



ADAPTATION CASE STUDY: HEAT RESILIENCE (UK)

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National Centre for
Earth Observation
NATURAL ENVIRONMENT RESEARCH COUNCIL



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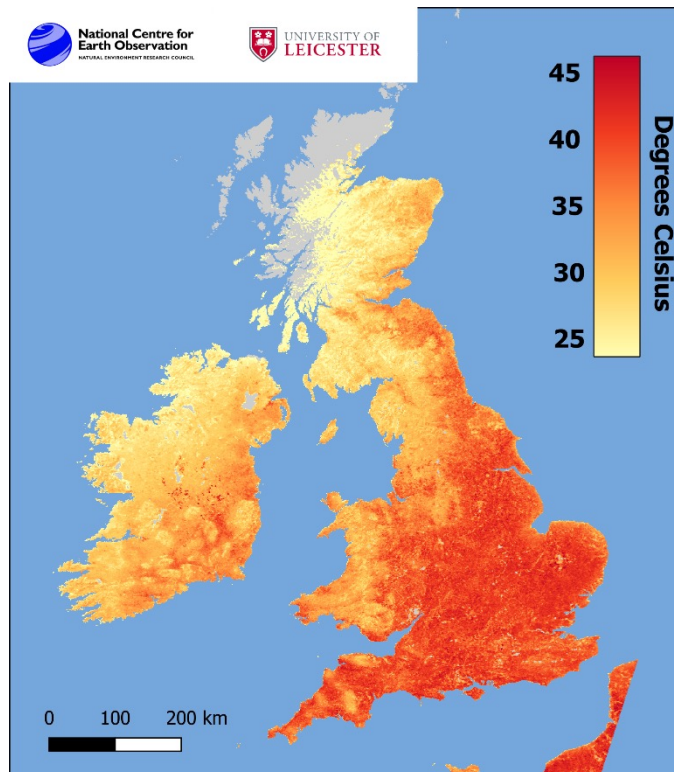
Estellus



Danmarks
Meteorologiske
Institut



UK Drought 2022

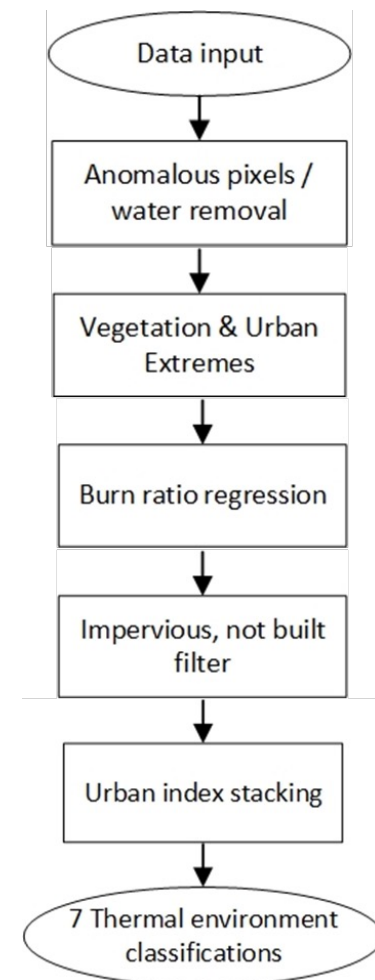
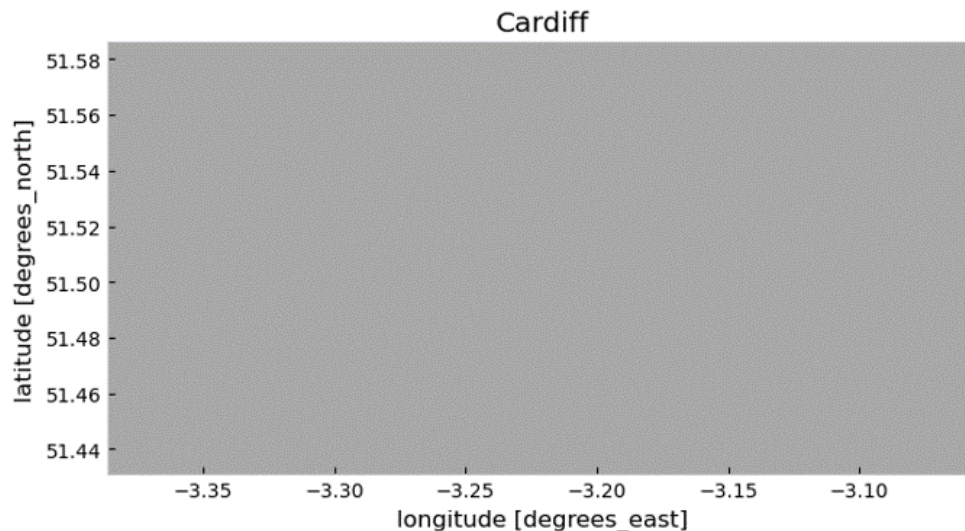
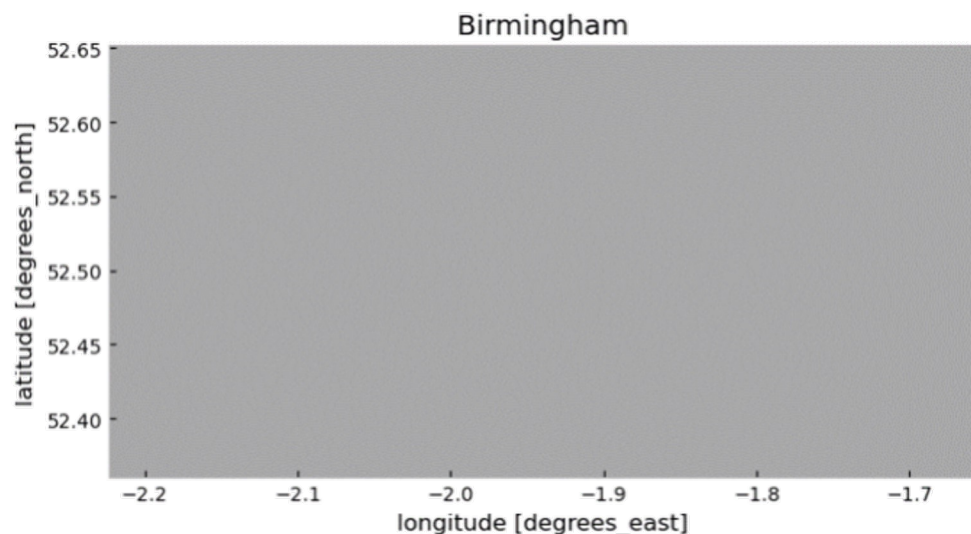


UK LST during Heatwave 2022

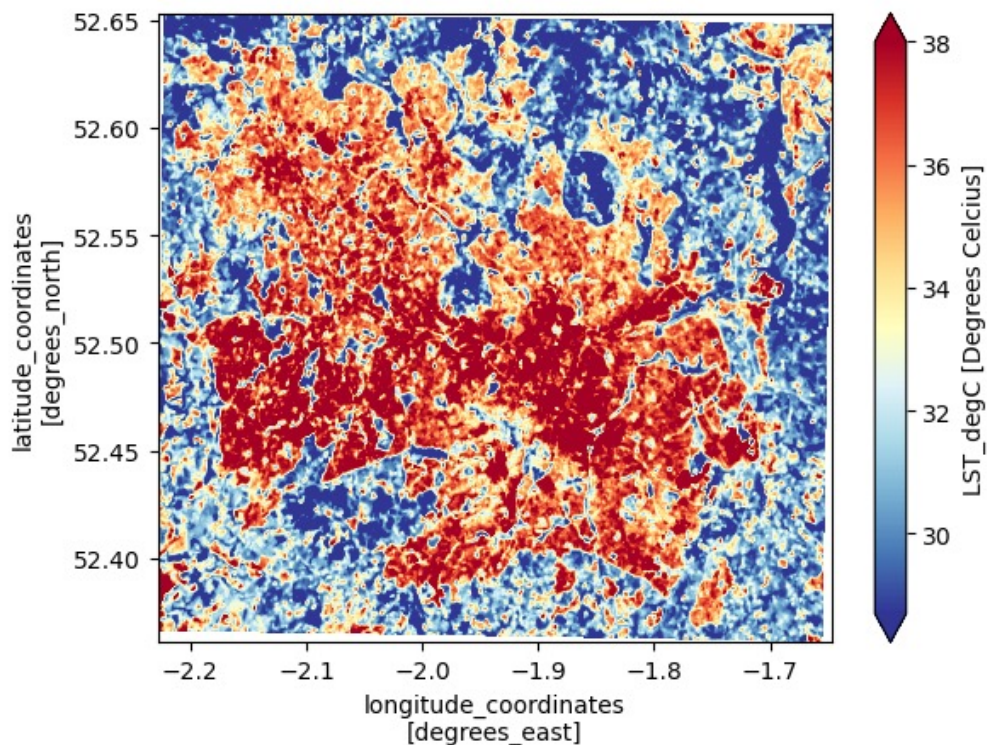
- Satellite and in-situ land surface temperature observations can be used to evaluate diurnal variations and spatial heterogeneity of UK (e.g. urban versus rural)
- Data on cities being tested with government and industry users

<https://www.bbc.co.uk/news/science-environment-62257163>

To create a series of thermal environment classifications to aid in providing a better emissivity to the LST algorithms and to create a robust methodology for determining rural background for UHI studies

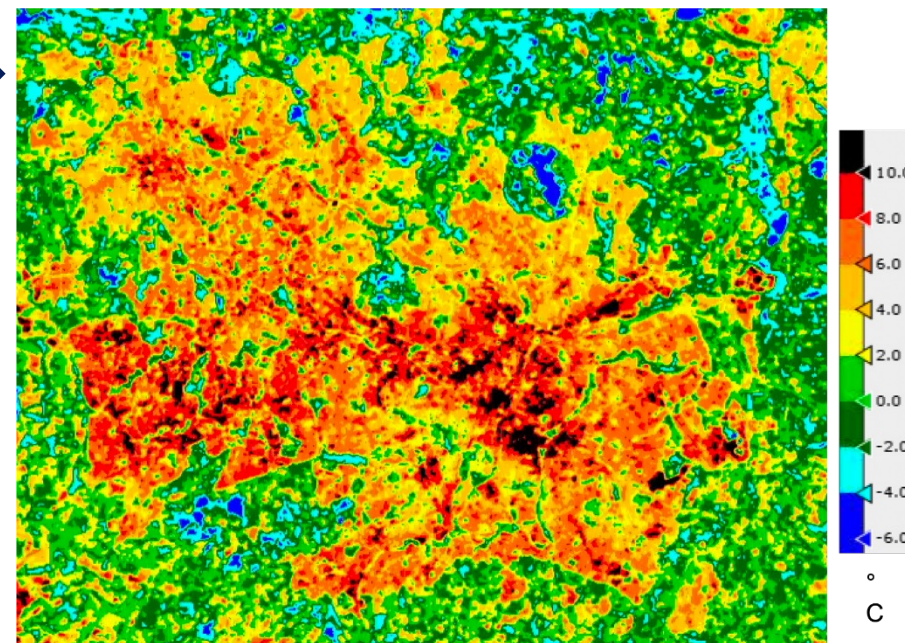


Birmingham

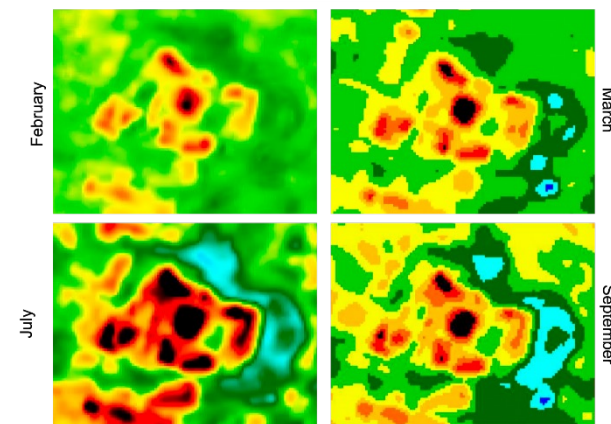


Birmingham's UHI for July 2021

By considering the 90th percentile of pixels it was found that the City Centre experienced higher temperatures of 11.7 ± 2.5 °C when compared with a rural background



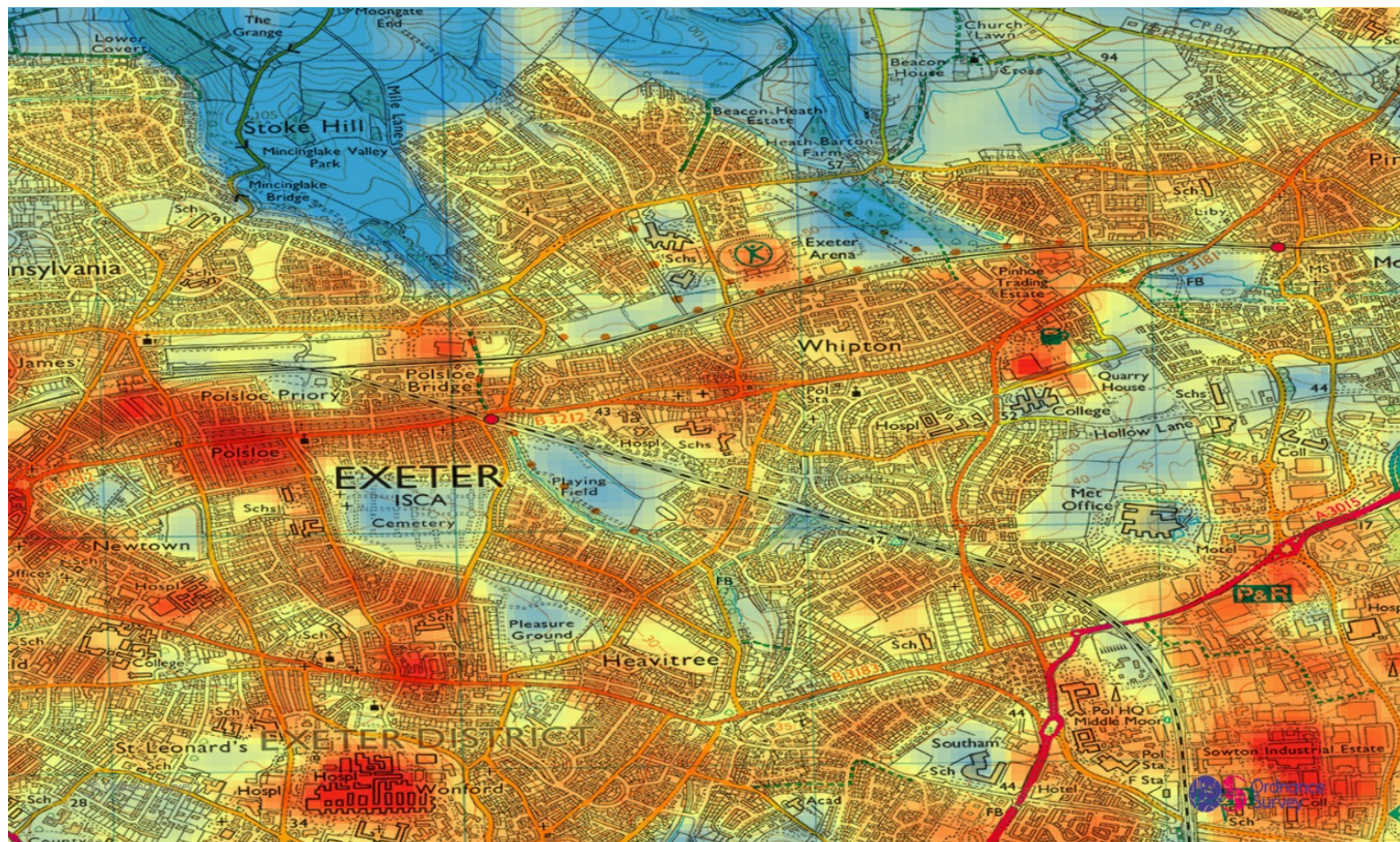
Seasonal dependency in the UHI



With the detailed Ordnance Survey (OS) overlay, the data can clearly be seen to correspond to the expected land uses, with parks / playing fields and a cemetery showing lower LST, and industrial regions presenting the highest LST values.

Building on CCI approaches and NCEO / UKSA work (DUSTI) and current implementation in UK Earth Observation Climate Information Service (EOCIS).

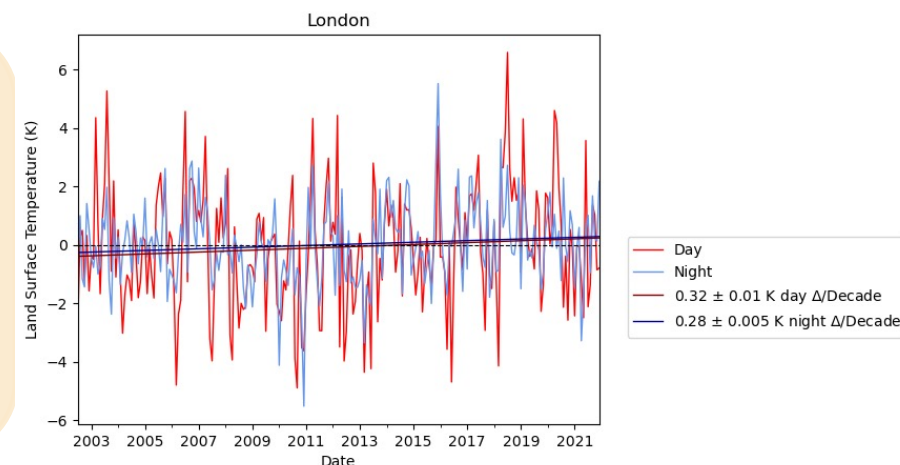
Working with multiple stakeholders: OS, Office for National Statistics (ONS), UK Health Security Agency (UKHSA)



Our initial focus has been on modelling urban heat, as cities exhibit most extreme conditions during heatwaves

UHI's can cause a range of health and infrastructure issues:

- Increased chance of morbidity and mortality due to heat stress, especially during heat waves
- Affecting the circulation of air, causing air pollution to become worse
- Causing greater energy demand which in extreme cases can cause blackouts
- Deformities in pavements and roads resulting in safety risks as well as increased funding required for repairs

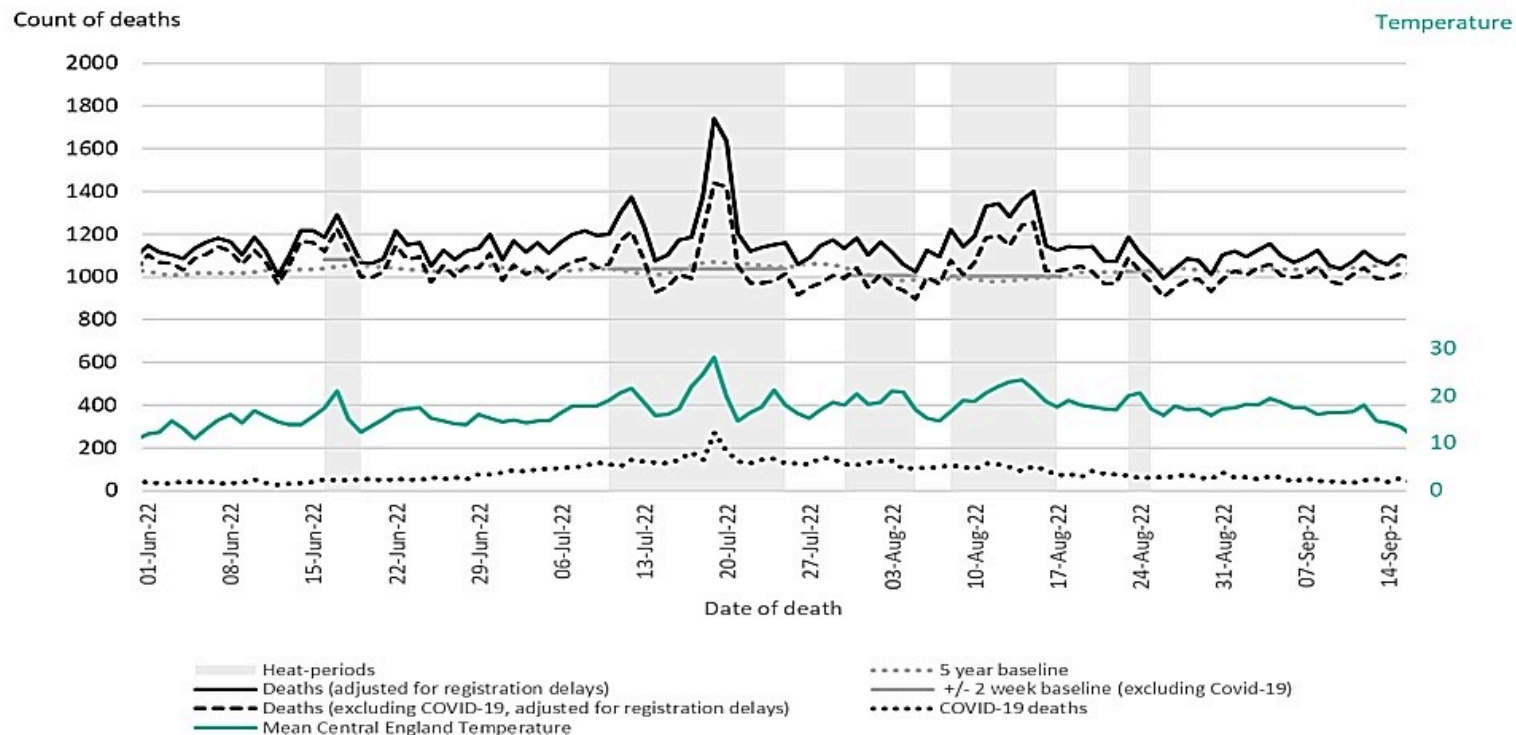


Thermal Discomfort:

- To enable decision making and urban planning LST can be converted into it's impact on either the built or human environment
- There are several Comfort or Heat Stress Indices which convert environmental temperature to the effective impact on humans
- For example, the Thermal Discomfort Index (TDI)

“the relationship between temperature and mortality, and between temperature and emergency hospital admissions (as indicators of the health impact of hot weather), suggests that hot weather in England is associated with an increase in deaths and emergency hospital admissions” (Heatwave Plan for England)

“England has experienced heatwaves of public health importance in 2018, 2019 and 2020 which were associated with significant impacts on daily mortality. There is also more evidence regarding the non-fatal impacts of heat on maternal health, mental health and occupational health” (The Third UK Climate Change Risk Assessment Technical Report)

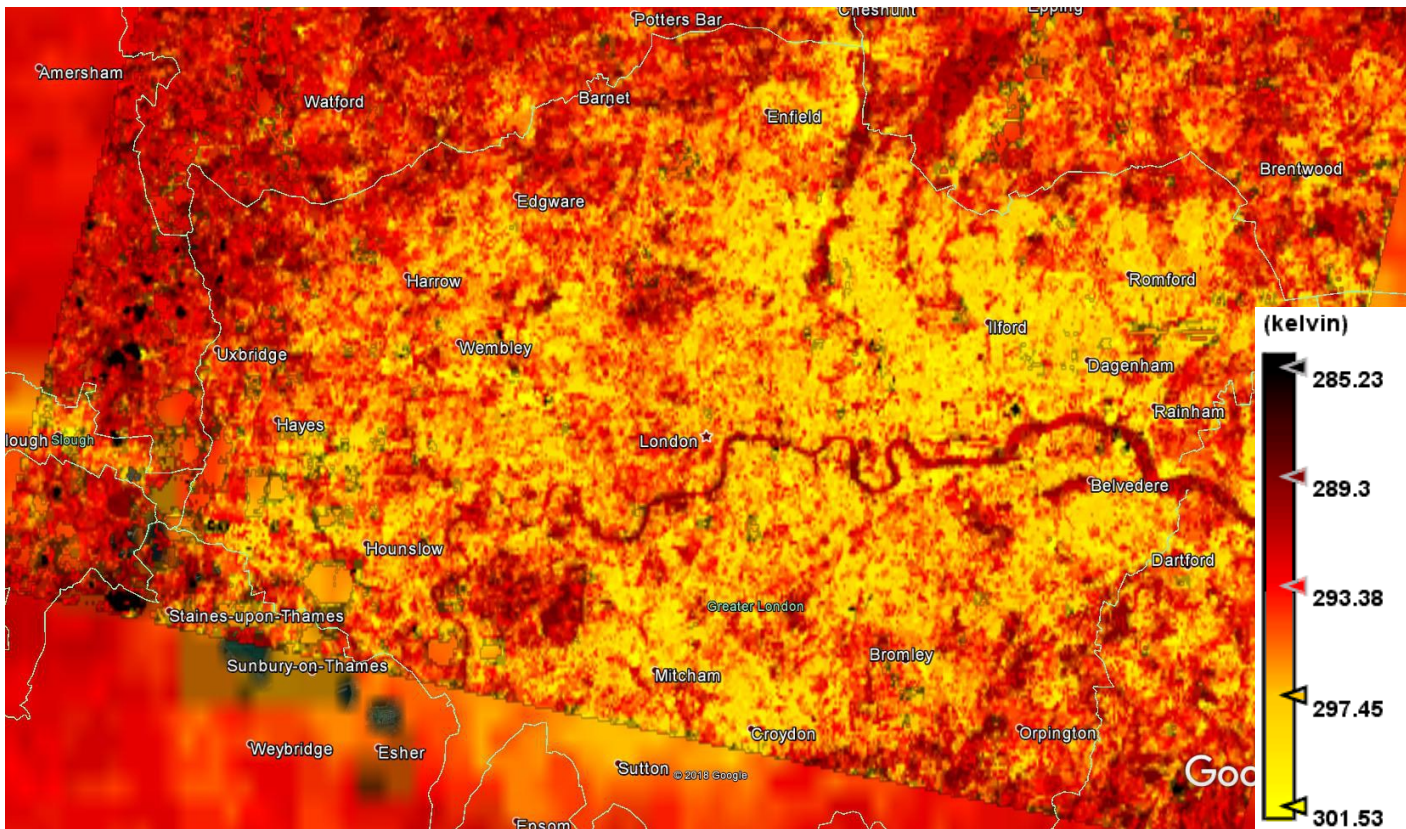


Credit: UK Health Security Agency (UKHSA) Heat mortality monitoring report: 2022

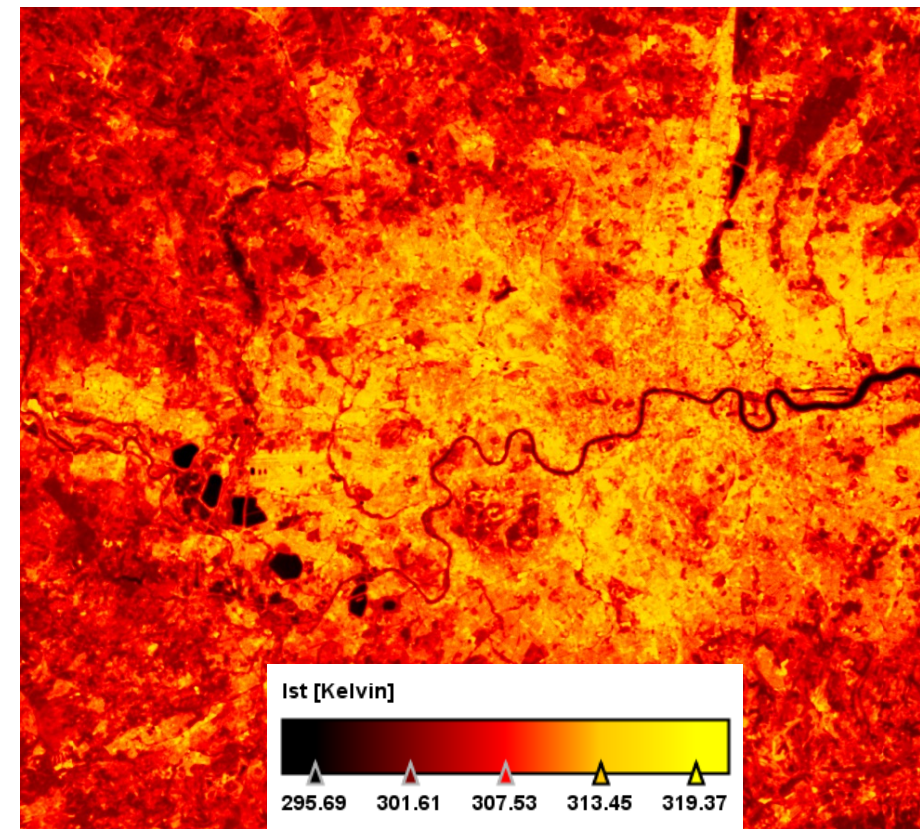
“there is strong evidence that heat episodes in England are becoming more intense, longer and more frequent, with an associated impact on the estimated heat mortality. Therefore, it is increasingly important that organisations ensure they have heat response plans in place – aligned with recently published Adverse Weather and Health Plan – as well as longer-term adaptation strategies to mitigate the impacts across all sectors to reduce the number of avoidable deaths during adverse heat events in the coming years” (UK Health Security Agency (UKHSA) Heat mortality monitoring report: 2022)

Key messages:

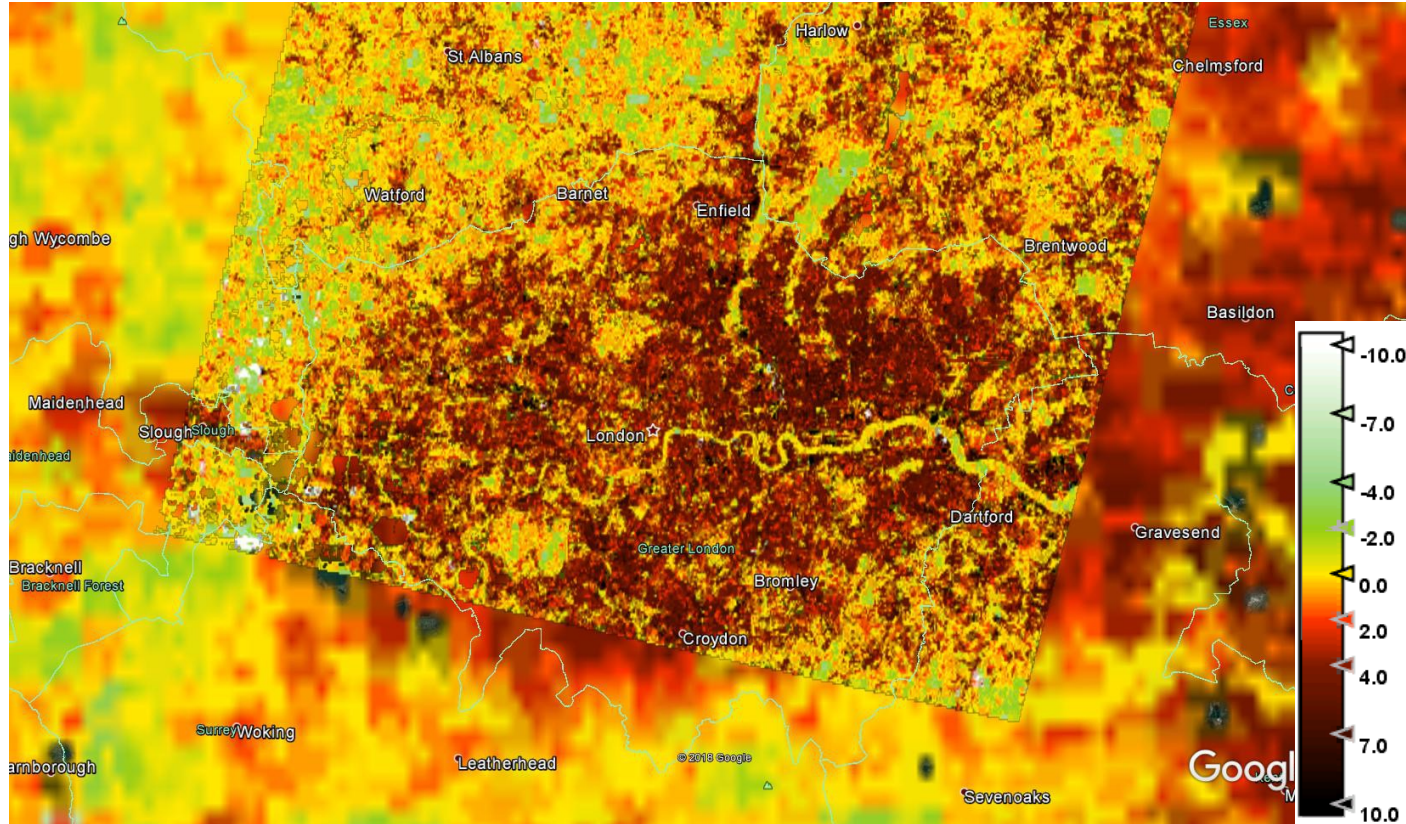
- Insufficient understanding of who is vulnerable to extreme heat and why
- More local and regional data and mapping of heat risks and vulnerabilities are needed to prepare for increasing heat risk in the UK
- More effective translation and incorporation of such data are also required to inform rapid operational responses and strategic planning



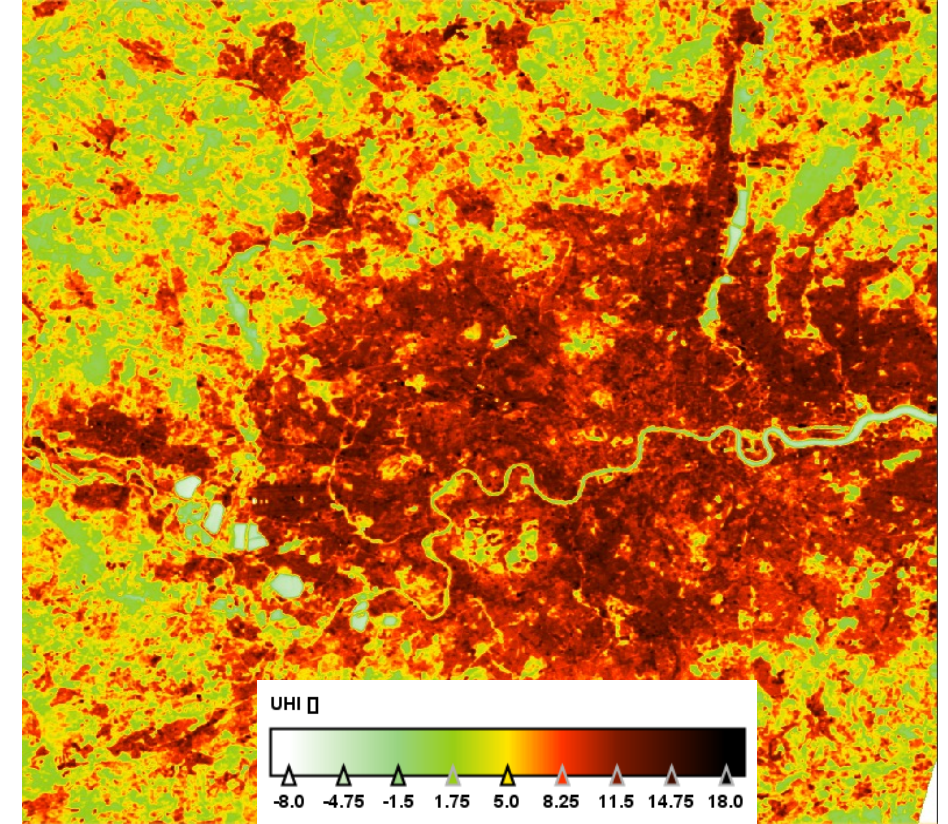
Warm Day: London 22/09/2017



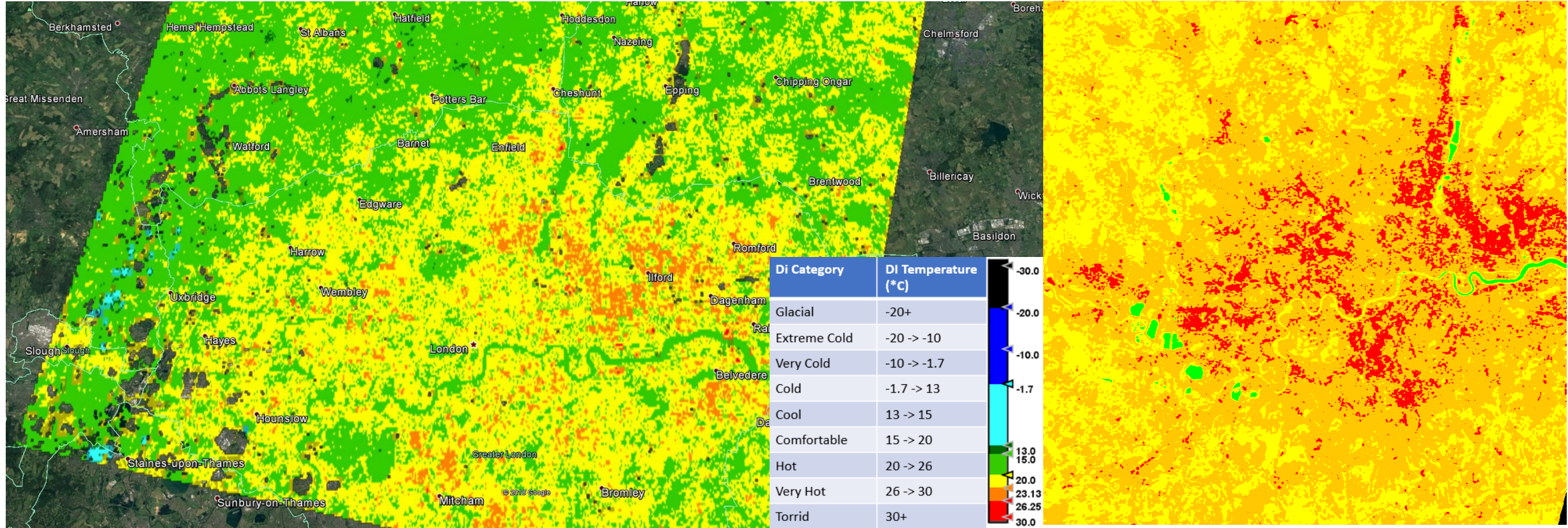
Hot Day: 2020-07-07



Warm Day: London 22/09/2017



Hot Day: 2020-07-07



Warm Day: London 22/09/2017

Hot Day: 2020-07-07

The UKHSA is keen to explore the use of heat related metrics and indicators and translate them into actionable information in the form of alerts and associated advice to local authorities and other regional stakeholders (small AIP with Assimila Ltd under the framework of UK EOCIS):

- For these alerts, and also for analysis of excess heat-related mortality, data at high spatio-temporal resolution are desirable.
- Whilst available for socioeconomic data, temperature related indicators (e.g. from Earth observation) are commonly on a rather coarse spatial scale, i.e. of order of km.
- To match environmental and socioeconomic data, and to account for phenomena such as urban heat islands, meteorological data at higher spatial and temporal resolutions are required.
- The focus will be on how to maximise the use of data to generate key metrics at the required spatial and temporal resolutions
- It will showcase the use of the metrics generated for a particular year e.g. heatwave Summer 2022.

An objective has been to develop a prototype dataset in customised end-user formats for monitoring heat risk vulnerability. These activities will deliver objectives through the exploitation and distribution of thermal infra-red satellite data to decision makers at the national and local level to address issues of Heat Risk, Vulnerability, Urbanisation and understanding the natural environment (Green Space assessment)

This development could act as a Case Study for promotion to downstream users, from which uptake would be expected by different city authorities, building industries etc

Information indices, such as TDI and others, gives the perceived temperature to humans referred to as the 'feels-like' temperature and is key to providing a link between the satellite observed heating and the impacts this has on the human body

This prototype could additionally set out a pathway for further exploitation of other CCI data, and contribute satellite based information towards the Global Stocktake