Extreme temperatures and health briefing

Contents

Introduction:

This briefing aims to describe the impact that extreme temperatures, both cold and heat, have on the health of East Sussex residents in terms of emergency hospital admissions and mortality.

Summary:

- Excess emergency hospital admissions are greater during heatwave periods compared to excess admissions in winter
- Excess winter mortality averages at 22.5% for East Sussex residents and along with hospitalisations, are generally in line with the national picture. Although smaller numbers, excess admissions in winter are greatest in the under 5s, particularly in under 1s
- In 2022 there were 149 excess deaths in East Sussex associated with heatwave periods. This equates to 24% excess deaths and is higher than the 6% excess deaths seen at a national level
- National surveillance data suggests that during a heatwave week a greater demand is placed on 111 services and even more so on emergency departments, than during a typical winter week. Out of hour GP services see a greater demand in a typical winter week compared to a heatwave week
- The old age profile of East Sussex means a larger proportion of our residents are particularly vulnerable to extreme temperatures. This is exacerbated further in terms of heat due to East Sussex being located in the warmest part of the UK

National and Local Policy and Strategy:

The main framework currently in place for guiding extreme temperature interventions are the UKHSA's adverse weather health plan[1], which is underpinned by 'Weather Health Alerts'. This is a colour coded early warning system based on MET office data, issuing different guidance based on the level of anticipated risk, from preparedness and prevention to emergency response. This plan includes communication and recommendations to both national and local stakeholders, focussing on minimising harm, in particular for at-risk populations. The interventions put in place should also follow the Climate Change

Committee's (CCC) recommendations[2]: complying with and delivering on the UK's Net Zero polices, active management of contingency plans and incorporating the rising cost of living into planning.

Extreme temperatures and health

Historically extreme cold weather has been viewed as the bigger threat to health in the UK illustrated by the greater number of excess deaths in winter versus summer months[3]. However, recent data shows consistently increasing temperatures with the average temperature across the UK increasing by 0.9 degrees over the last 30 years[4]. In the summer of 2022 temperatures reached 40ºC, leading to the first UKHSA Level 4 Heat Health Alert. This shift in temperature has been found to have a significant impact, at least in part contributing to the decline in excess winter deaths and increase in excess summer deaths[5], supporting the UKHSA's projection of heat related deaths tripling by 2050[6].

Extreme temperature has been shown to put additional stress on the body as it tries to maintain thermoregulation. These physiological changes have been associated with increased mortality and worse health outcomes. The impacts of extreme temperature have also been found to disproportionately affect certain groups, increasing their risk of adverse outcomes further. These more susceptible groups include: the extremes of age (under 5's and over 75's), those with pre-existing health conditions and those taking certain medications including antidepressants and anticholinergics[7,8,9].

Direct comparison between changing trends in excess winter and summer deaths is difficult and needs to be viewed in context considering other factors such as socioeconomic deprivation. The IPCC's 2023 climate change report[10] highlights some of these complex interactions, such as the inequality experienced by economically and socially marginalised urban residents, who have been found to have more adverse impacts relating to increasing temperatures.

The literature shows cardiovascular and cerebrovascular conditions such as heart attack and stroke account for 40% and 43.7% of excess winter and heat related mortality respectively. Respiratory conditions follow closely behind accounting for a further 33% and 43.8% of excess deaths[5,10]. Other conditions which increase the risk of adverse health outcomes during extreme temperatures include Parkinson's, Dementia, certain mental health conditions, renal disease, and diabetes. It is suggested this list can be generalised to include conditions that compromise one's thermoregulation, mobility, awareness, and behaviours[5,10,11,12,13,14]. Injuries are also closely linked with extreme temperature, for instance the well documented association between cold and increased rates of falls, particularly affecting older people[15]. Analysis shows increasing rates of hospitalisation due to this, increasing by 113,150 in England between 2010-2018[5].

The indirect effects of extreme temperature on health are widespread and further analysis of these are beyond the scope of this briefing. Examples include the worsening of air quality associated with wildfires and the financial implications of reduced food security.

The Southeast is "most vulnerable to current and future effects of hot weather", with this region being consistently one of the warmest in the UK and according to the MET office this has been linked with reduced cloud cover[16,17]. This highlights the need for local analysis to help inform the most appropriate allocation of resources.

Measuring the impact of extreme temperatures on health

This report considers two ways to measure the impact of extreme temperature on health in East Sussex: excess mortality and emergency hospital admissions. Analysis uses a pre-existing methodology of the Office of National Statistics (ONS)[3]. Mortality data was gathered from NHS Digital using the Primary Care Mortality Database[18] and hospital admission data (Hospital Episode Statistics - HES) gathered from NHS Digital via their Data Access Environment[19].

Winter periods were defined as December to March and compared to the preceding August to November and the following April to July. Heatwave periods were identified using the UKHSA definition: day(s) on which a Level 3 Heat Health Alert is issued and/or, day(s) when the mean Central England Temperature (CET) is greater than 20°C[15]. Following ONS methodology the preceding and subsequent days to the identified heat period were also included, see Appendix 1. Aligning with the established ONS methodology for heatwave periods does not take into account the fact that the Southeast is often more vulnerable to heat, and that the CET may not reflect the extent of the heat experienced in East Sussex.

Excess winter mortality was calculated by comparing the number of winter deaths to the average number of deaths in the non-winter period[3]. The interpretation of excess winter mortality data from recent years has proven challenging due to the coronavirus pandemic, with national data showing 6.1x greater deaths in the 20/21 winter versus the previous year[3] and so covid deaths have been excluded from the analysis.

Excess heatwave mortality was calculated by comparing the number of deaths to the 5-year average over the specific heatwave dates in addition to the pre and post periods of the event. For example, if the event was 7 days in length the preceding and following 7 will both be included in the comparison[15]. Again, the coronavirus pandemic greatly affected data from 2020 and 2021 and so these years have been excluded from the analysis.

The above methodology was also applied to calculating excess emergency heatwave hospital admissions. Trends in the data collected were used for analysis due to the large differences in absolute numbers when comparing winter vs heatwaves and national vs local data.

Limitations of the measures used:

We've used excess mortality and emergency admissions to illustrate the impacts of extreme temperature. However, both measurements do not fully capture the multifaceted effects of extreme temperature and provide only a snapshot of the effects in the immediate aftermath. These measures do not consider any of the substantial long-term effects that do not cause death/hospitalisation in close succession to the event, and they do not consider broader impacts such as impacts on the workforce, wellbeing, or infrastructure.

Research needs to be expanded by including milder temperatures that do not fulfil heatwave criteria. This is an important consideration in planning due to the increased frequency of milder days and thus their potential cumulative effect. This is of particular importance in an older population such as in East Sussex as age has been shown to increase the risk of adverse temperature-related outcomes[15] and therefore these findings should be considered an underestimation. Much of the literature focuses on the extreme ends of temperature distribution, however those that include ambient temperature in their analysis illustrate even minor fluctuations in temperature can increase the rate of injuries, diabetic and hypertensive related hospitalisations and cardiovascular-related mortality[20,21,22].

Another limitation is the lack of consideration into the differences in lag structures between exposure and health outcome for heat and cold. These differences are well established in the literature, with the effects of heat occurring within days as opposed to cold taking up to 3-4 weeks[23]. This analysis accounts for lag on a rudimentary level by including brief periods pre and post heatwave in the analysis, increasing the likelihood of capturing the true health impact. Winter months on the other hand did not include any lag period and thus would benefit from a more robust statistical model that incorporates this into the analysis.

The analysis did not consider temperature variations over time, only using maximum daily temperatures to capture heat intensity. This may result in the analysis not fully capturing the nature of the heatwave and additional measurements such as minimum night-time temperatures are required[24]. These measurements must also consider factors such as humidity, wind, the influence of population density and subsequent urban heat island effect. Furthermore, this analysis does not consider the relationship between heat and health over time. Recent data shows a decrease in susceptibility to heat with repeated exposure[25]; such data would be invaluable for the creation of long-term strategies and requires further research, particularly into local effects and whether this relationship translates into cold temperatures.

As previously stated, the relationship between extreme temperature and health outcomes are complex and influenced by many factors. The role of socioeconomic status and deprivation in excess mortality[7] and hospitalisation[26] is a well-documented effect modifier in the literature. Due to the small size of the data, further analysis into these effect modifiers were not possible and therefore their influence on health outcomes locally is unclear.

Analysis:

Winter mortality

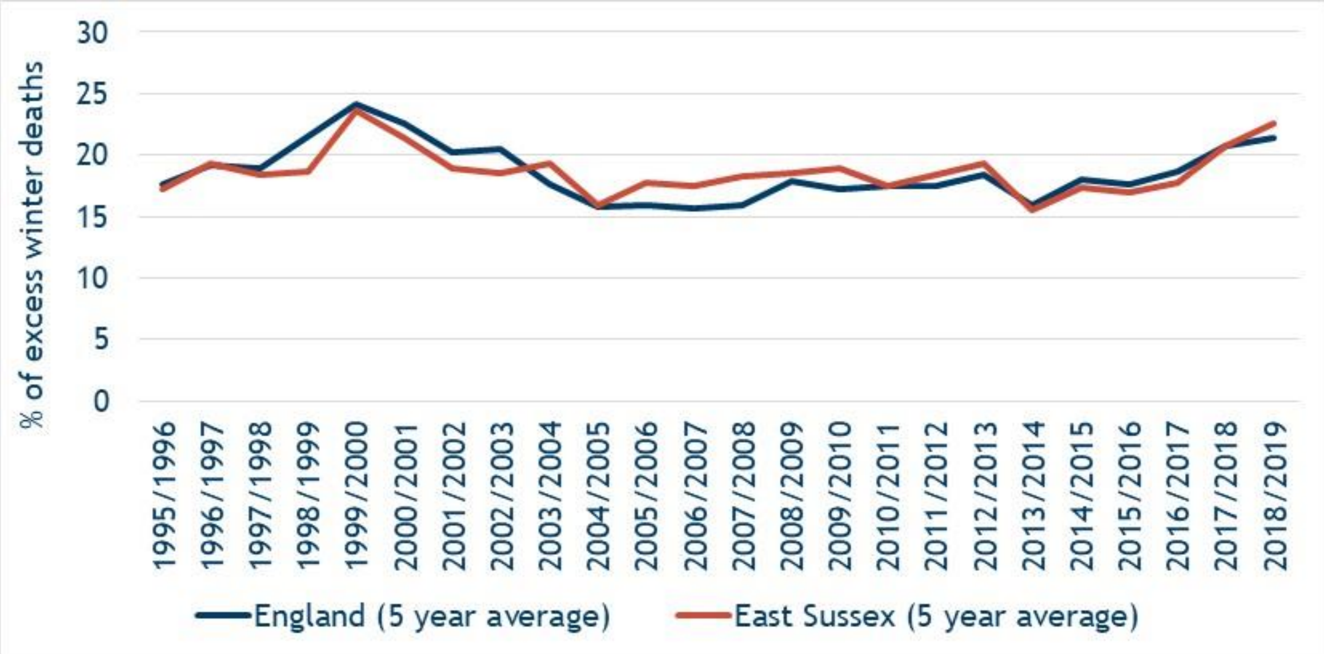
East Sussex had 300 excess winter deaths (excluding covid) in 2019/20 and 290 in 2018/19. The 5-year average of excess winter mortality in 2018/19 was 22.5%, higher than the national average but lower than West Sussex, a neighbouring county with a similar demographic. The East Sussex data illustrates a slight upwards trend in excess mortality rates in comparison to the 5-year average a decade earlier which is also reflected in national[3] and West Sussex data. Data available in Table 1 and East Sussex trends in comparison to England are shown in Figure 1.

Table 1: 5-year average excess winter mortality index (%), East Sussex, West Sussex and England from 2009/10 to 2018/19

Year (5 years to)	East Sussex	West Sussex	England
2009/10	19.0%	16.7%	17.3%
2010/11	17.4%	18.5%	17.4%
2011/12	18.4%	21.1%	17.5%
2012/13	19.0%	21.0%	18.4%
2013/14	15.5%	18.4%	15.9%
2014/15	17.4%	20.9%	18.0%
2015/16	17.0%	19.4%	17.6%
2016/17	17.7%	19.9%	18.7%
2017/18	20.8%	23.6%	20.7%
2018/19	22.5%	24.6%	21.4%

Source: ONS. 2019/20 and 2020/21 excluded due to the effect of the pandemic on mortality.

Table 1: 5-year average excess winter mortality index (%), East Sussex and England, 1995/96 to 2018/19



Source: ONS. 2019/20 and 2020/21 excluded due to the effect of the pandemic on mortality.

Heatwave mortality

East Sussex experienced 149 excess deaths associated with 5 heatwave episodes in 2022, a 24% excess mortality rate. To contextualise this, comparing this to 2021 data; heatwaves caused 11 times more deaths than road traffic accidents and 25 times more than drowning. Excess deaths due to heatwaves for the years 2016 to 2022 (excluding 2020 and 2021 due to Covid) are shown in Table 2. Dementia and Alzheimer’s are the leading cause of mortality in these excess deaths and over 70’s and females are affected to a greater extent, all of which are in keeping with national trends. The older age profile of East Sussex, together with its geographical location being particularly vulnerable to heat, is likely to explain why the local excess mortality rate from heat is much greater than the England average.

Figure 2: Number of daily death occurrences, 5-year average and heat-period days, 1st June to 31st August 2022

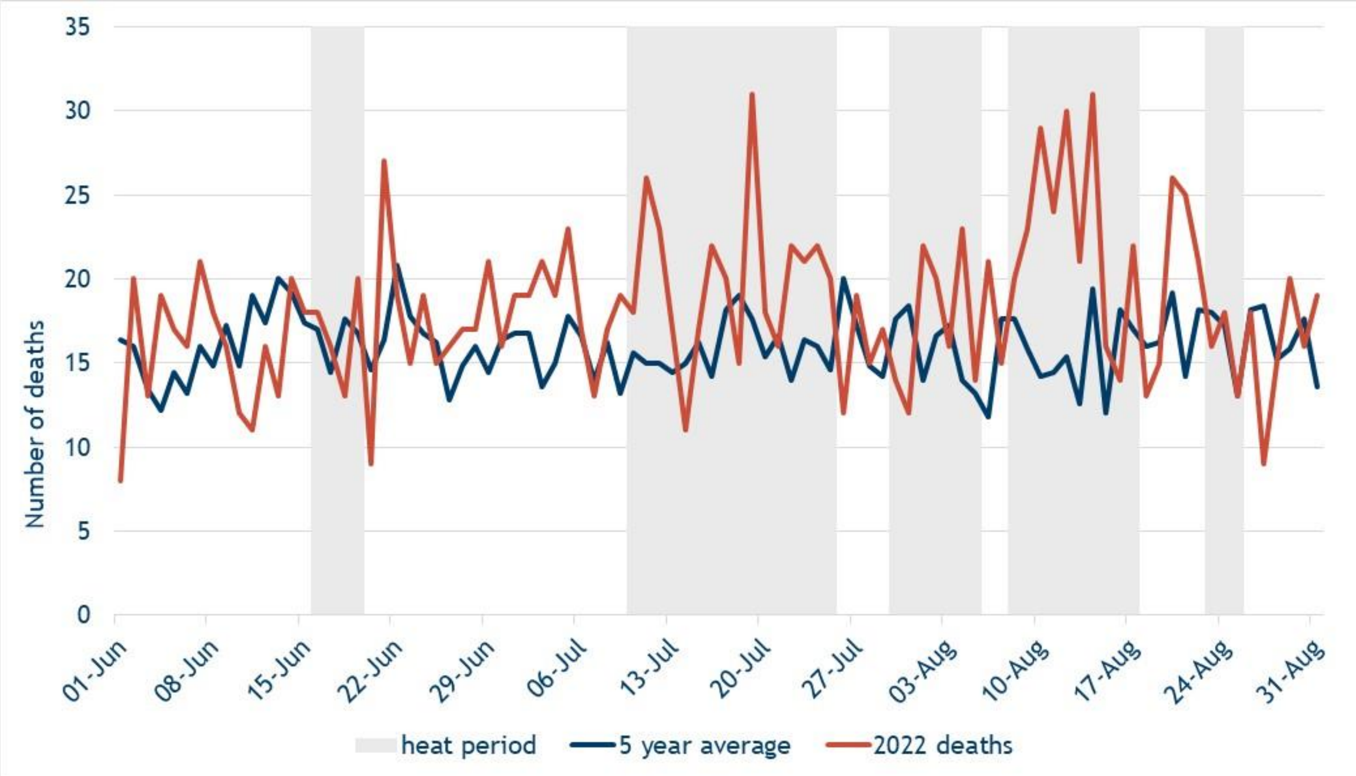


Table 2: Excess mortality, numbers and percentages, during heatwaves, East Sussex and England[27] from 2016 to 2022

	East Sussex		England[27]	
Year	Excess deaths	Excess mortality	Excess deaths	Excess mortality
2016	43	17%	1,705	9%
2017	28	18%	1,434	12%
2018	-11	-2%	1,888	5%
2019	43	15%	1,357	6%
2022	149	24%	3,036	6%

Source: ONS and Public Health mortality files. Note 2020 and 2021 excluded due to Covid.

Winter emergency admissions

Pre-existing research into temperature-related emergency admissions over the last 9 years show an increase of 8,000 admissions per year in England. Admissions associated with cold weather (less than 6.4ºC) have decreased by approximately 4,000 per year and admissions associated with warmer weather (over 13.8ºC) have increased by approximately 12,000 per year, further illustrating the increasing impact of warmer weather. Excess emergency admissions in East Sussex over the winter period varied from -0.9% to 3.2% with an average of 238 excess admissions for pre-pandemic data, this compared similarly to national data, see table 3.

Table 3: Excess winter hospital admissions (%) in East Sussex and England from 2013/14 to 2018/19

Year	East Sussex	England
2013/14	0.5%	1.2%
2014/15	2.0%	0.7%
2015/16	1.6%	2.4%
2016/17	-0.9%	-0.1%
2017/18	3.2%	0.1%
2018/19	0.9%	0.6%

Source: HES open data, NHS Digital and HES data accessed via DAE, NHS Digital. Note 2019/20 and 2020/21 data excluded due to the impact of Covid on admissions.

Excess admissions in East Sussex increased when focussing on the extremes of age. In those aged 75+ the average between 2012 and 2019 was 4%; well above the highest rate of excess admissions in the general population. However, the younger age groups were affected more with under 5's averaging an excess admission rate of 20%, increasing to 27% when focussing on under 1's. To contextualise these results, each winter causes an average excess of 294 admissions for the under 5's in East Sussex.

Table 4: Excess winter hospital admissions (%) for under 5s and under 1s in East Sussex from 2012/13 to 2018/19

Year	Under 5s	Under 1s
2012/13	9%	13%
2013/14	28%	35%
2014/15	20%	26%
2015/16	20%	21%
2016/17	22%	29%
2017/18	31%	37%
2018/19	12%	28%

Source: HES data accessed via DAE, NHS Digital. Note 2019/20 and 2020/21 data excluded due to the impact of Covid on admissions.

Heatwave emergency admissions

Within East Sussex, the average excess admission rate during heatwaves pre-pandemic was 14%, ranging from 10-17% which translates to an average of 416 excess admissions per year. This shows a higher demand on hospital services from baseline demand in heatwaves in comparison to winter.

Table 5: Excess emergency admissions associated with heatwaves (%) in East Sussex from 2016 to 2019

Year	Excess admissions
2016	10%
2017	13%

Year	Excess admissions
2018	17%
2019	17%

Source: HES data accessed via DAE, NHS Digital. Note 2020 to 2022 data excluded due to the impact of Covid on admissions.

Demand on other healthcare services

Syndromic surveillance carried out by the UKHSA monitors the use of: NHS 111, GP services in and out of hours, emergency department attendances and ambulance calls in England. Local data for the use of these services is not available, however there is no reason as to why service use patterns would be any different in East Sussex compared to England. Analysis of national data is therefore presented to help understand the patterns that would likely be seen in East Sussex.

Using the 16-19th July 2022 heatwave to analyse service use, an initial increase was noted from the week commencing 4th July. There were increased calls to 111 for heat exposure and sunburn, increased out of hours GP use and emergency department admissions for heat or sunstroke and increased ambulance call outs for 'impact of heat (or cold), 'unconscious or passing out' and injuries. The demand on services increased with the intensity of the heat and with rates peaking on 18/19th July when the level 4 Heat alert was issued, increased call outs for cardiac and respiratory arrests were observed. Demand returned to expected levels by 22nd July.[28]

When looking at this same data for the second week of January 2022, a typical winter week, the main demands on services were respiratory infections. Out of hours GP services noted small increase in contacts due to 'impact of cold' above baseline[28]. Comparing the demand on services between the heatwave week and the mid-winter week shows 8.8% higher call rate to 111 in winter, however, out of hours GP service usage increased by 6.2% in the heatwave week and emergency department presentations were 72.4% higher in the heatwave week. This is just a snapshot comparison and more robust data analysis is needed.

Table 6: Average daily numbers of patients using other services in the w/c 10th January 2022 (winter week), 18th July 2022 (heatwave) and the percentage difference in demand, England

	Winter week	Heatwave week	Difference (winter vs heatwave)
111	41,673	45,346	+8.8%
Out of hour GP	24,321	22,801	-6.2%
Emergency department	19,079	32,897	72.4%

Source: Syndromic surveillance systems, UKHSA

Considerations:

This analysis highlights that further action is needed to better understand the local population, those at risk and what is needed to mitigate risk. This in turn will help tailor the weather health alerts to the local population. One example of this is mapping the impacts of extreme temperature by area, helping identify which residents are experiencing the highest burden. By doing this we can identify which areas need additional support when moving into the response phases of the alert system. This mapping could also be cross referenced with demographic data to identify vulnerable groups within the community whom the weather health alert system has identified require earlier intervention through yellow alerts versus the general population who will experience a much lower impact at this level.

The type of support required may vary between different areas/communities, from enhanced communication for the socially isolated to improving energy efficiency in older homes. Information distribution is vital in all stages of the early warning system, from alerting the population to the most up to date prevention strategies to emergency warnings. Currently, there are very efficient and well-established networks of national communication, however much of this relies on access to technology. This poses significant accessibility issues for the older population, who are at an increased risk and make up a large proportion of the East Sussex population. Areas such as Stockton-upon-Tees[29] produce paper-based communication with useful information for the winter, such as the location of grit bins, expected school closures and advice on how to drive in the snow. This technique could be deployed in East Sussex; however, evaluation would be required to review the effectiveness of this and other local interventions in place, measuring real terms impact and cost-effectiveness. Additionally, this paper-based form of communication does not align entirely with the Climate Change Committee's (CCC) recommendations and efforts instead may be better focused on more sustainable interventions such as improving access to the technology through education and community donation programmes.

More work can be done to further tailor the advice offered to residents, with assistance from public health teams. Examples include condition-specific support such as liaising with GPs to reduce diuretic use during heatwaves, thereby reducing falls risks, and offering education to patients with mental health issues on the impact of heat on their conditions. Lewisham Council[30] offers multiple schemes aimed at reducing falls burden, including a 'Handyman service' for residents at high falls risk to undertake minor homework. They also have an early intervention team of occupational therapists for people who are referred to social care and can receive equipment, adaptations, and assistive technologies prior to assessment for care support. Again, interventions like these would require regular review into their effectiveness.

One major area requiring attention is heat adaptation and cooling in urban areas. Research indicates urban areas have higher levels of heat exposure during the day and reduced recovery at night[31]. This is due to larger amounts of heat stored within buildings and the ground and is described as the urban heat island effect, which causes significantly greater excess mortality[32]. A significant proportion of the excess heat experienced comes from heating/cooling buildings, transport, and other energy use. A longer-term project, that has been identified as a gap in legislation by the CCC[2], is to work with the construction industry and city planners to help create more energy-efficient buildings and cities, incorporating more green and blue spaces, optimising building mass and orientation[12] to reduce the amount of heat stored. This can also be carried out on a smaller scale, focussing on education and support for residents to make their homes more energy-efficient and change energy wasting behaviours. Within this work the impact of deprivation should also be considered as deprived urban areas are known to experience worse heat-health outcomes[7]; this has been partly attributed to reduced access to green spaces and shade[33].

Many healthcare staff feel unprepared for extreme weather events[34] and so investment into their education on the matter is essential. Reviewing the regulations in care facilities such as hospitals and care homes ensures there is appropriate monitoring and protection against the overheating of vulnerable patients. Hospital discharge protocols can be adapted to include property assessments for vulnerable patients. However, this would be extremely resource-intensive and analysis into cost-effectiveness would be required. In addition, the creation of contingency plans of alternative discharge destinations would be required, if homes were deemed unsuitable, to prevent extended hospital stays which are associated with their own adverse health impacts[35]. If research showed this system was possible and proved financially viable, this would deliver on one of the key areas the CCC have deemed the UK is currently underperforming in[2] and may be of interest to central government for investment.

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Appendix

Heatwave dates 2016[13]

- H1: 18 to 22 July
- H2: 22 to 26 August
- H3: 12 to 17 September

Heatwave dates 2017[13]

- H1: 17 to 23 June
- H2: 5 to 7 July

Heatwave dates 2018[13]

- H1: 25 to 27 June
- H2: 30 June to 10 July
- H3: 21 to 19 July
- H4: 2 to 9 August

Heatwave dates 2019[13]

- H1: 28 to 30 June
- H2: 21 to 28 July
- H3:23 to 29 August

Heatwave dates 2020[13]

- H1: 23 to 27 June
- H2: 30 July to 1 August
- H3: 5 to 15 August

Heatwave dates 2021[13]

- H1: 16 to 23 July
- H2: 6 to 9 September

Heatwave dates 2022[13]

- H1: 16 to 19 June
- H2: 10 to 25 July
- H3: 30 July to 5 August
- H4: 8 to 17 August
- H5: 23 to 25 August