



## **Horizon 2020**

H2020-EO-2014 New ideas for Earth-relevant Space Applications

### **EUSTACE**

(Grant Agreement 640171)



**EU Surface Temperature for All Corners of Earth**

**Deliverable D2.6**

***Final verified products delivered to CEMS for dissemination***

Deliverable Title	<i>Final verified products delivered to CEMS for dissemination</i>	
Brief Description	<i>The main outputs from WP2 are a set of state-of-the-art products that meet the product design specifications defined in Task 2.1. The products will be made available to CEMS after validation by WP3 (Task 2.5).</i>	
WP number	2	
Lead Beneficiary	<i>Nick Rayner, Met Office</i>	
Contributors		
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Version Number	1.0	
Version Date	28/05/2019	
Deliverable Due Date	M50	
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Nature of the Deliverable	<input type="checkbox"/>	<i>R - Report</i>
	<input type="checkbox"/>	<i>DEM – Demonstrator, Pilot, Prototype</i>
	<input type="checkbox"/>	<i>DEC – Dissemination, Exploitation or Communication</i>
	<input checked="" type="checkbox"/>	<i>O - Other</i>
Dissemination Level/ Audience	<input checked="" type="checkbox"/>	<i>PU - Public</i>
	<input type="checkbox"/>	<i>CO - Confidential, only for members of the consortium, including the Commission services</i>

Version	Date	Modified by	Comments
0.1	06/04/2019	Nick Rayner	First draft
1.0	28/05/2019	Nick Rayner	Final



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## 1. Executive Summary

This deliverable report documents the delivery of the final EUSTACE products to CEDA for archiving.

## 2. Project Objectives

With this deliverable, the project has contributed to the achievement of the following objectives (DOA, Section B1.1):

No.	Objective	Yes	No
1	Intensively develop the hitherto immature use of Earth Observation estimates of Earth's surface <b>skin</b> temperature to enable new Climate Data Records of the surface <b>air</b> temperature Essential Climate Variable (ECV) to be created, for all locations over all surfaces of Earth (i.e. land, ocean, ice and lakes), for every day since 1850. EUSTACE will achieve this by: combining information estimated from multiple satellites with surface air temperature measurements made <i>in situ</i> and <b>creating complete analyses</b> of surface air temperature, through the application of novel statistical in-filling methods.		X
2	Integrate these new daily surface air temperature Climate Data Records into a range of applications in Earth System Science and Climate Services and research, amongst others. EUSTACE will achieve this via the active and continuous engagement of trail-blazer users, and the provision of products through already-existing user community data portals and service mechanisms, in standard formats.	X	
3	Undertake and report detailed research into the relationships between surface skin temperature estimated from Earth Observation satellite measurements and surface air temperature observed <i>in situ</i> by conventional measurements, over all surfaces of the Earth, including the polar regions. This is likely to provide information useful for refining coupling in Earth system models.		X
4	Create a sustainable, automated system at an appropriate level of maturity for the potential production of the products beyond the lifetime of the project. To enable this, EUSTACE will also identify Earth Observation and conventional data streams that could be used to update the surface air temperature Climate Data Records in the future, including those from Sentinel missions.		X

5	Extensively validate the new surface air temperature Climate Data Records against independent, surface-based reference data, sourced by the project for this purpose.		x
6	Develop and report new, consistent, validated estimates of uncertainty both in already-existing Earth Observation surface skin temperature estimates and in the new surface air temperature Climate Data Records, at all locations and times across the Earth's surface.		x
7	Develop links with related activities within Europe and beyond to help to ensure the execution of a joined-up work programme, the Copernicus Services and to enable the provision of requirements for the future surface skin temperature and surface air temperature observing system.		x
8	Other – not directly linked to one of the above objectives		x

### **3. Detailed Report**

The Description of Action foresees this relating to the final products from WP2 conforming to the product design documentation. In practice, more products than these have actually been delivered to CEDA (see table below).

In addition, EUSTACE system code has been uploaded to a static GitHub repository (<https://github.com/eustace-data/eustace-system>).

The data products are summarised in the table below.

Short name	Descriptive Name	Status
<b>Global satellite land surface temperature, v2.1</b>	EUSTACE / GlobTemperature: Global clear-sky land surface temperature from MODIS Aqua on the satellite swath with estimates of uncertainty components, v2.1, 2002-2016	Delivered
	EUSTACE / GlobTemperature: Global clear-sky land surface temperature from MODIS Terra on the satellite swath with estimates of uncertainty components, v2.1, 2000-2016	Delivered
<b>Global satellite ice surface temperature, v1.0</b>	EUSTACE / AASTI: Global clear-sky ice surface temperature from the AVHRR series on the satellite swath with estimates of uncertainty components, v1.0, 2000-2009	Delivered
<b>Global satellite sea surface temperature, v1.2</b>	EUSTACE / CCI: Global clear-sky sea surface temperature from the (A)ATSR series at 0.25 degrees with estimates of uncertainty components, v1.2, 1991-2012	Delivered
<b>Global Station Measurements</b>	EUSTACE: Global land station daily air temperature measurements with non-climatic discontinuities identified, for 1850-2015	Delivered
<b>Validation match up database, v1.0</b>	EUSTACE: coincident daily air temperature estimates and reference measurements, for validation, 1850-2015	Delivered
<b>Air temperature estimates from satellite</b>	EUSTACE: Globally gridded clear-sky daily air temperature estimates from satellites with uncertainty estimates for land, ocean and ice, 1995-2016	Delivered
<b>Global air temperature estimates, v1.0</b>	EUSTACE: Global daily air temperature combining surface and satellite data, with uncertainty estimates, for 1850-2015	Delivered <sup>1</sup>

<sup>1</sup> A second data set, v1.1 (a revised analysis for 1880-2015), has also been delivered to CEDA and will be released in due course