Three Weeks More Summer? How Crowdsourced Observations Could Enhance Urban Climatology

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What happens if we include crowdsourced observations in climate grids?

- The centre plot of Fig. 1 shows the count of “summer days” (where $T_{\text{max}}$ exceeds 25$^\circ$C) in 2020 from the current baseline, HadUK-Grid. Temperatures above this are associated with excess mortality, particularly for vulnerable individuals.
- The leftmost plot of Fig. 1 shows the same metric from grids built using crowdsourced observations from citizen weather stations. In some areas, this metric is increased by as much as three weeks (rightmost plot).
- HadUK-Grid is currently used to bias-correct climate model projections. If a crowdsourced baseline was used instead, we would see a substantial increase across such hazard metrics both now, and in future scenarios; impacting future mortality, health, and public policy decisions.

Why include crowdsourced observations?

- A long-standing challenge in urban climatology is to improve our observational basis. Climate information obtained from citizen weather stations, such as those in Netatmo, Davis, WOW (left), the standard HadUK-Grid (centre), and the crowdsourced grids minus HadUK-Grid (right).
- Reference networks comprise high-quality instruments in standardised exposures and conditions. Crowdsourced observations, meanwhile, may suffer from any combination of lags, radiative overheating, non-standard exposures, intermittent reporting, false metadata, and more.
- Robust quality control is necessary to remove or correct problematic sites, but this must be applied carefully to avoid discarding the very information on extremes that is sought.
- The limited scope of this pilot permitted the use of both automated and manual methods to screen out problematic sites and values, e.g. Fig. 3.

What are the challenges?

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How do the grids compare?

- Quality-controlled observations were interpolated onto a regular 1km grid. Regression equations relate the temperature to location, elevation, coast, and urban fraction, with a single fit for each day.
- Exploiting the greater density of crowdsourced sites allows us to capture domain-wide dependencies on elevation, coastal proximity or land use more precisely in space and more consistently in time.
- Generally, the crowdsourced grids capture a stronger elevation dependence (e.g. Pennines), as well as additional urban warmth in the city centre (Fig. 4). Industrial parks can be identified as local temperature hot-spots, along with various outlying towns.
- Local spatial variations of 1-2 $^\circ$C in the mean summertime daily $T_{\text{max}}$ are observed. On one of the hottest days, the crowdsourced grid was 4-5$^\circ$C warmer in some areas of Greater Manchester.