

# Validation for Sentinel 3 Land Surface Temperature Products

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## 1. Introduction

Copernicus Sentinel-3 (S3) satellites providing accurate measurements and data products aiming to address environmental and security issues. In order to ensure these datasets are of high quality and consistency for these applications, and to identify areas of improvement, they must be validated using independent data sources such as from in situ data. Strengthening the validation of the Land Surface Temperature (LST) S3 data product derived from SLSTR (SL\_2\_LST), for currently non-validated biomes and regions, is one of the aims of the “Validation for LST, AOD and I WV S3 products” (LAW) project.

Here we present initial work within the LAW project to identify gaps in the existing in-situ LST networks, in order to identify priority areas for extending the network, as well as a summary of the proposed validation methodology to be used.

## 2. Gap Analysis of Existing in-situ Networks

- Several networks include stations taking measurements that can be used to derive in situ LST (Fig. 1). A gap analysis, focused on unrepresented biomes, was performed.
- Of the 27 ALB2 biomes which are typically classified as land:
  - 55.55% of biomes (15), covering 71.21% of the Earth, have at least one existing in situ site.
  - 11 of these biomes include more than one site.
  - Biome 14, closed to open (more than 15%) grassland, is currently the best sampled biome.
- The biome coverage utilised for current SL\_2\_LST validation activities (S3MPC and S3VT) is similar to the above.
  - Any additional gaps (biomes 27, 5, 12) can be filled by including already existing sites.
- Yet, some biomes covering relatively large proportions of the Earth’s surface are not represented or are under-represented.
- Filling some of these gaps is the focus of LAW LST activities.

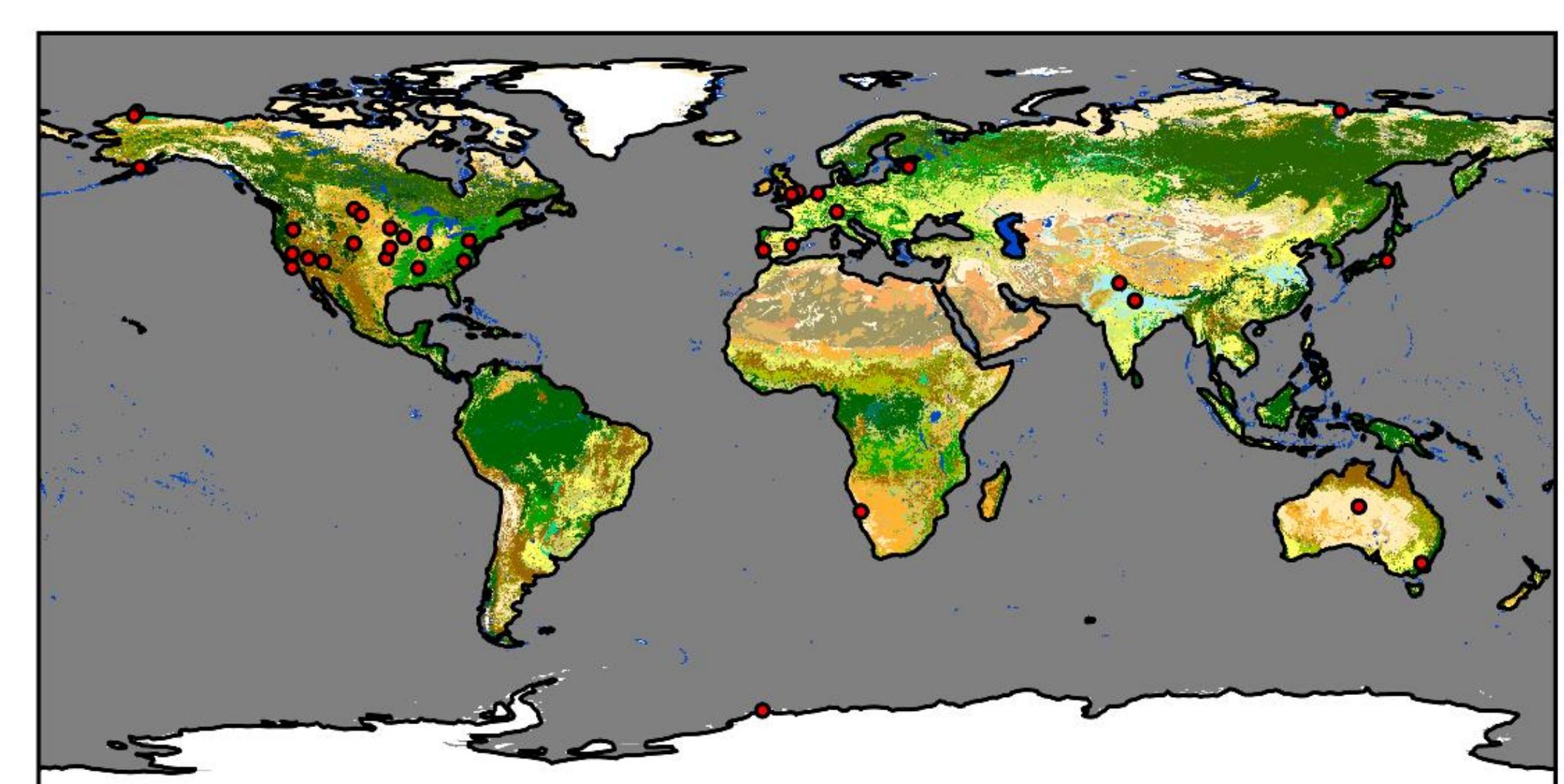
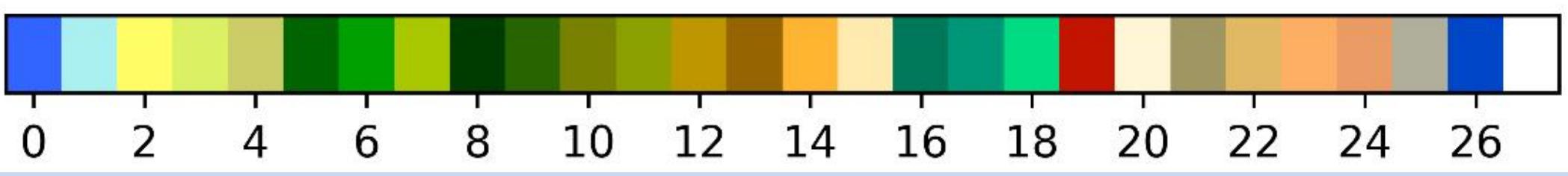


Fig. 1: Location of identified existing LST in situ sites with the biome classification for SLSTR data products (ALB2). Sites are shown with red markers.



## 3. New In-Situ LST sites for Law Deployment

- New in situ sites which could host LAW LST instrumentation were identified from the CEOS LPV supersites list and existing collaborations.
- New sites were ranked using metrics based on the gap analysis, suitability of site (access, maintenance, homogeneity in the satellite field of view), and cloud cover.
- Following discussion, the following sites were chosen:

Site Name	Country	Lat	Lon	ALB2	Impact level
Svartberget	Sweden	64.26	19.77	9	Very High
Dahra	Senegal	15.40	-15.43	4	High
Hyytiälä	Finland	61.85	24.29	10	High
KIT forest site	Germany	49.09	8.43	6	High
Robson Creek	Australia	-16.11	145.38	5	Medium
Puechabon	France	43.74	3.60	15	High

Table 1: Sites recommended for deployment. Puechabon will be an in-kind contribution by NCEO given in yellow.

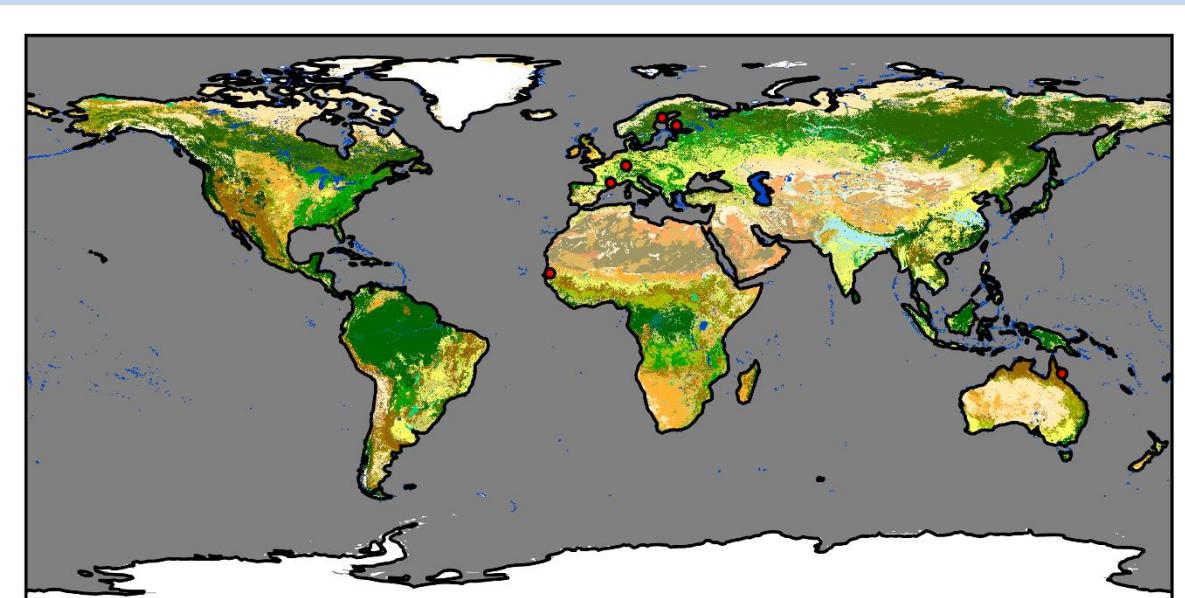


Fig. 2: Location of new LST in situ sites with the biome classification for SLSTR data products (ALB2). Sites are shown with red markers.

## 4. Proposed Validation Methodology

- Based on documents such as the CEOS LPV Best Practices Protocol and from FRM4STS, the validation methodology for LAW is:
  - In situ observations of LST derived from new sites will be compared to SL\_2\_LST data.
  - Calibrated Heitronics radiometers will be deployed to measure upwelling and downwelling long wave radiation.
  - They will be set up using best practice guidelines and setup will be site specific.
  - Matchups between in situ and satellite data will be within 1 minute of each other and robust statistics will be utilised.
  - Uncertainty in in situ measurements will be evaluated.
- Technical details of LAW deployments will be documented and data will be made available.



Fig. 4: Heitronics radiometer similar to those acquired for LAW deployed at Wytham Woods, Oxford. Photo from Emma Dodd.



Fig. 3: Setup of Heitronics radiometers at Dahra, which will be re-installed by LAW. Photo from KIT.

## 5. Summary and Future Work

- The LAW project aims to strengthen the validation of S3 data products, including LST.
- Initial work has identified priority sites to fill gaps in validation coverage for SL\_2\_LST and a validation methodology, based on the current state of the art, has been proposed.
- Deployment of new instrumentation is expected in late 2020 at 6 new sites. Data and documentation for these new sites will be made available by the LAW project.
- For updates on LAW activities: <https://law.acri-st.fr/app/home>.

## 7. Acronyms

**CEOS:** Committee on Earth Observation Satellites

**LPV:** Land Product Validation

**FRM4STS:** Fiducial Reference Measurements for satellite derived surface temperature product validation