the maps below show the highest reached during the Septembers of 1949, 1929, 1926, 1919, 1911 and 1906 when this previously occurred.

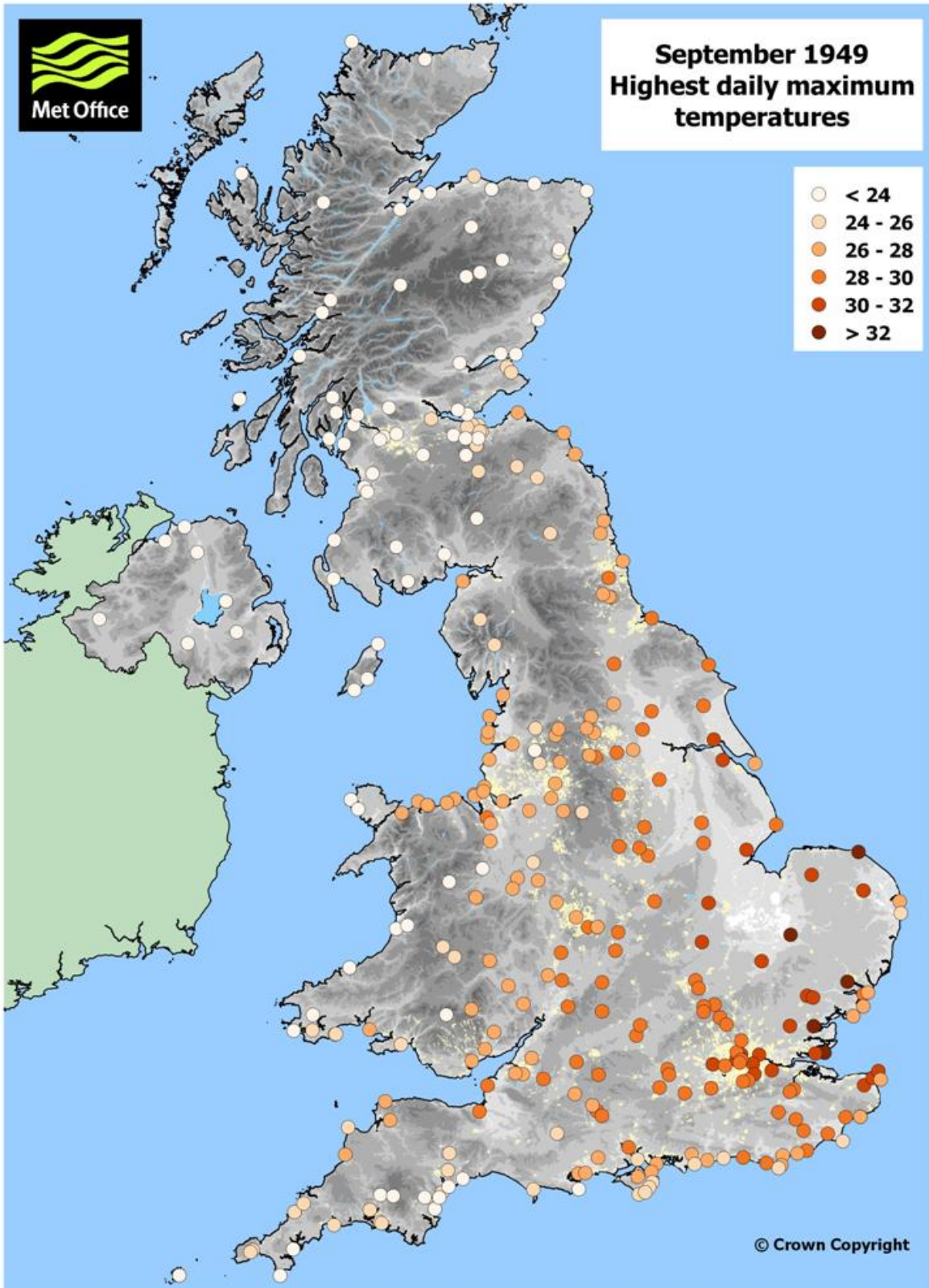
34.4 °C at Gravesend (Kent) on 13 September 2016 was the UK's highest September temperature since 1911, when 34.6 °C was reached at Raunds (Northamptonshire) on the 8th. However, the most significant September heatwave in observational records was from 1 to 2 September 1906. Temperatures exceeded 32 °C as far apart as Cheltenham (Gloucestershire), Macclesfield (Cheshire), Cromer (Norfolk), Oxford and Gordon Castle (Moray), with 35.6 °C at Bawtry, South Yorkshire on the 2nd being the UK record; this heatwave also set the Scotland record of 32.2 °C at Gordon Castle and the Northern Ireland record of 27.8 °C at Armagh. The 1906 event would appear to be the most notable September heatwave in observational records.

Note that the smaller number of stations plotted on the maps for earlier years reflects reduced availability of data for these years; work to digitize historical data is ongoing.



September 1949 Highest daily maximum temperatures

- < 24
- 24 - 26
- 26 - 28
- 28 - 30
- 30 - 32
- > 32

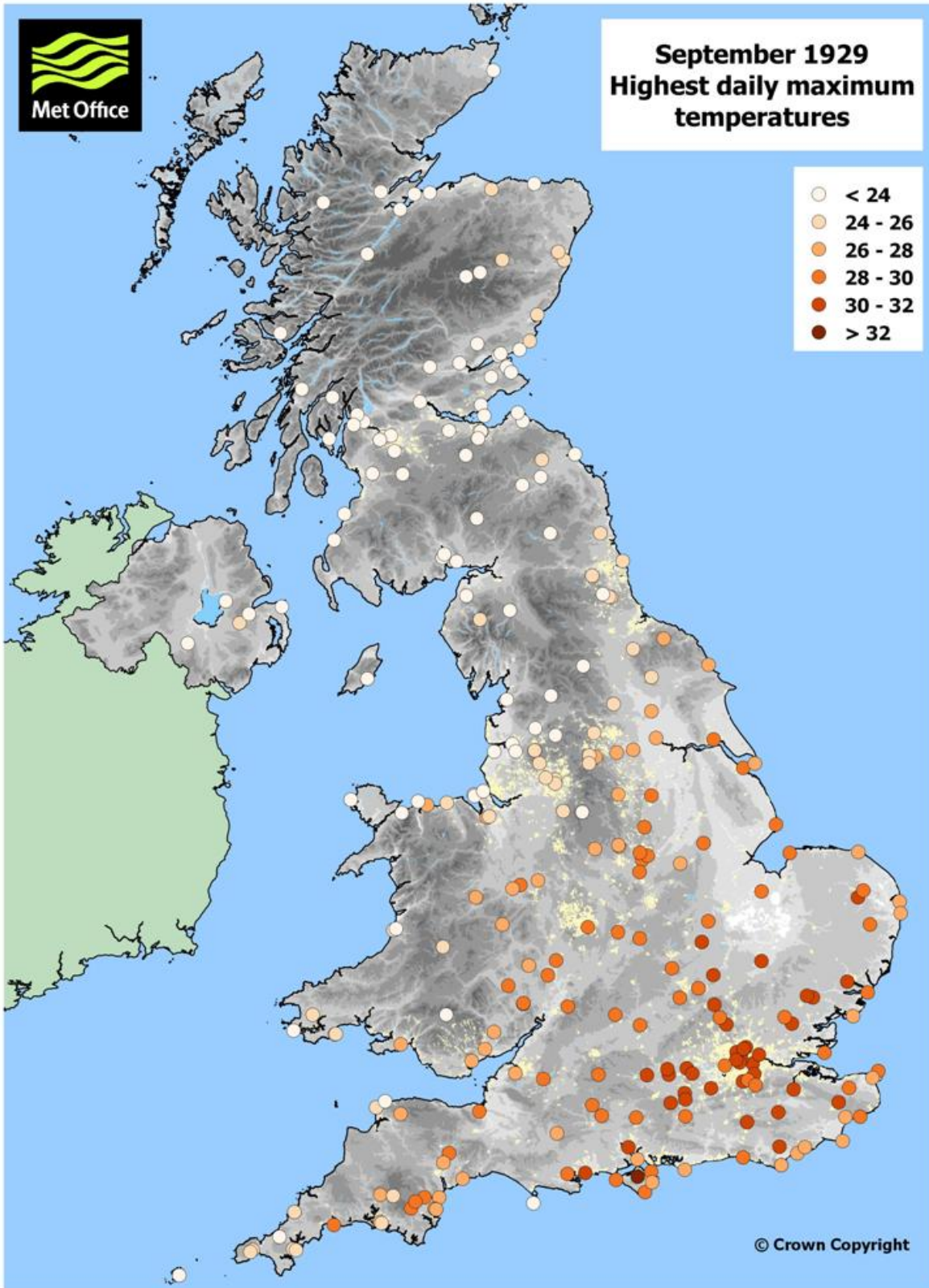


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September 1929 Highest daily maximum temperatures

- < 24
- 24 - 26
- 26 - 28
- 28 - 30
- 30 - 32
- > 32

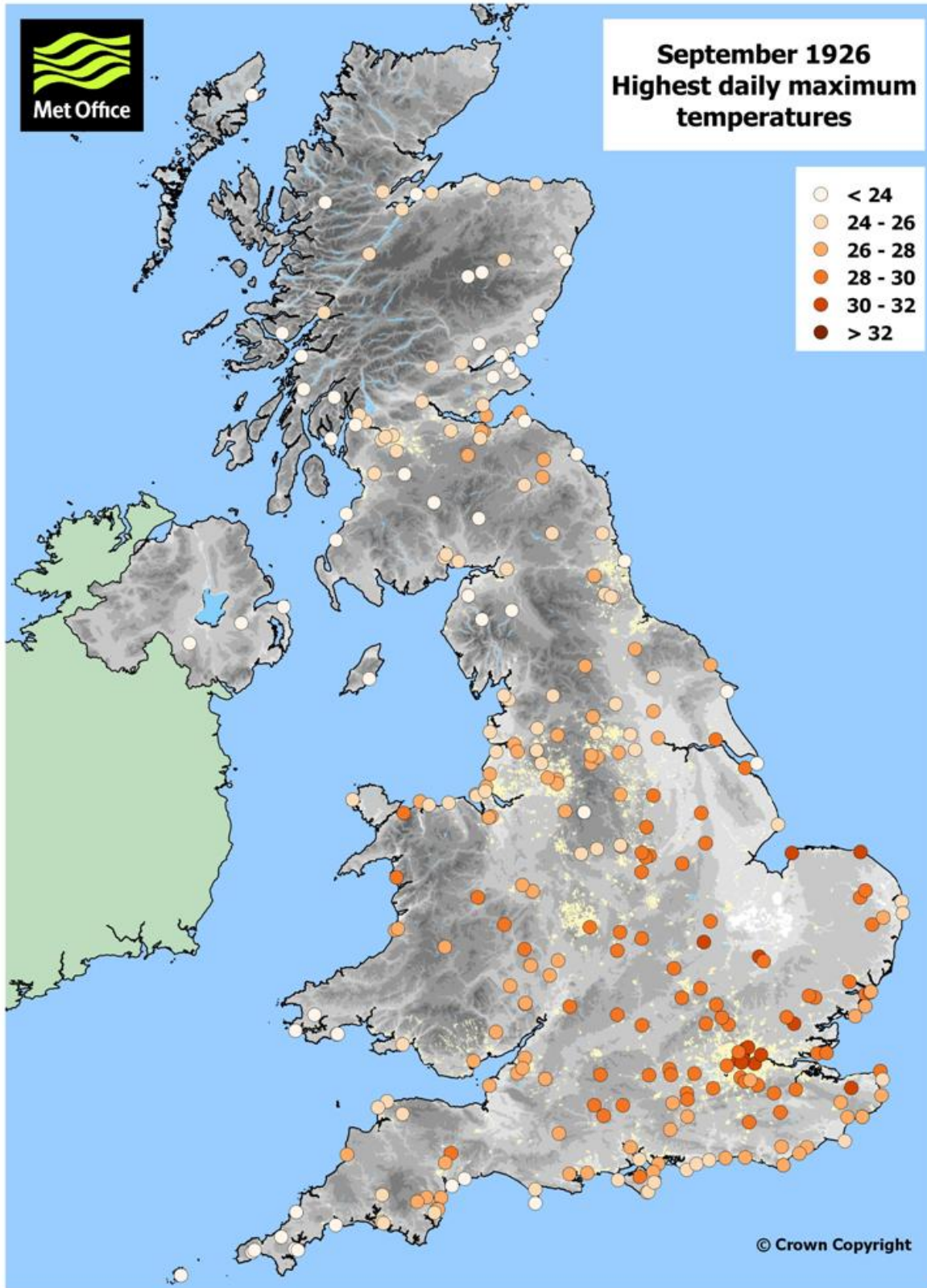


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September 1926 Highest daily maximum temperatures

- < 24
- 24 - 26
- 26 - 28
- 28 - 30
- 30 - 32
- > 32

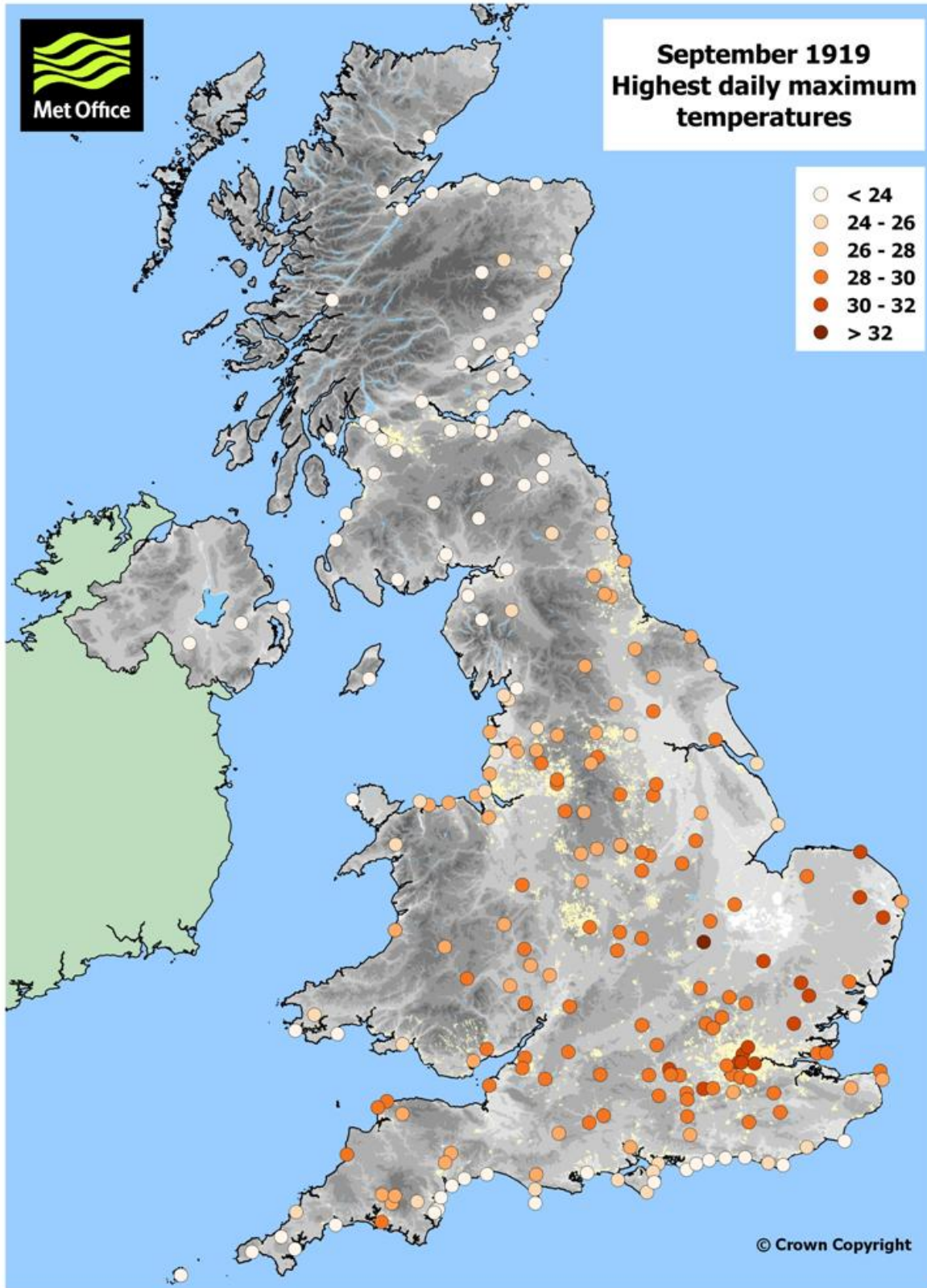


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September 1919 Highest daily maximum temperatures

- < 24
- 24 - 26
- 26 - 28
- 28 - 30
- 30 - 32
- > 32

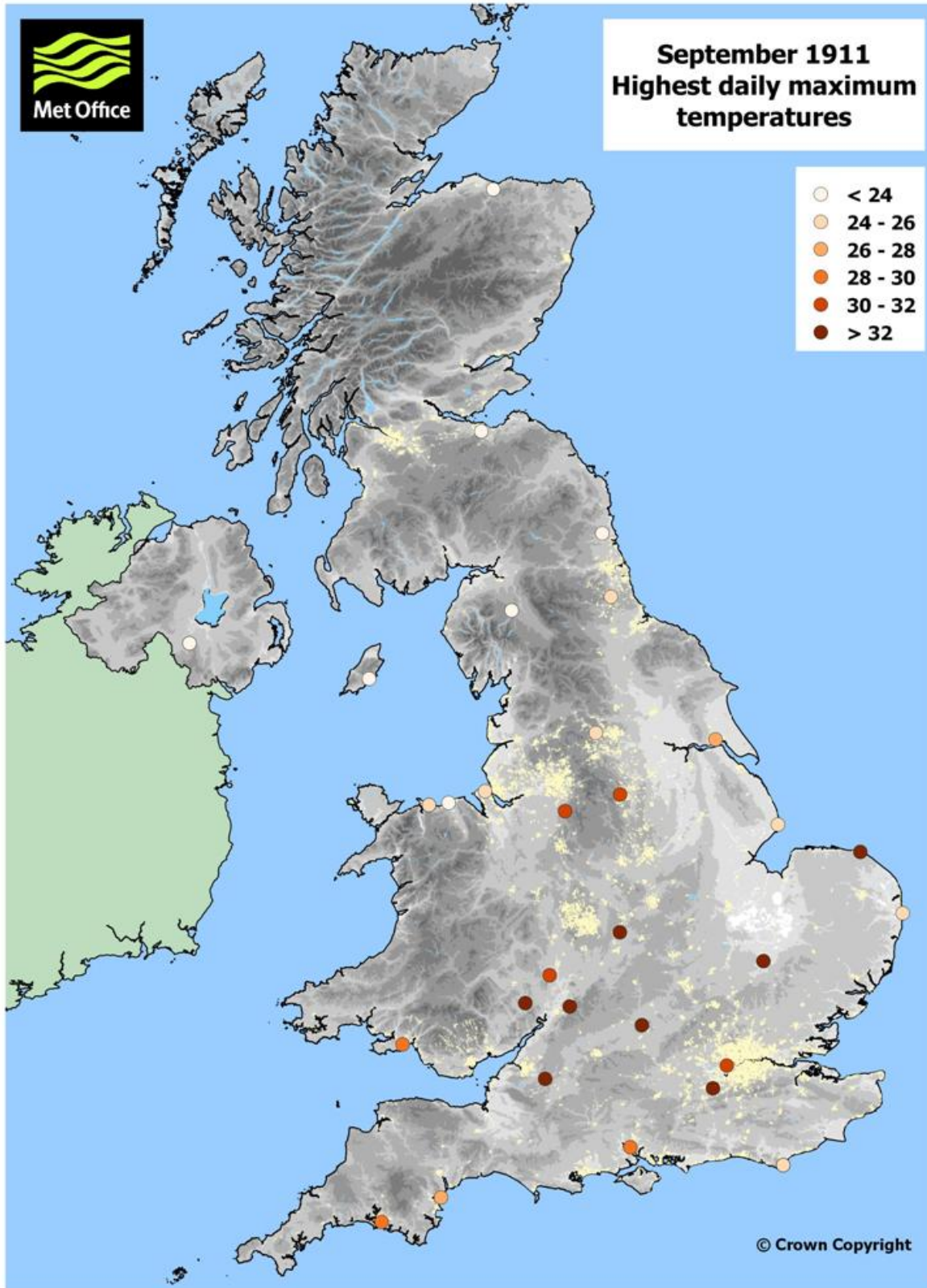


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September 1911 Highest daily maximum temperatures

- < 24
- 24 - 26
- 26 - 28
- 28 - 30
- 30 - 32
- > 32

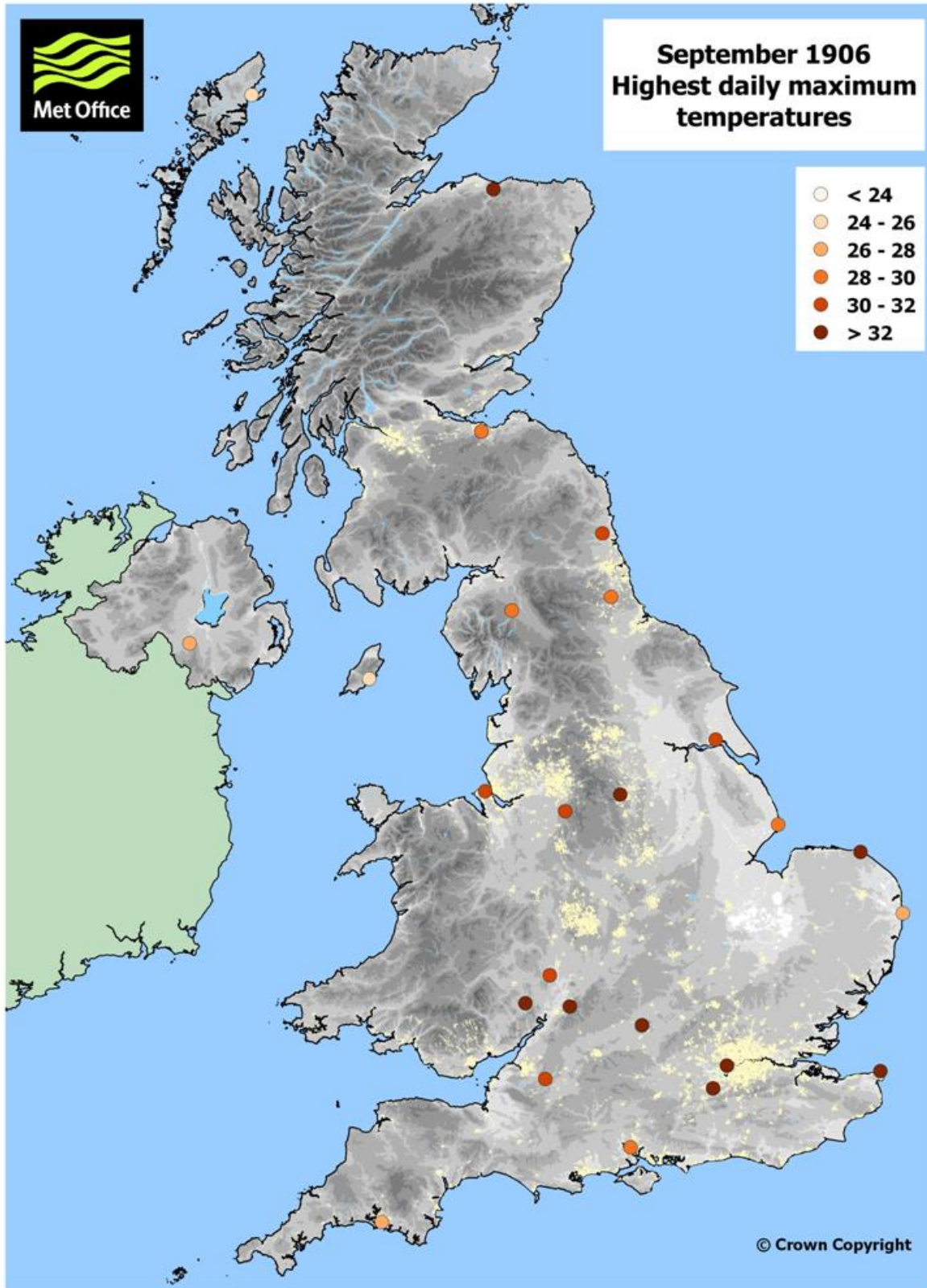


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September 1906 Highest daily maximum temperatures

- < 24
- 24 - 26
- 26 - 28
- 28 - 30
- 30 - 32
- > 32



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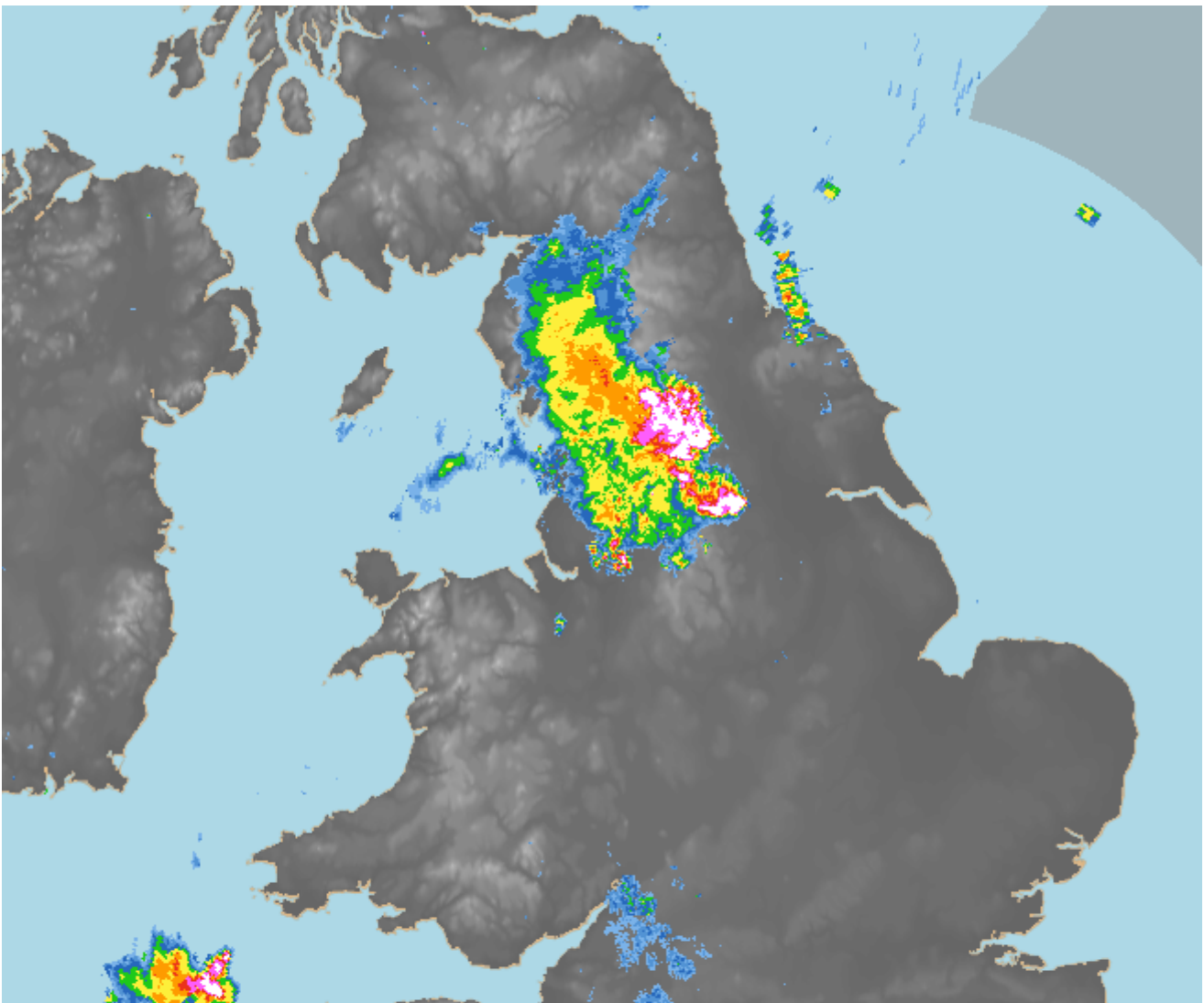
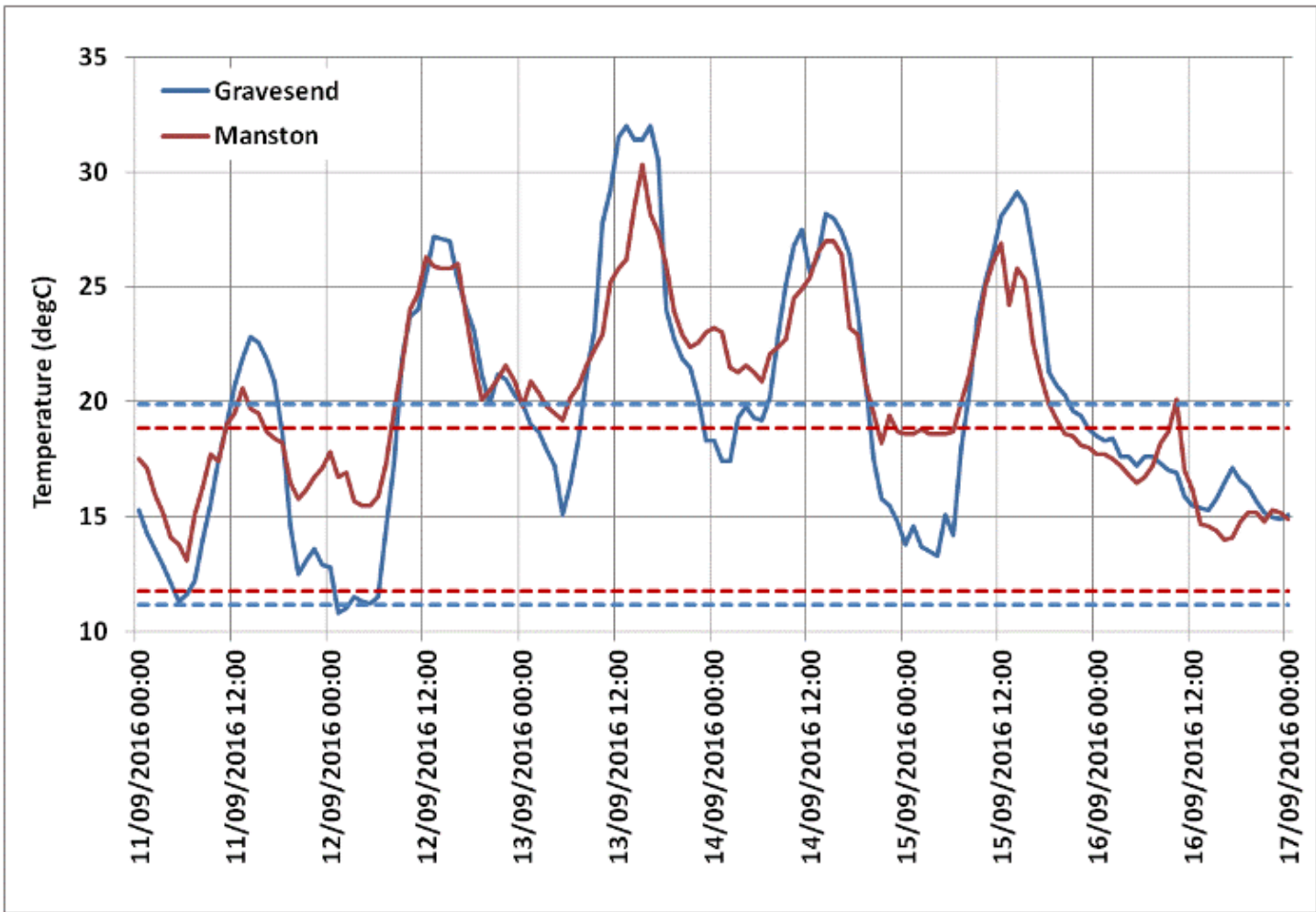
The following table lists individual long-running weather stations which set new September temperature records, or for Durham the highest September temperature for over 100 years.

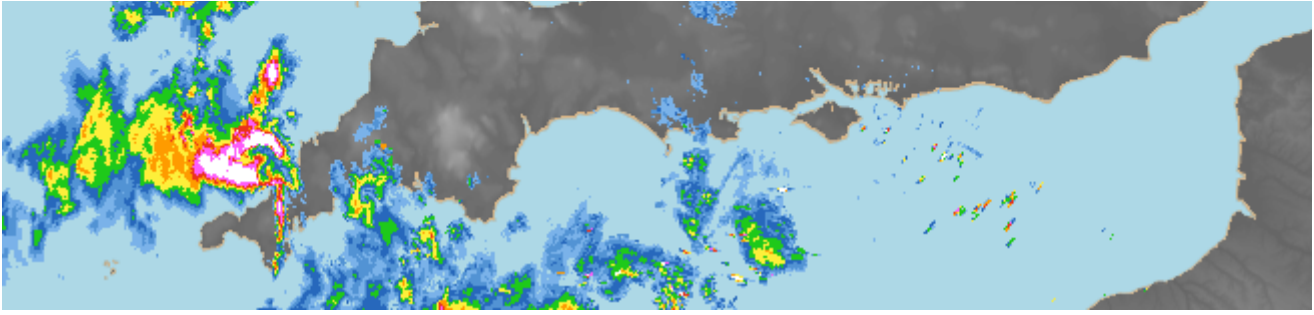
Station	Date	Max (°C)	Record type	Previous max(°C)	Previous date	Number of years since or record length (years)
Durham	13-Sep-2016	27.3	Highest since	30.0	01-Sep-1906	110
Rothamsted, Hertfordshire	13-Sep-2016	31.0	New record	29.4	05-Sep-1949	103
Woburn, Bedfordshire	13-Sep-2016	30.7	New record	29.4	05-Sep-1949	102
East Malling, Kent	13-Sep-2016	31.3	New record	31.1	04-Sep-1929	90
Sutton Bonington, Nottinghamshire	13-Sep-2016	29.6	New record	29.4	19-Sep-1926	86

Note that multiple historical occurrences of 29.4 °C in the table may reflect the fact that historically temperatures were recorded in whole degrees Fahrenheit, 85F is 29.4 °C.

It was also exceptionally mild overnight 13 to 14 September 2016; daily minimum temperatures on 14th included 20.7 °C at Manston and 20.6 °C at Langdon Bay (both Kent) and 20.1 °C at St James's Park (Central London). The latter station holds the UK's daily minimum September record with 21.7 °C on 5 September 1949.

34.4 °C on 13 September 2016 was the UK's highest temperature of the year, exceeding 34.1 °C at Faversham (Kent) on 24th August. While it is not especially unusual for individual weather stations to record their highest annual temperature outside summer (June to August), for the UK overall the last time this occurred was in 1954, when 30.0 °C was recorded at Regents Park (London) on 1st.





Last updated: 28 September 2016

