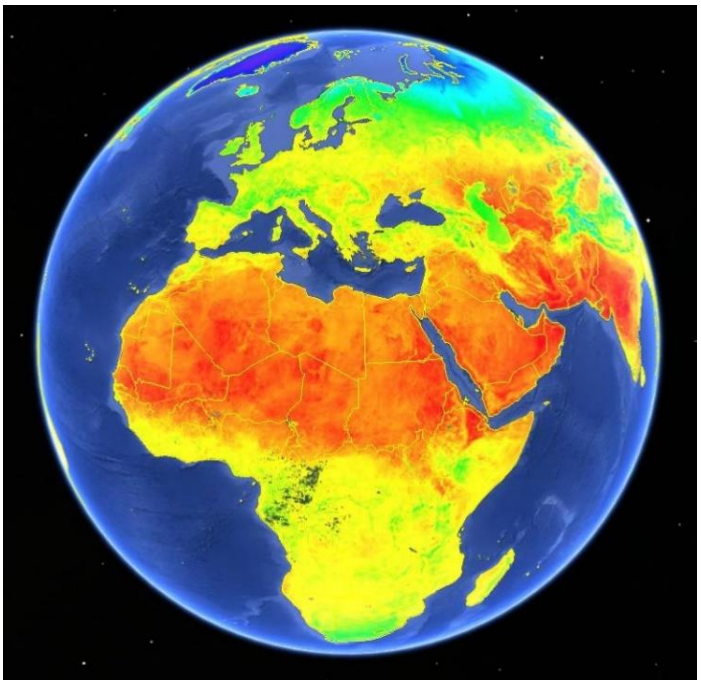
climate change initiative

→ LAND SURFACE TEMPERATURE NEWSLETTER



In this issue:

Issue 3 | September 2021

Objectives of the project

The land surface temperature (LST) CCI project, which is funded by the European Space Agency (ESA) as part of the Agency's Climate Change Initiative (CCI) Programme, aims to deliver a significant improvement on the capability of current satellite LST data records to meet the challenging Global Climate Observing System (GCOS) requirements for climate applications to realise the full potential of long-term LST data for climate science.

Accurate knowledge of LST plays a key role in describing the physics of land-surface processes at regional and global scales as they combine information on both the surface-atmosphere interactions and energy fluxes within the Earth Climate System. LST provides a metric of surface state when combined with vegetation parameters and soil moisture and is one of the drivers of vegetation phenology. Furthermore, LST is an independent temperature data set for quantifying climate change complementary to the near-surface air temperature ECV based on in situ measurements and reanalyses.

The team has produced the first data products from a variety of satellites to provide an accurate view of temperatures across land surfaces both regionally and globally of up to 20 years currently. Consistency between products and better characterisation of uncertainties are key advancements with these products. These data are delivering new insights to scientists working at leading climate centres.

land surface temperature cci

Science highlights

As ESA's CCI project targets the production of data sets that can be used for climate research, a crucial requirement is to assess the suitability and utility of these data from a climate-science perspective. The Climate Research Group have undertaken six different User Case Studies (UCS) (Table 1). Based on UCS results, together with the feedback from the LST_cci User Workshop, held virtually 24-26 June 2020, **user needs have been comprehensively captured and key ones implemented by the Project Team in the latest Version 2.0 product release**.

Table 1: LST_cci User Case Studies

Team	Title
Met Office Hadley Centre	Regional and Global Trends in LST
DMI	Assimilating Greenland ice sheet surface ice temperature
Ruhr University Bochum	Global Surface Urban Heat Islands
MPI-BCG	Simulation of carbon fluxes
MeteoRomania	SUHI analysis in Romania
LIST	Using LST in a surface energy balance (SEB) model

Key messages which emerged from the Climate Research Group on the assessment of the LST_cci products are:

- The products are easy to use and are well described in netCDF format. Users comment that the common format for LST products from different sensors is very valuable.
- Users appreciate the provision of additional fields in the files, such as viewing and solar geometry, and land cover class.
- Use of higher resolution gridded products at 0.01° has been core to the success of these studies.
- The gridded LST products are generally well correlated with collocated 2-m air temperatures (T2m) for both 'actual' and 'anomaly' temperatures.
- The Surface Urban Heat Island Intensity (SUHII) estimates and hysteretic cycles calculated from the 0.01° LST_cci products agree with those reported in the published literature using other products.

Each UCS is in the process of finalising their submissions to leading scientific journals and papers will be available soon.

The Version 2.0 release of the LST_cci products has now completed with all products publically available on the JASMIN facility (http://gws-access.ceda.ac.uk/public/esacci_lst/). An important advance on the Version 1.0 products is the implementation of consistency across the product suite. **This means products are using common algorithms, cloud detection methods, uncertainty models and calibration databases to deliver the best possible climate data records for LST**. Examples of the of Version 2.0 LST ECV products available are shown in Figure 1. This includes **global and regional cloud free data** from thermal infrared sensors, **global all sky data** from microwave sensors, and **global cloud free data over the full diurnal cycle** from merging data of geostationary and polar-orbiting thermal infrared sensors.

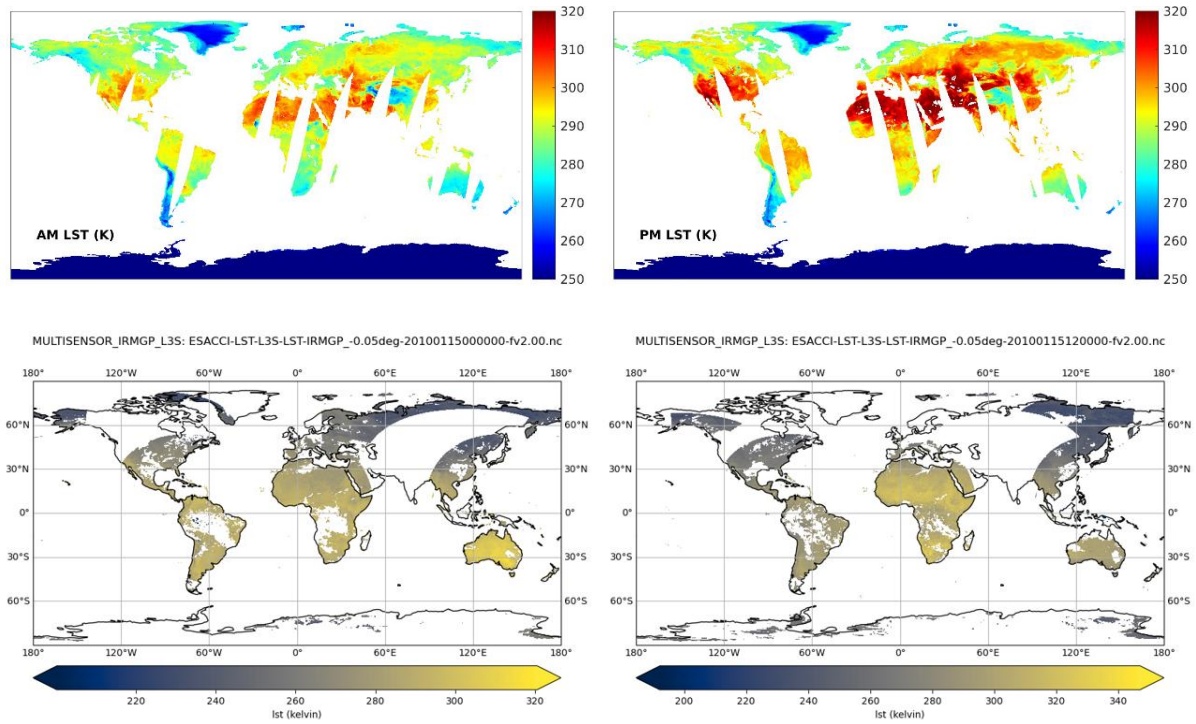


Figure 1: Example Version 2.0 multi-sensor LST_cci output products available from the LST_cci public workspace: Microwave product from SSM/I (top row); Merged thermal infrared product from geostationary and polar orbiting sensors (bottom row)

Exploitation

A useful metric of the value of the outputs of the LST_cci products to both scientific and non-scientific entities is exploitation. Using LST_cci algorithms and approaches, and in collaboration with NCEO and Space4Climate, a first **high quality LST product at high spatial resolution** (~100m) has been developed. This activity 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. This product could contribute satellite-based information towards the Global Stocktake. With consideration towards the location of COP26, we show an example of the product for Glasgow, UK (Figure 2).

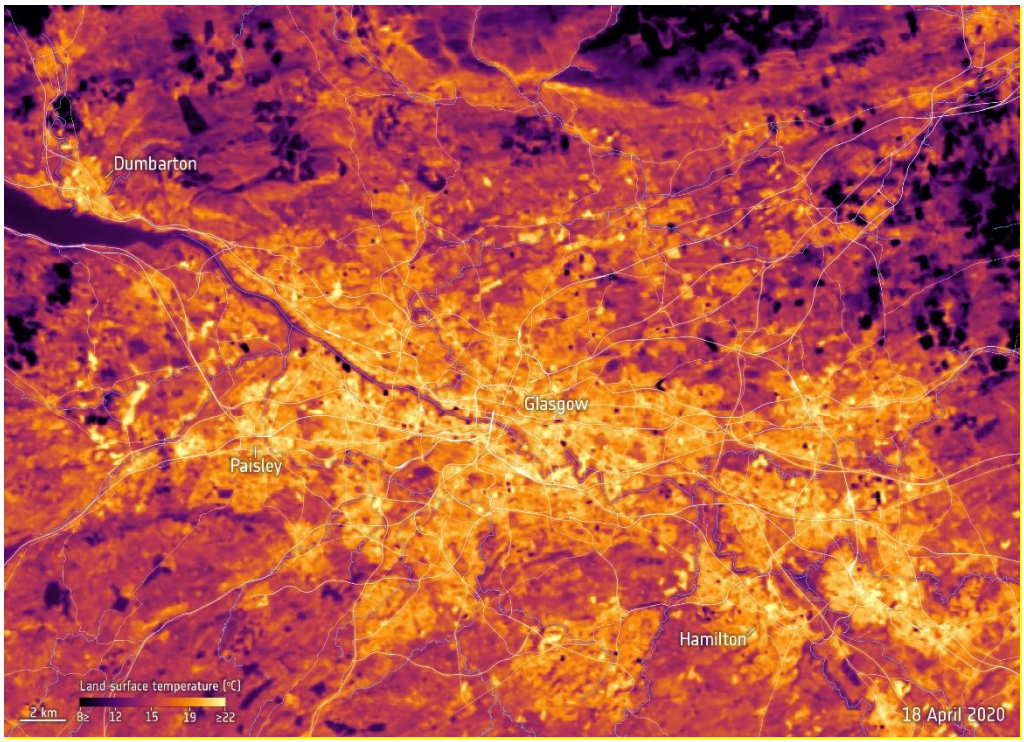


Figure 2: High resolution LST from LST_cci for Glasgow, UK from Landsat-8 satellite for 18th April 2020. (Credit: LST_cci, NCEO, Space4Climate for algorithm and data; ESA for visualisation)

Project Team

The Consortium is based on a close collaboration between the following partners:

- University of Leicester (primary)
- ACRI-ST
- NCEO: National Centre for Earth Observation
- University of Reading
- UK Met Office
- ESTELLUS
- UVEG: University of Valencia
- KIT: Karlsruhe Institute of Technology
- IPMA: Instituto Português do Mar e da Atmosfera
- Ruhr University Bochum
- DMI: Danish Meteorological Institute
- Max Plank Institute
- LIST: Luxembourg Institute of Science and Technology
- Meteo Romania

Science Lead is Darren Ghent, University of Leicester and NCEO (djg20@leicester.ac.uk)

Project Manager is Jerome Bruniquel, ACRI-ST, (jerome.bruniquel@acri-st.fr)

ESA Technical Officer is Simon Pinnock: (simon.pinnock@esa.int)

Events

A session proposal from LST_cci will be submitted to the ESA Living Planet Symposium 2022 to be held in Bonn, Germany 23–27 May 2022.