Evaluation and verification of new UK air temperature extremes during the July 2022 heatwave: part 1, maximum temperatures

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Stephen Burt
Department of Meteorology, University of Reading, UK

The July 2022 heatwave in the United Kingdom

The brief but intense heatwave which affected all areas of the British Isles during the third week of July 2025 was particularly noteworthy as being the first occasion on which screen temperatures exceeded 40°C anywhere in the United Kingdom. The event resulted in widespread new records for high air temperatures, both day maximum and night minimum, many by surprisingly wide margins relative to existing climatology.

The World Meteorological Organization seeks to encourage the objective evaluation and publication of national and international weather and climate extremes (see, e.g. WMO, 2023a and Merlone *et al.*, 2024). With this in mind, this paper sets out an objective examination 'for the record' into the circumstances and validity of the two new UK air temperature records established on 19 July 2022. Part 1 considers the maximum temperature (hereafter Tmax) 40.3°C recorded at Coningsby in Lincolnshire, while Part 2 (Burt, 2025) reviews the 24h minimum temperature (hereafter Tmin) 26.8°C at Shirburn Model Farm in Oxfordshire. The UK Met Office maintains the accepted list of national weather records (Met Office, 2025).

Figure 1. Places referred to within the text.

Synoptic background

The circumstances leading up to the brief but intense heatwave which affected the British Isles during 18–20 July 2022 have already been examined (Kendon, 2022; Kendon *et al.*, 2023; Yule *et al.*, 2023 and others) and this section provides only a summary overview sufficient to provide context to the body of the paper itself. Places referred to within the text are shown on Figure 1.

Figure 2 depicts the surface synoptic situation over the eastern Atlantic area at 0000 UTC on 19 July 2022. The British Isles lay in a southerly flow between an anticyclone extending from Scandinavia to central Europe, and a low-pressure system located between Scotland and Iceland. Northern and western parts of the British Isles were cloudier and cooler under the influence of weak Atlantic fronts. The southerly airflow advected hot, dry air northwards from the near continent, which had seen very high temperatures over the preceding days, and these characteristics were further enhanced by rapid anticyclonic subsidence. Figure 3 shows a trajectory analysis of the origin of this air mass at various levels above southern England (red plot shows the preceding 3D trajectory of a parcel of air arriving at 500m amsl over London at 0000 UTC 19 July; similarly for the blue line at 1000m amsl and the green line at 2500m). The very pronounced subsidence inversion around the European anticyclone ensured extremely stable conditions: Figure 4 shows the ascent from Herstmonceux, on the south coast of England, at 0000 UTC on 19 July. As discussed in more detail subsequently, this 'subsidence cap' (or 'heat dome' as it became known in the media) limited the depth of both convective and turbulent mixing within the near-surface boundary layer, and in doing so, exerted considerable influence on surface temperatures, both by day and by night.

In passing, it is interesting to note that the synoptic pattern leading to the heatwave, together with expectations of possible 40°C temperatures, was indicated in some forecast

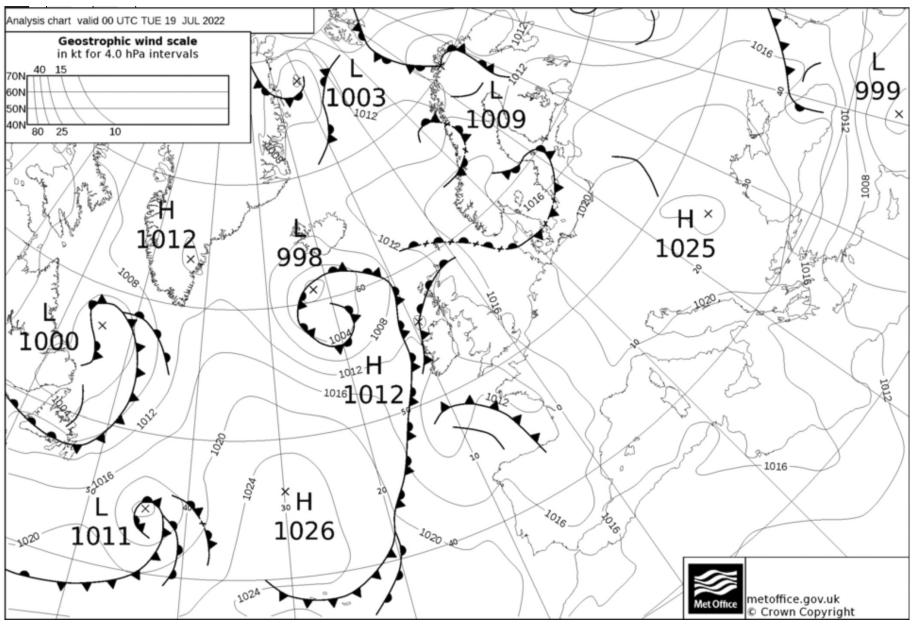

Figure 2. Surface synoptic situation over the eastern Atlantic area at 0000 UTC on 19 July 2022. (Courtesy Met Office: ©Crown.)

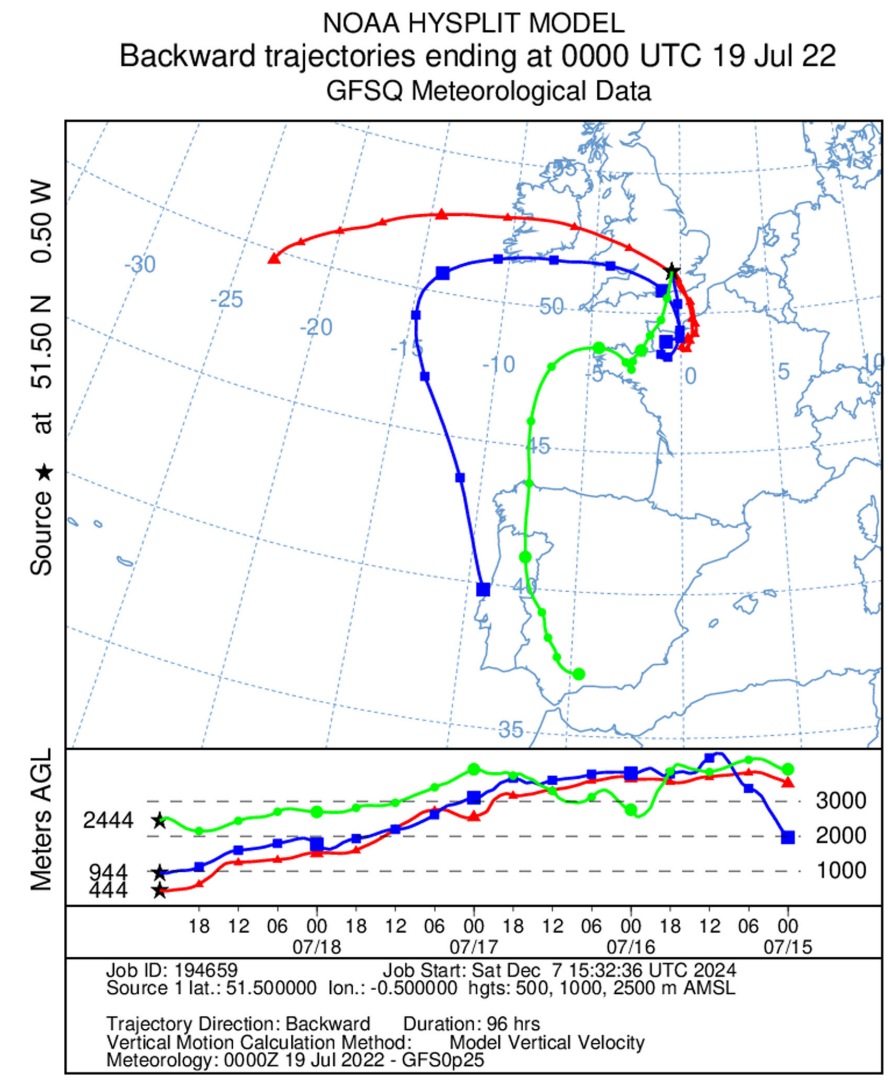

Figure 3. Backward trajectory analysis over 96h of air at various heights above London ending at 0000 UTC 19 July 2022: red, 500m amsl; blue, 1000m; and green, 2500m. The timescale runs from right to left, starting at 0000 UTC on 15 July. Note the rapid anticyclonic subsidence at lower levels and advection from the (very warm) Iberian Peninsula. (Courtesy of NOAA Air Resources Laboratory's HYSPLIT model.)

runs as early as the end of June (Holley and Lee, 2022), while shorter-outlook forecasts (48–72h) provided excellent advance warning of the impending extreme temperatures, including the first red heatwave warning by the Met Office (Kendon *et al*., 2023, p 50). As a result of such forewarning, Met Office staff were alert to the likelihood of new records being set in the coming days, and their internal check/validation scheme covering such significant events – described in more detail subsequently – was put into action, allowing for prompt assessment of all resulting temperature extremes.

The main causal factors for this heatwave were the advection of a hot, dry air mass from the near Continent, high solar elevation near midsummer, the subsidence cap, and very dry surface conditions following a dry winter and spring (Kendon *et al*., 2023, section 9.3; Barker *et al*., 2024). In common with many previous UK summer heatwaves, the extent and depth of limited soil moisture, itself considerably exacerbated during the hot spell, resulted in the conversion of a greater proportion of incoming shortwave solar energy directly into sensible heat, rather than latent heat exchange taken up in evaporating surface and subsurface water.

Daytime temperatures, 18/19 July

Aside from a short hot spell mid-month, in which temperatures in parts of eastern and southern England attained the low 30s Celsius, June was mainly dry and sunny, but without any particularly noteworthy extremes of temperature. Warmer conditions set in after the first week in July, and 30°C was again reached in places during the second week. Once the hot continental air mass reached the British Isles, temperatures climbed rapidly on 18 July, surpassing 35°C

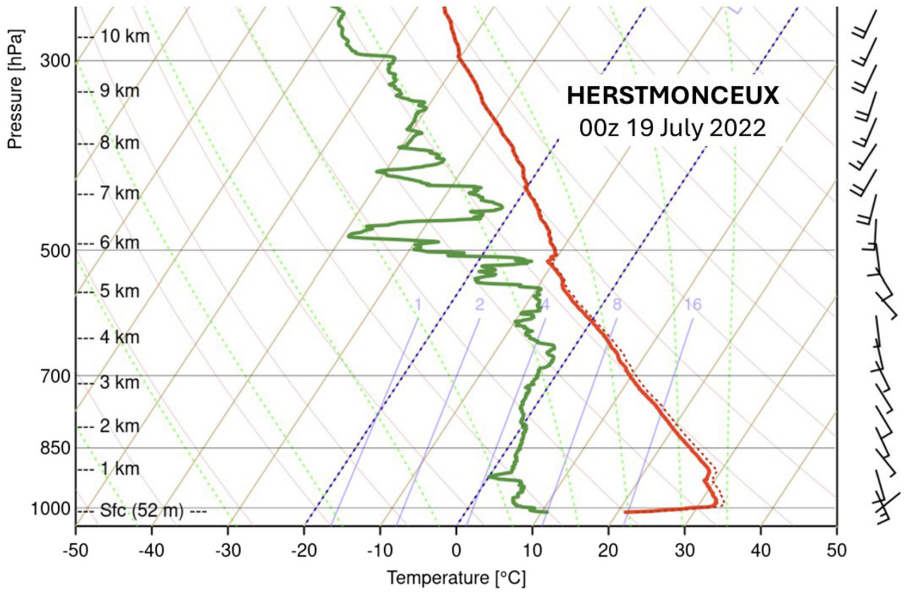

Figure 4. Upper air ascent to 10km (300hPa) above Herstmonceux (03882) on the south coast of England at 0000 UTC on 19 July 2022. The red line shows the dry-bulb temperature, the green line dew point. Winds are shown in the right-hand margin in conventional notation. The very sharp subsidence inversion evident between the surface and 300m (980hPa) was responsible for the very high minimum temperatures reported that morning from sites at even modest altitudes. The resulting very stable layer also inhibited the depth of convective mixing during daylight hours on 19 July, allowing surface temperatures to rise still further by limiting entrainment of cooler air towards the top of the surface boundary layer. The surface temperature at launch was 21.0°C; the highest temperature attained during the sounding was 32.2°C, 220m above the launch location. (SkewT plot courtesy of www.rawinsonde.com/thunder_app/.)

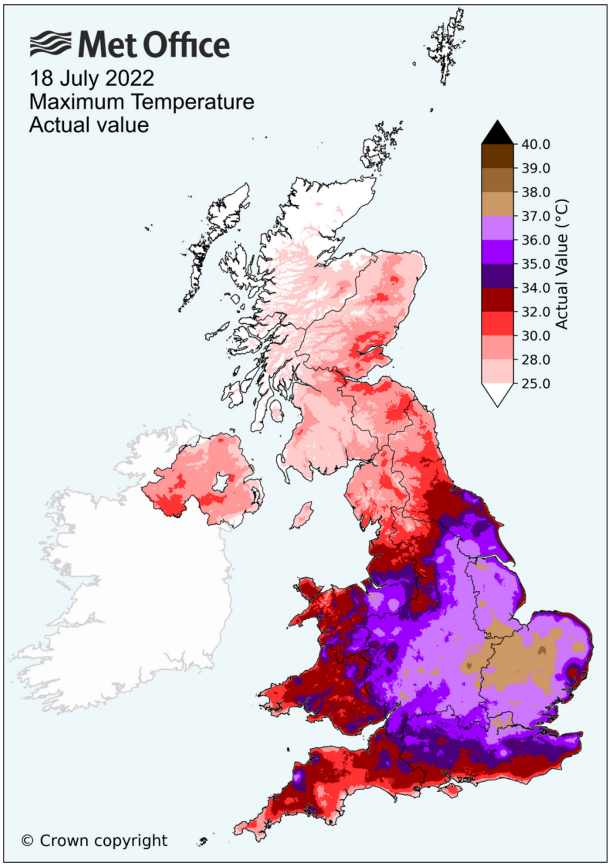

Figure 5. Maximum temperatures, 18 July 2022, after Kendon et al. *(2023), section 9.2, fig. 69a. (©Crown.)*

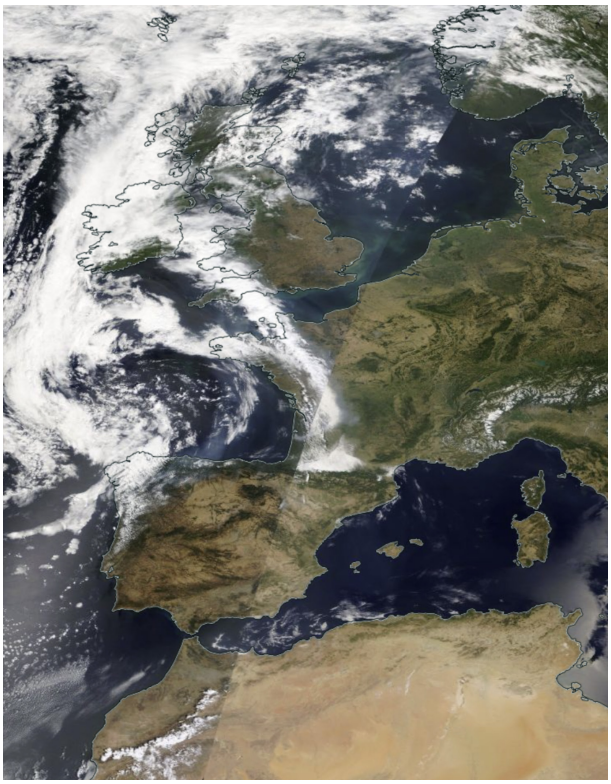

Figure 6. Visible light satellite image over western Europe at around 1200 UTC on 19 July 2022. (Courtesy: NASA Worldview, https://worldview.earthdata.nasa.gov/.)

widely across central England and east Wales. The highest Tmax on this date was 38.2°C at Pitsford in Northamptonshire (see Figure 1 for locations). Indeed, temperatures on 18 July were broadly similar to those attained on 25 July 2019, when the existing UK record Tmax of 38.7°C was attained at Cambridge Botanic Garden (Kendon, 2019; Kendon *et al.*, 2020). However, the extent of the highest temperatures was greater on this occasion, extending further west into Wales, southwest England and Northern Ireland (Figure 5). At Hawarden Airport in Flintshire, Tmax reached 37.1°C, itself a new Welsh record (by a margin of 1.9K – previously 35.2°C at Hawarden Bridge, Flintshire, on 2 August 1990 – Burt, 1992), while in Northern Ireland, Derrylin (Co. Fermanagh) attained 31.2°C, just 0.1K below the national record.

While the high temperatures recorded on 18 July 2022 would, in normal circumstances, have been exceptional, approaching or exceeding all-time records in many places, they were widely exceeded – by an astonishing 2–4K in eastern and northeastern England – on the following day, as set out subsequently. (The intervening night 18/19 July saw several locations surpass the previous UK record for the highest 24h minimum temperature, and this aspect is reviewed in Part 2.) Notably, the two days, 18/19 July 2022, became the UK's two hottest days on record when, averaged across the whole UK (in a gridded series from 1960), the average Tmax surpassed 30°C for the first time (Kendon *et al.*, 2023, fig. 73).

Figure 6 shows the visible light satellite image at about 1200 UTC on 19 July 2022. Cloudless skies across southern, central and eastern England allowed many hours of strong midsummer sunshine, and temperatures rose quickly after the very warm night. In contrast, a weak front introduced cloud, and later some thundery rain, across Wales and southwest England. Cloud spreading east and north ahead of this front across central and central southern England during the afternoon limited the peak temperatures reached in these areas (although still at record levels), but unbroken solar heating continued further east and north, and as a result, this is where the day's highest temperatures were attained.

Figure 7 shows the distribution of maximum temperatures on 19 July 2022, the first occasion on the UK's long records in which a screen temperature of 40°C was reached. The highest reliably-recorded screen temperature on this date was 40.3°C at Coningsby in Lincolnshire (Table 1: see Figure 1 for locations) surpassing the 2019 Cambridge record by 1.6K. The circumstances of the Coningsby record are discussed in more detail later in this paper. In all, seven stations reached or exceeded 40°C (Table 2), while 39°C was attained at a further 30 sites (Figure 7). In all, the previous UK screen temperature record of 38.7°C at Cambridge in 2019 was equalled or exceeded at 46 climate stations within England across an extensive area from Suffolk to Warwickshire, and from Kent to North Yorkshire. Table 11 in the 2022 *State of the UK Climate report* (Kendon *et al.*, 2023) lists the previous highest temperatures recorded at selected stations on 19 July 2022. At most of those shown, the previous station record (excluding where this was attained on 18 July) was exceeded by 2–3K; at the Radcliffe Observatory site in Oxford, the day's maximum of 38.1°C was the highest on a daily record back to 1813 (Burt and Burt, 2019), where until July 2019 the two hottest days in over 200 years (in the Augusts of 1932 and

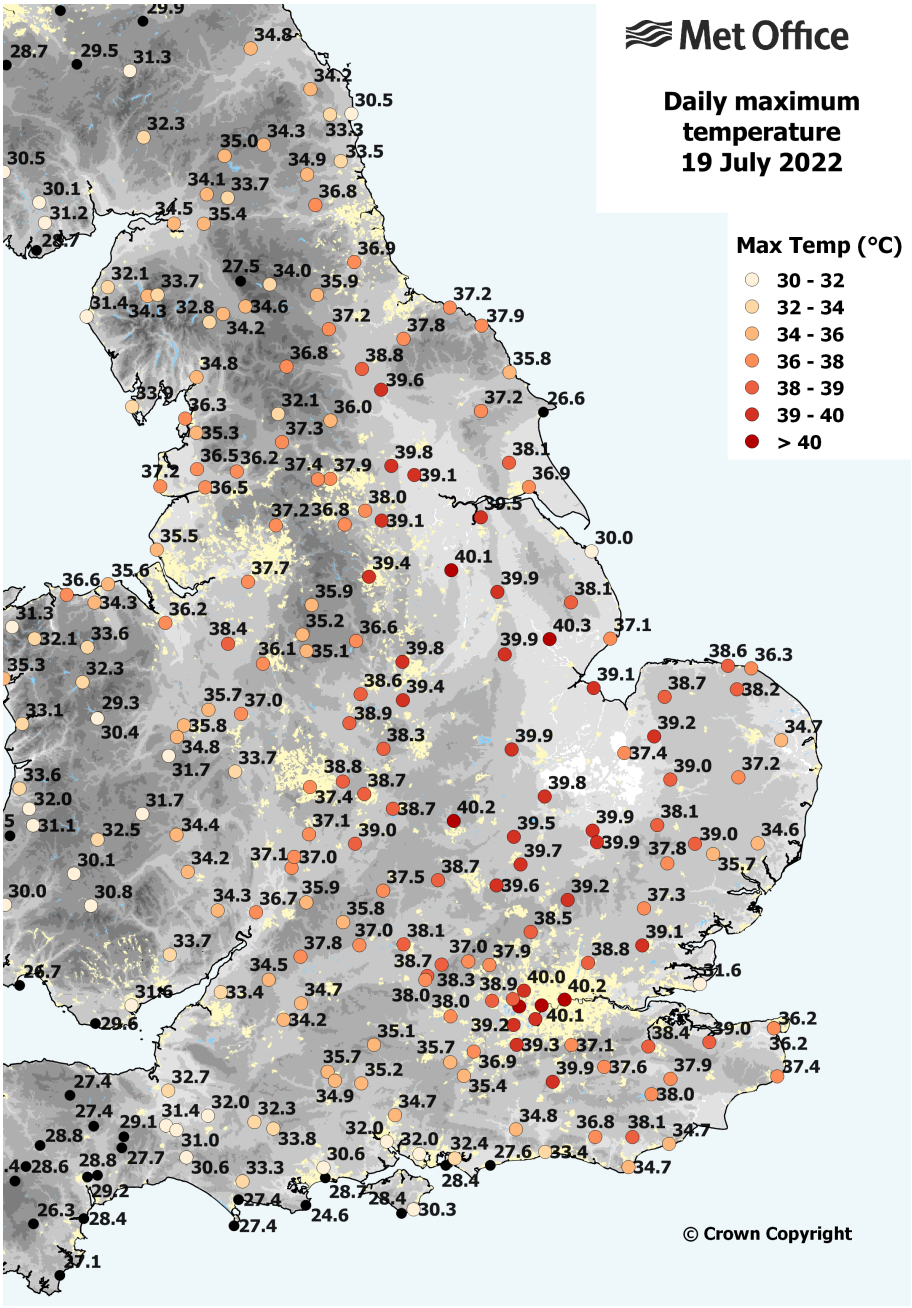

Figure 7. Daily Tmax on 19 July 2022,°C. Source: Met Office National Climate Information Centre (Crown Copyright). For comparison with Figure 5, an equivalent contoured plot for this date is provided in Fig. 69b in State of the UK Climate 2022 (Kendon et al., *2023).*

Table 1

Hourly observations from Coningsby (WMO no. 03391, 53.094°N, 0.172°W, 7m amsl, Figure 9) for the period 1200–1800 UTC on 19 July 2022. The day's maximum temperature, 40.3°C, was reached at 1512 UTC (see Figure 8).

Report time (UTC)	*Cloud cover (oktas)*	*Wind direction (°)*	*Wind speed (kn)*	*Dry bulb (°C)*	*Dew point (°C)*	*Relative humidity (%)*
1200	0	160	12	37.3	10.6	20
1300	0	170	12	39.1	9.7	17
1400	0	170	14	39.6	9.0	16
1500	1	170	13	39.6	8.8	16
1600	0	170	13	39.4	8.7	16
1700	0	160	13	38.3	9.9	18
1800	0	160	11	36.4	10.4	21

1990) stood at 35.1°C. At a few stations, the difference from the previous hottest day was much greater. For example, at Bramham in West Yorkshire, where records began in 1954, the day's Tmax 39.8°C surpassed the previous site record (on 3 August 1990) by an extraordinary 6.3K. At Durham, where records began in 1843 (Burt and Burt, 2022), the day's maximum of 36.9°C stood 4.0K above the previous hottest day, and similarly on the 138 year record at Sheffield, where the maximum of 39.4°C exceeded the previous site record by 3.8K; in both cases, the previous record was attained on 25 July 2019. Further north still, the previous all-time record Tmax in Scotland (32.9°C at Greycrook, Borders Region, on 9 August 2003 – Burt, 2004) was surpassed by almost 2K, when 34.8°C was recorded at Charterhall, also Borders Region (Figure 7). Tmax 35.1°C was initially reported from Floors Castle, also Borders Region, but was disallowed following a post-event inspection by a Met Office inspector, owing to unspecified shortcomings in the site or equipment.

How reliable is the 40.3°C Tmax recorded at Coningsby on 19 July 2022?

After the July 2019 heatwave event, when the previous UK highest Tmax was set, the Met Office established a more formal internal process to investigate and validate various categories of meteorological extremes. This was an acceleration of existing quality control (QC) methods in specific circumstances in order to be able to respond quickly to media enquiries regarding the validity – or otherwise – of such events and is known as the Site Weather Assessment Team or SWAT process. This is an internal Met Office validation only, without external or independent input or peer review. Its remit covers an (imminent) forecast or current reported extreme as follows:

- A provisional *national* record in one of the following categories:
  - Highest or lowest daily maximum or minimum temperatures for any month within any of the four countries within the UK;
  - Extreme 24h rainfall totals, whether 09–09h UTC or otherwise;
  - Highest monthly duration of bright sunshine hours;
  - Highest wind gust speed record; and
  - Snow depth and atmospheric pressure measurements where significant.

Coverage is limited to the geographical area of the UK. The list of sites acceptable for inclusion is normally limited to Met Office sites (synoptic or climate), or data provided through partners

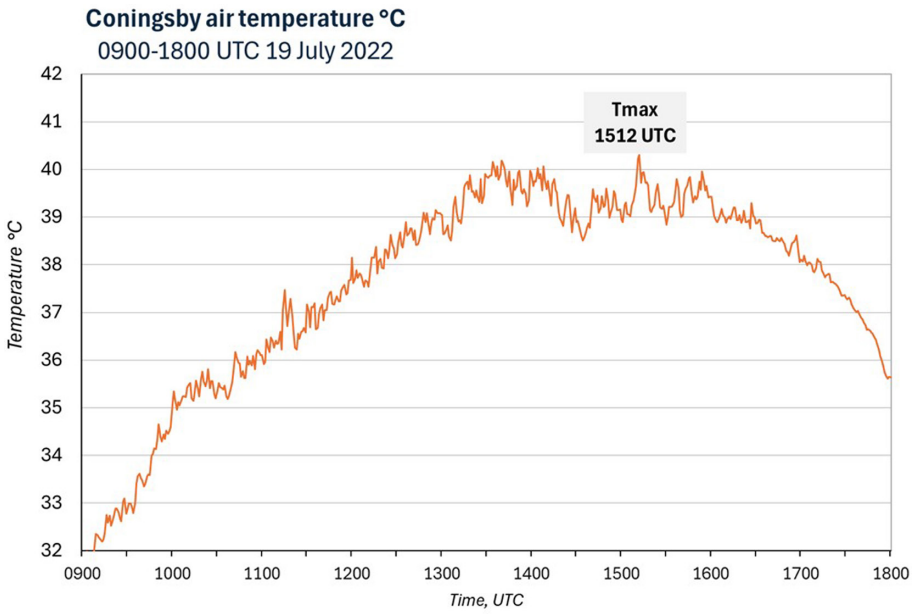

Figure 8. One-minute temperature record from Coningsby, 0900–1800 UTC on 19 July 2022, taken from the operational PRT record within the Stevenson screen: Tmax (i.e. the highest 1-min mean temperature) was 40.3°C at 1512 UTC. (Data courtesy: UK Met Office.)

Table 2

The seven UK sites at which Tmax on 19 July 2022 attained or exceeded 40°C.

Station	*Altitude (m)*	*First year of record*	*Tmax 19 July 2022,°C*	*Previous highest Tmax°C*	*Date of previous highest*
Coningsby, Lincolnshire	7	1941	40.3	34.8	31 July 2020
St James's Park, London	5	1903	40.2	37.6	10 Aug 2003
Heathrow, London	24	1946	40.2	37.9	10 Aug 2003
Pitsford, Northants	114	2018	40.2	36.1	1 Aug 2020
Gringley-on-the-Hill, Nottinghamshire	68	1996	40.1	35.4	25 July 2019
Kew Gardens, London	6	1981	40.1	38.1	10 Aug 2003
Northolt, London	38	1946	40.0	37.7	10 Aug 2003

Note: Based upon table 11 in Kendon *et al.* (2023), and in rank order.

with whom existing data handling and validity checks exist, such as (but not limited to) rainfall data received via the Environment Agency, Natural Resources Wales and the Scottish Environmental Protection Agency (SEPA). (At the time of writing, it remains unclear whether the scope of such investigations is or will be intended to cover other extreme events, such as monthly extremes, or extremes within the UK's four constituent countries – for instance, whether a new daily rainfall record occurring within Northern Ireland, or a new November highest gust, would qualify for examination/verification).

As it became clear several days in advance of the 18/19 July heatwave that a new national air temperature record was possible, the SWAT process was instigated, with input from forecasting personnel, observations and regional network inspectors. Accordingly, as the event unfolded and observations came in, they were promptly reviewed, and some were rejected. The Coningsby record passed through several validation checks, as detailed subsequently, prior to being accepted and duly confirmed as the new UK national record temperature. Where appropriate, some of the information that follows has been extracted or summarised from the Met Office internal SWAT report; for clarity, the section headings used are the same.

Stage 1: The synoptic situation – is the occurrence of the proposed record feasible given the season and synoptic situation?

As set out earlier in this paper, the British Isles lay in a hot southerly airstream on the periphery of an anticyclone over central Europe. Thickness values within the tropical air mass indicated several days in advance that screen-level temperatures could reach 40°C on this date (and 38°C had already been reached in places on the previous day), and synoptic developments fully justified issuing a red 'extreme heat' warning across England. The situation was thus deemed favourable for extremely high temperatures to occur quite widely.

Stage 2: The station's geographical situation – given the synoptic situation, would a potential record be feasible from such a location?

Forecast model output from several days previously, alongside inferences on duration and strength of solar heating from the day's satellite image (Figure 6) together with incoming observations during the day itself, suggested that the highest temperatures on 19 July would most likely occur in eastern England, as indeed happened. Coningsby's reported Tmax of 40.3°C is amply supported by neighbouring sites (Figure 7).

Stage 3: Evidence of the occurrence/data

The relevant evidence considered here is Coningsby's screen temperature record: Figure 8 shows the 1-min temperature record from the thermometer screen at Coningsby, covering the 9h period 0900 to 1800 UTC on 19 July 2022. This record was derived from the 'operational' platinum resistance thermometer (PRT) within the screen (details of the sensor itself, and its calibration, follow subsequently). The plot shows a series of rapid temperature fluctuations typical of a well-mixed surface boundary layer in conditions of strong solar radiation. The temperature first reached 40°C at 1334 UTC, and the highest 1-min mean temperature, 40.3°C, was reached at 1512 UTC. In all, ten 1-min values surpassed 40°C. Hourly values of air temperature and relative humidity at Coningsby, together with reported wind direction and speed, are given in Table 1.

A backup record was also available from a second PRT within the screen and carefully compared against the 'operational' sensor; differences were small, within ±0.1K instrumental tolerance, and it is not shown here.

Figure 9. General view of the site at Coningsby, and (inset) detail of the screen interior; both photographs were taken on 20 July 2022. (Source: Met Office SWAT report: ©Crown.)

Stage 4: Record quality considerations

The quality of the record – are the data from this site usually high quality and reliable? Have there been any quality flags placed on the data that would cause us to reconsider its use?

Synoptic and climatological records have been made at Coningsby since 1941, albeit with several breaks in the record. The site was automated around 2012, and its highest temperature recorded prior to 2022 was 34.8°C on 31 July 2020 (Table 2). Coningsby's reported Tmax of 40.3°C on 19 July 2022 passed automated QC checks, together with manual examination and verification from both the Real Time Monitoring and Climate QC teams within the Met Office.

Stage 5: Security: Are there any risks of interference at the site?

Coningsby is an operational Royal Air Force base with appropriate military security: external interference with the meteorological site would be highly unlikely. The site is fully automatic other than occasional maintenance visits, with no display of current temperature available, and for this reason, it is very unlikely that the screen door would have been opened at any time during the event.

Stage 6: Details of the sensor(s) and exposure

All checks to this point were undertaken at Met Office HQ in Exeter. As part of the SWAT process, a Met Office regional inspector visited Coningsby on 20 July 2022 to review possible external influences on the site or exposure of the instruments which may have influenced the site's records. Such influences may include poor site/enclosure maintenance leading to excessive surface heating,[1] artificial heat sources and/or considerable amounts of concrete or tarmac in the vicinity of the screen, over-sheltering of the site and screen owing to tree and hedge growth and suchlike. The checks here included *Is the thermometer screen in good condition and exposed at the correct height above short grass? Was the record made with an approved sensor, within its calibration cycle? Is the sensor correctly installed within the screen and itself in good working order? When was the sensor last calibrated?*

Figure 9 shows a general view of the site at Coningsby, and (inset) detail of the screen interior, both photographs taken shortly after the event described here.

The operational and backup PRTs were both approved Met Office sensors and found to be in good condition with no obvious signs of physical damage. The operational sensor had last been calibrated on 14 April 2021, with calibration valid for 8 years: installation at Coningsby was on 27 May 2021. Both passed the regional inspector's field calibration compliance test check when compared against a travelling standard thermometer of known calibration, showing an average departure from the standard (across three readings) <0.1K, itself a negligible change in calibration since April 2021. The operational unit was subsequently de-installed and returned to the Met Office QA lab for checking, where it was found to be in good condition and with equivalent error <0.1K across the range tested (−40 to +40°C). Potential objections to the extreme on the grounds of incorrect sensor calibration were therefore unfounded.

Sampling and averaging times

The PRTs in use are 4mm in diameter and are sampled every 15s; four samples are averaged to derive the 1-min mean, which is logged every 60s (Molyneux, 2024). Ventilation through the screen at the time of the extreme would be approximately 7% of the mean 10m wind (Burt, 2022), taken here as 6.5ms^{-1} (Table 1), and thus about 0.45ms^{-1} in-screen. For this level of ventilation speed, a 4mm PRT similar to that used at Coningsby has a 63% response time (τ_{63}) in air of about 70s (Burt and de Podesta, 2020), considerably slower than the 20s guideline given in WMO's Committee on Instruments and Methods of Observation (CIMO) guide (WMO, 2023b, section 2.1.3.3 and Annex 1.A). Response time theory indicates that a 95% response time to a change in temperature for such a sensor in 0.45ms^{-1} airflow would take $3 \times \tau_{63}$, that is about 210s or 3½ min, which strongly suggests that the peaks and troughs of the Coningsby temperature record shown in the 1-min plot (Figure 8) slightly under-sample the true amplitude of said variations. From this, we can conclude that the observed Tmax at Coningsby was, if anything, slightly understated: the same conclusion would, of course, apply to

[1]The site at RAF Waddington, 25km west-northwest of Coningsby, also recorded Tmax 40.3°C on 19 July 2022, but failed verification checks owing to the application of weedkiller under the Stevenson Screen which left an unrepresentative surface of bare soil. As a result, the site was judged to be unsatisfactory and rated as CIMO Class 5 (see Table 3 for details), and the validity of the temperature records deemed subject to greater uncertainty than a standard site.

Table 3

Summary of WMO CIMO air temperature site classification criteria.

WMO temp. site class	*Estimated uncertainty*[a]	*Surroundings*	*Ground cover*	*Heat and water sources*[b]	*Shade*
1	Reference site	Flat, horizontal land, surrounded by an open space, slope less than ⅓ (19°)	Natural and low vegetation (<10cm) ground cover, representative of the region	>100m distant, or <1% within 10m radius, <5% within 10–30m radius and <10% within 100m radius	No shade whenever solar elevation >5°
2		*As above*	*As above*	>30m distant, or <1% within 5m radius, <5% within 5–10m radius and <10% within 30m radius	No shade whenever solar elevation >7°
3	±1°C	*As above*	Natural and low vegetation (<25cm) ground cover, representative of the region	>10m distant, or <5% within 5m radius, <10% within 10m radius	*As above*
4	±2°C	Close, artificial heat sources and reflective surfaces or bodies of water occupying <30% of the surface within 3m radius around the screen and <50% within a 10m radius			No shade whenever solar elevation >20°
5	±5°C	Sites not meeting the requirements of Class 4			

Note: All measurements are from the thermometer screen or the main operational thermometer screen if there is more than one on site.

Source: Adapted from WMO (2023a).

[a]The WMO annex from which this is taken states 'This uncertainty is derived from bibliographic studies and comparative tests', although these are not listed or referenced in the document.

[b]Heat sources or reflective surfaces include buildings, concrete surfaces, car parks and the like; similarly for bodies of water, unless representative of the locality, such as lakes or coastlines.

all other sites using similar sensors given similar conditions.

The site itself is open and unobstructed between northeast and west through south. Within the enclosure, the screen itself is correctly installed and was in good repair. The site was rated as Class 3 on WMO's CIMO 1–5 scale, where 1 is a 'reference' site and 5 is 'unsatisfactory' (WMO 2023: see Table 3 for details of the CIMO scale). Figure 10(a) shows a Google Earth aerial view of RAF Coningsby, with north at the top of the frame; the met enclosure is indicated by a yellow arrow, and this area is shown in greater detail and circled in the Figure 10(b). The middling Class 3 CIMO site classification arises primarily from the proximity of non-natural surfaces around the site, primarily concrete or tarmac, which represent possible heat sources in conditions of strong solar radiation. These were assessed as 16% within 3m of the screen (including partially bare area under the screen resulting from weedkiller – Figure 9), 9% within 10m, 20% within 30m and 36% within 100m; CIMO class 2 mandates <1% non-natural surfaces within 5m radius of the screen and <10% within 30m radius. The grass within the enclosure was very dry due to prolonged dry weather, but as such was representative of the surrounding area. Counting against this being a significant factor in this extreme is the record of 10m wind speed and direction from the site (Table 1), showing that throughout the afternoon of 19 July 2022 the surface wind was from slightly east of south at 12–14kn (6–7ms^{-1}). Examination of Figure 10 makes clear that the area of concrete or tarmac surfaces directly south of the site is small compared to the area of grassland bordering the main runway, which at its nearest is almost 200m distant. This, taken together with the speed of the airflow, would act to minimise the heating effects of such surfaces on the screen temperature record. (In any case, the surface radiative impact of the desiccated grass in the dry conditions may not have been very different to that of a concrete runway.) When considered alongside the response time characteristics, suggestions that the Coningsby Tmax may have been significantly affected by short-term gusty advection of warmer air from perimeter tracks or the main runway south of the enclosure remain without foundation.

Stage 7: Observer reliability and competence

This point is not relevant as Coningsby is an automatic site.

Summary: SWAT evaluation

Following detailed consideration of each of the points in turn, the internal Met Office SWAT committee was satisfied that the Coningsby Tmax was valid, and it was duly confirmed as a new UK Tmax extreme. The outcome, and brief details of the checks made, was announced in a Met Office press release dated 28 July 2022 (Met Office, 2022a). The original (undated and part redacted) SWAT report is available online through Met Office Archives (Met Office, 2022b).

Climatological context of the maximum temperatures on 19 July 2022

The climatological context of the events of 19 July 2022 has been adequately covered elsewhere, notably in the 2022 State of the UK Climate report (Kendon *et al*., 2023). Specifically, this first instance of 40°C within the British Isles marks the event out as one of extraordinary historical significance. For more detail on the extent, intensity and duration of previous noteworthy UK heatwave events over the past 50 years, see Shaw (1977), Burt (1992, 2004), Kendon (2019).

Overnight temperatures, 18/19 July

Following the exceptional heat by day on 18 July, temperatures remained very high overnight in most places, with minimum temperatures of 18–20°C quite widely. Part

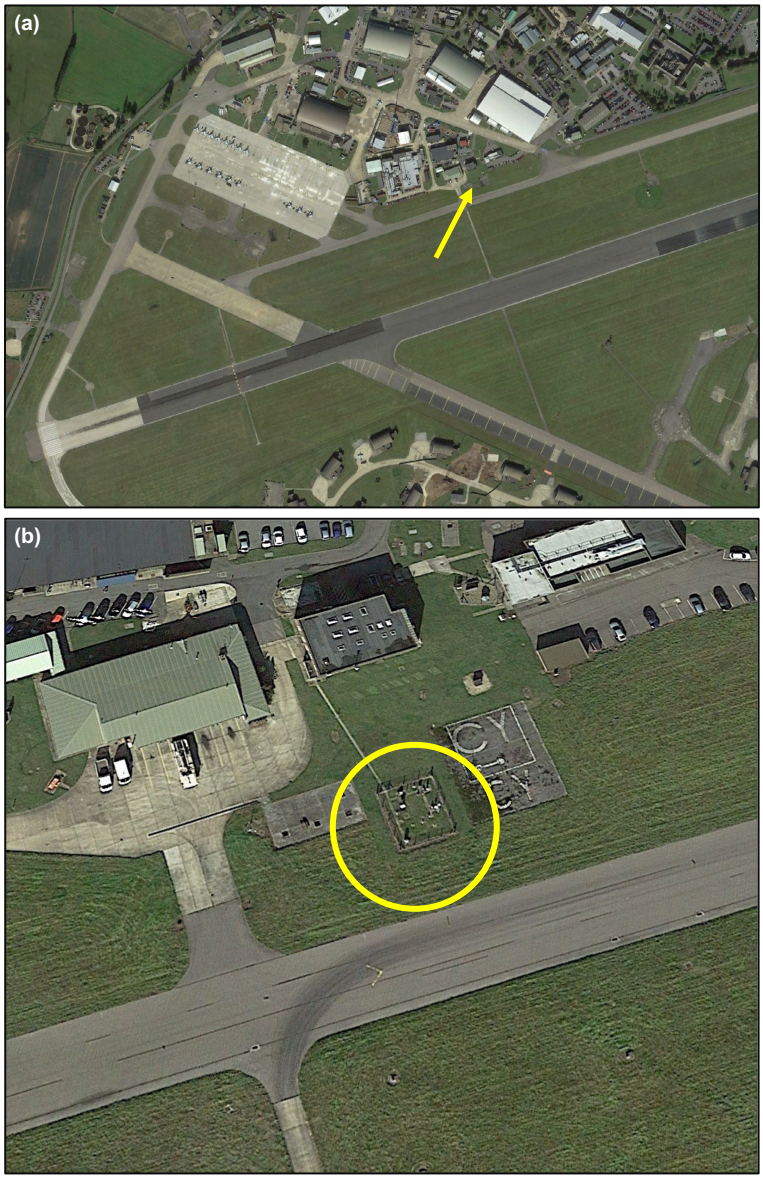

Figure 10. Google Earth image showing (a) the location of the Coningsby met enclosure (highlighted by arrow) and (b) a detailed view of the met enclosure area (circled in yellow).

2 of this paper (Burt, 2025) examines this aspect of the heatwave. In passing, the high minimum temperatures that morning also provided a springboard for the high temperatures attained later in the day. Of particular note were temperatures at 0900 UTC on 19 July already well in excess of 30°C widely across central and southern England: at London's Heathrow Airport, the screen temperature at that time was 34.1°C, following 21–09h Tmin 21.7°C. At the same time, at the University of Reading Atmospheric Observatory site, where daily 0900 UTC observations have been maintained since 1908, the temperature stood at 32.3°C, almost 2K higher than any previous 0900 value.

Summary and conclusions

The brief but very intense heatwave in July 2022, which affected the British Isles, was of historical climatological significance, resulting in the establishment of new UK extremes of Tmax and Tmin; previous records were surpassed by very considerable margins, both at national and at individual site level. It is a statistical curiosity that, between 1868 and 2019, despite July being on average the warmest month of the year, England's most intense heatwaves tended not to occur during July. There are exceptions, of course (notably 1911, 1923, early July in 1976 and in 2006), but notable hot spells were more frequent in late June/early July (in 1957 and 1976) and particularly August (in 1911, 1932, 1990, 1995 and 2003) for most of this long period.

Until August 1990, the UK's highest Tmax stood at 36.7°C in July 1911. It was almost 80 years before this was surpassed (37.1°C at Cheltenham, Gloucestershire on 3 August 1990 – Burt, 1992), but then only 13 years elapsed before this was exceeded in turn (38.1°C at Kew, Royal Botanic Gardens, London and disputed 38.5°C at Faversham, Kent on 10 August 2003 – Burt, 2004; Burt and Eden, 2004). That record also lasted less than two decades, being surpassed in 2019 (38.9°C at Cambridge Botanic Garden, on 25 July – Kendon, 2019). That record itself lasted less than 3 years and has now been firmly eclipsed by 40.3°C at Coningsby on 19 July 2022. The 2022 *State of the UK Climate report* (Kendon *et al*., 2023, section 2.4) rightly draws attention to the increase in the mean temperature of increasingly frequent heatwaves, particularly in southeast England, pointing out that over the decade 2013–2022 the hottest day of the year has warmed by 2.8K relative to the 1961–1990 period, a much faster rise than mean temperatures over the same period (1.1K). It remains to be seen how long it will be before the Coningsby record is itself surpassed.

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Conflict of interest statement

The author declares no conflict of interest.

Data availability statement

No new datasets were created during this analysis. Synoptic data were obtained through ogimet.com, and background climatology via the Natural Environment Research Council's CEDA archive at https://archive.ceda.ac.uk/.

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Correspondence to: Stephen Burt
s.d.burt@reading.ac.uk

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