REPORT

Identification of Major Summer Hotspots over Greater London Area using Landsat-8 Thermal Satellite data

Fine resolution satellite thermal data can be used as a basis for mapping the spatial distribution of urban surface temperatures and identifying urban hotspots. This report documents the LST dataset that has been produced from satellite-derived land surface temperature (LST) data for the Greater London Area (GLA; United Kingdom) and reveals the city's major daytime summertime hotspots.

Data & Methodology

For spatial resolutions coarser than 30 m it can be reasonably assumed that the urban LST hotspots coincide with the urban air temperature hotspots[1]. Hence, thermal satellite data can be used so as to identify intra-urban areas with elevated temperatures.

To generate a dataset that presents the LST spatial distribution and the corresponding hotspots for GLA, a five-year (2016-2020) time series of satellite-derived 100 m daytime LST images (in °C) is employed. The utilized data correspond **only** to summer months (i.e. June, July and August) so as to capture the hotspots with the most important impact on thermal discomfort, human health and energy demand, and are derived from Landsat-8 thermal infrared images.

The next step after estimating the 2016-2020, average, summertime, daytime LST is to aggregate them to city block level. In addition to the average LST (avgLST), the avgLST standard deviation, minimum and maximum for each city block are also estimated. The aforementioned statistics are stored as new attributes in the Urban Atlas polygons and the updated vectors are then exported as a new shapefile. The spatial extent of this output shapefile corresponds to the boundaries of GLA.

[1] Coutts, A. M., R. J. Harris, T. Phan, S. J. Livesley, N. S. G. Williams, and N. J. Tapper (2016), Thermal infrared remote sensing of urban heat: Hotspots, vegetation, and an assessment of techniques for use in urban planning, Remote Sens. Environ., 186, 637–651, doi:10.1016/j.rse.2016.09.007.

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Deliverables

1	**Filename:**	*avgLST_London_UrbanAtlas.gpkg*
	Filetype:	Geopackage (polygons)
	Description:	The updated Urban Atlas polygons corresponding to the London core area. Their attributes have been updated with the derived LST data (in °C) and four new columns were added: 1. *avgLST*: the 2016-2020 average, summertime, daytime LST 2. *std_avgLST*: the avgLST standard deviation for each city block 3. *min_avgLST*: the avgLST minimum for each city block 4. *max_avgLST*: the avgLST maximum for each city block
	Map Proj.:	OSGB 1936 / British National Grid – Projected - EPSG:27700

2	**Filename:**	*London_avgLST.tif*
	Type:	Raster (geotiff)
	Description:	The averaged 2016-2020 summertime daytime LST image data (i.e. the avgLST). The dimensions of the raster data are 609 x 483 pixels and the data type is Float32 (32 bit floating point). The spatial resolution is 100 m and the noData value is -1000. The minimum, mean and maximum statistics are 7.9°C, 30.3°C and 43.6°C, respectively.
	Map Proj.:	OSGB 1936 / British National Grid – Projected - EPSG:27700

3	**Filename:**	London_daytime_hotspots_map.pdf
	Type:	portable document format (.pdf)
	Description:	A map produced using QGIS that presents the *avgLST_London_UrbanAtlas.gpkg* data.
	Map Proj.:	N/A

4	**Filename:**	Hex350_grid_GLA_with_avgLST.shp
	Type:	shapefile (polygons)
	Description:	The updated London core area hexagon grid (Hex350_grid_GLA.shp). The following four new attribute columns were added that have been calculated from the derived LST data (in °C): 1. avgLST: the 2016-2020 average, summertime, daytime LST 2. std_avgLST: the avgLST standard deviation for each hexagon 3. min_avgLST: the avgLST minimum for each hexagon 4. max_avgLST: the avgLST maximum for each hexagon
	Map Proj.:	OSGB 1936 / British National Grid – Projected - EPSG:27700