



# HIGH-RESOLUTION URBAN HEAT ISLAND MEASUREMENTS AND ELECTRICITY APPLICATIONS IN BIRMINGHAM, UK

*Juliana Antunes de Azevedo<sup>1</sup>, Lee Chapman<sup>1</sup>,  
Catherine L. Muller<sup>2</sup>*

- 1. University of Birmingham - UK*
- 2. Royal Meteorological Society - UK*

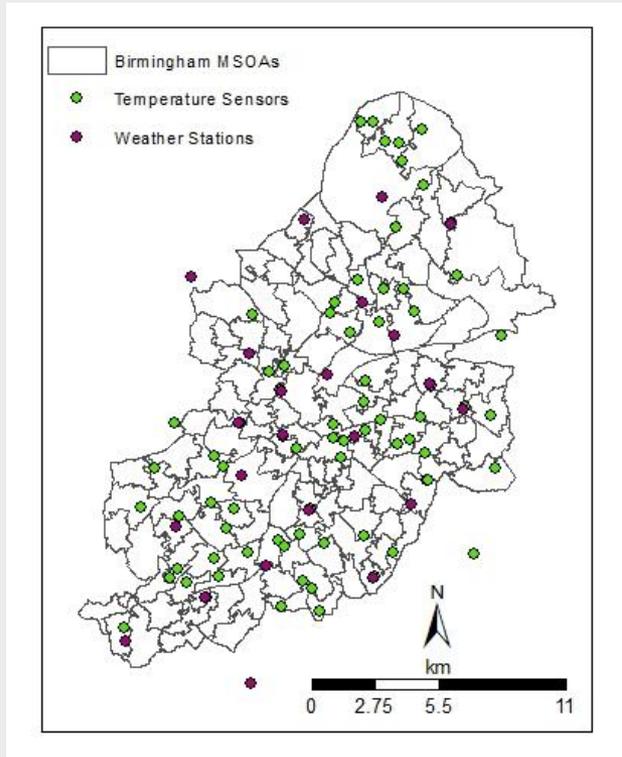
# BACKGROUND

- Heat waves, urban heat island and health
- Climate and energy consumption
- Income and air conditioning
- Energy industry needs



# BUCL

## □ Birmingham Urban Climate Laboratory (BUCL)



Air temperature data for Summer (June, July and August) 2013, from 82 low-cost, Wi-Fi air temperature sensors and radiation shield located on schools and lampposts at 3 meters from the ground, and 25 full automatic weather stations

HiTemp

# DEGREE DAYS METHOD

- Definition
- Cooling degree days (CDD)
- Other methods and results
- Base values

$$T_{average} = \frac{(T_{max} - T_{min})}{2}$$
$$x = T_{average} - T_{base}$$
$$CDD = \sum(x \geq 0)$$

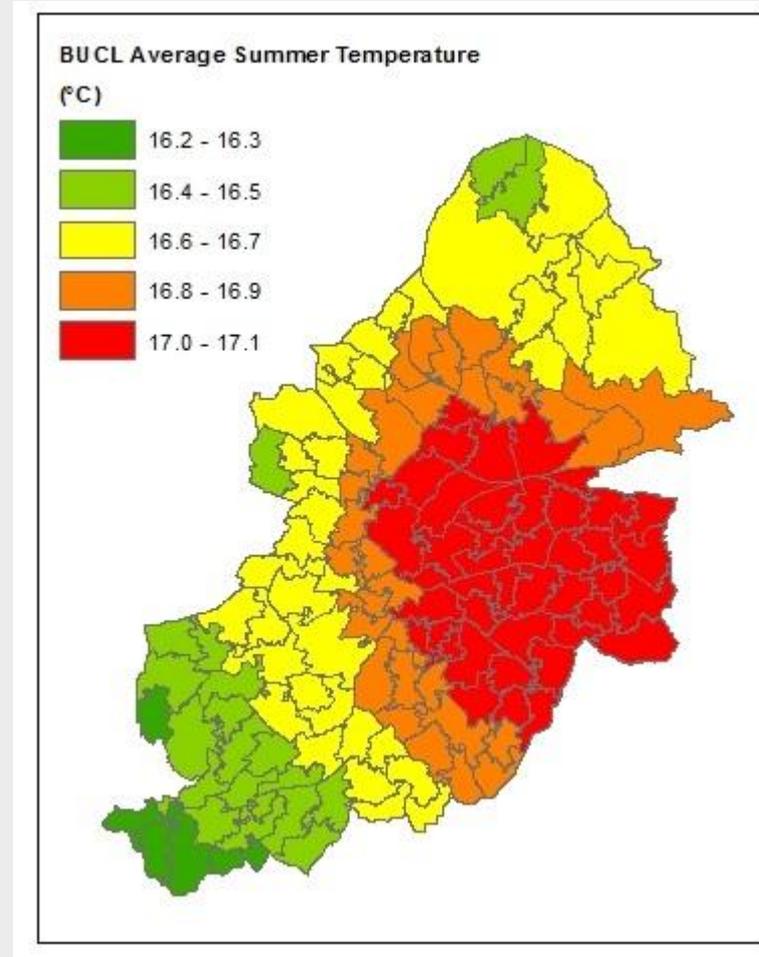
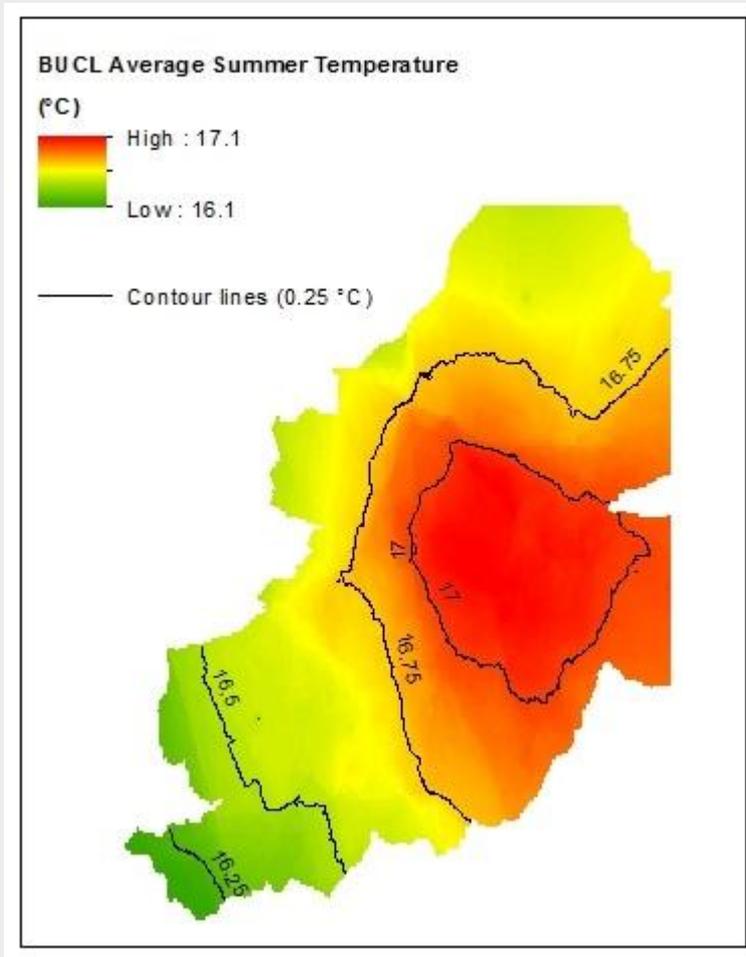
# STUDY CASE

- Calculate cooling degree days across Birmingham-UK, in the summer of 2013, based on data from a high resolution network

# METHODOLOGICAL STEPS

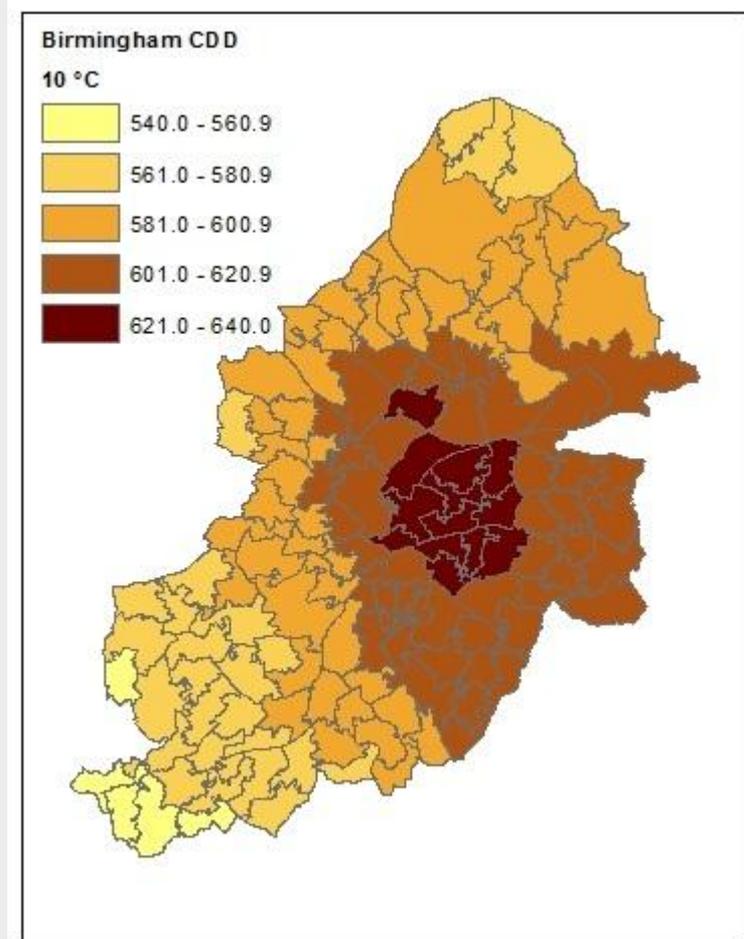
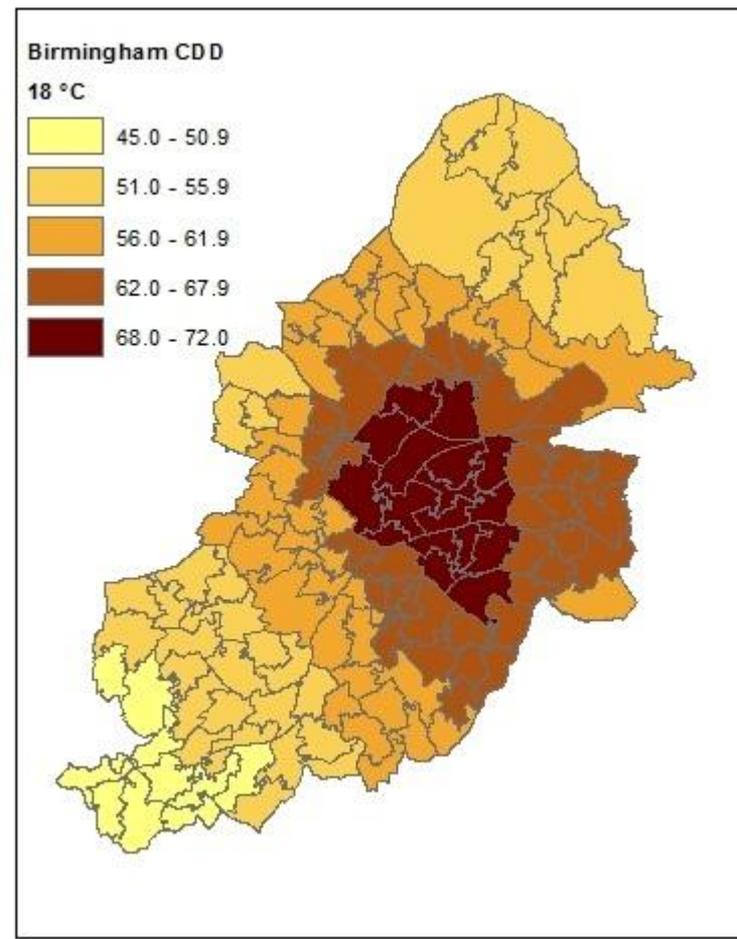
- Average air temperature calculated for each sensor and meteorological weather station
- Ordinary kriging (interpolation)
- MSOAs (Middle Layer Output Areas)
- CDD - Base values of 10° C and 18° C

# RESULTS



BUCL Summer Average Air Temperature 2013

# RESULTS



CDD Summer 2013

# RESULTS

1. CDD varies across a city due to differences in the air temperature across the city; therefore energy industry should consider such variations in their consumption forecasts
2. BUCL Network can be used to calculate CDD within a city, whichever is the base value adopted
3. The results can be incorporated into short and long term electricity consumption forecasting

# OTHER APPLICATIONS

- Other applications possible for the energy sector from the network data:
  1. calculating degree hours and heating degree days within a city;
  2. identifying heat impact on energy infrastructure (e.g. assets failure and reduced life expectancy due to excessive heat in the city core area);
  3. incorporate results into distribution planning;

# OTHER APPLICATIONS

4. incorporate results into urban planning mapping when focused on energy consumption;
5. calculation of other important indexes related to heat and comfort

# FUTURE WORK

- There is need for high resolution electricity consumption data
- Need for urban networks in cities where heat related consumption is high
- Acclimatization should be taken into account

# REFERENCES

- For energy:

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- For BUCL:

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# ACKNOWLEDGMENTS

- BUCL technicians Elliott Warren and Duick Young
- Brazilian National Council for Scientific and Technological Development
- Thank you for listening!



QUESTIONS?

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