

# Land Surface Temperature and Emissivity

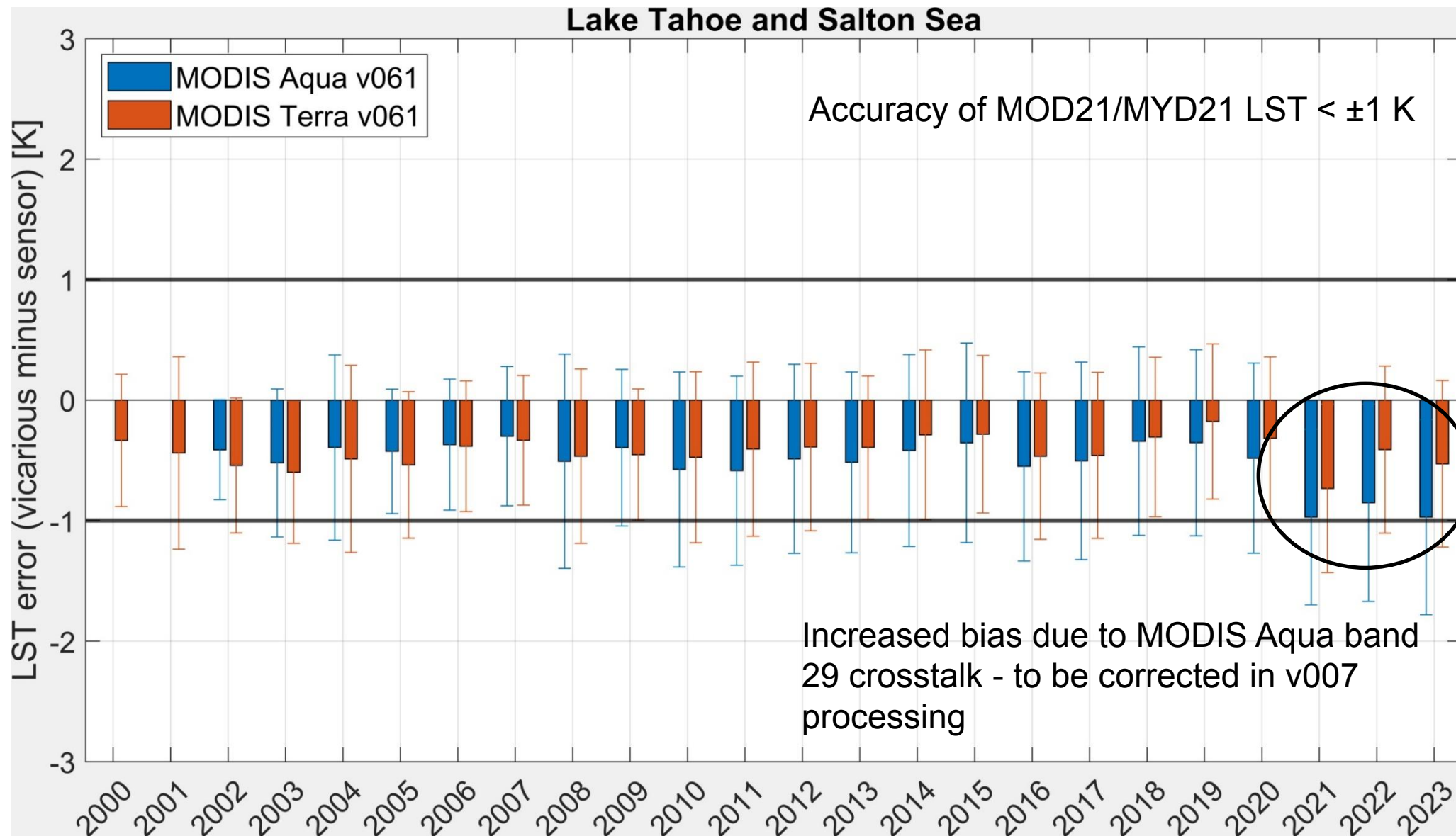
## Upcoming Conferences

- ESA LPS 2025. Friday 27<sup>th</sup>, Hall G2. A.02.01 Land Surface Temperature and Emissivity Data for Research and Applications.
- International Workshop on High-Resolution Thermal Earth Observation. 18 – 20 November, 2025. Toulouse, France.

## Project news

- TIRCALNet preparation study on going for 18 months
- ECOSTRESS forward processing and reprocessing for Collection 2 higher level products (ET, ESI, WUE) has begun.

# MODIS v061 LST Validation Summary



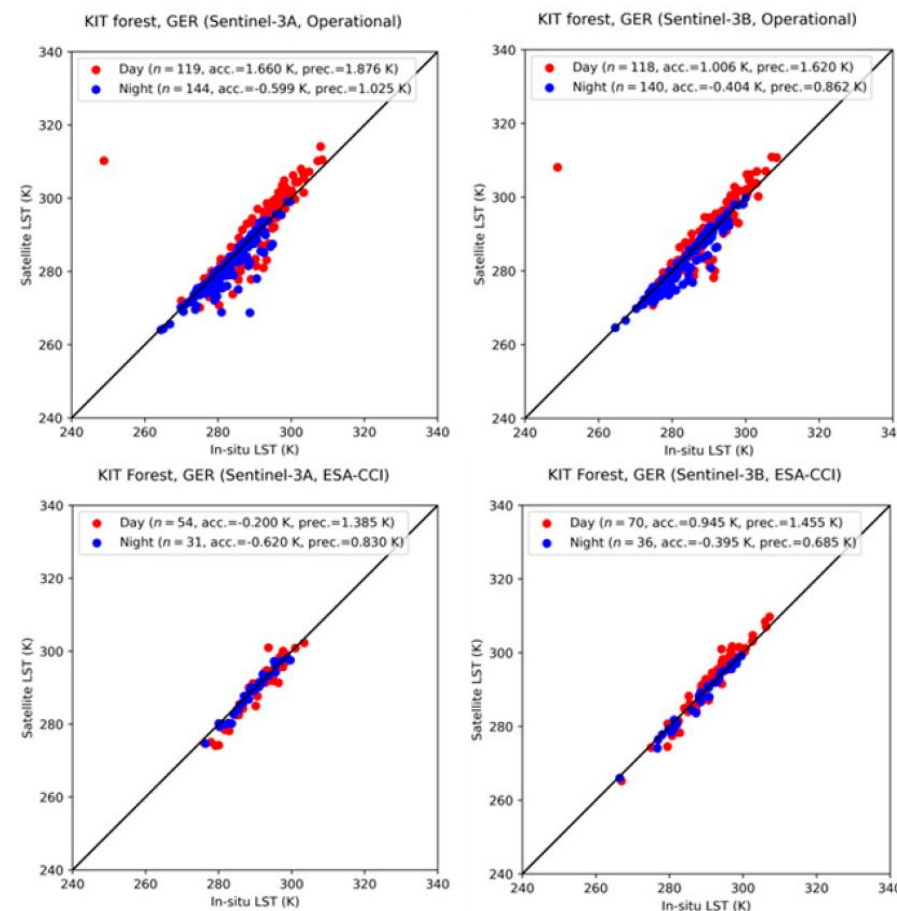
# Validation of Sentinel3-A/B SLSTR

## Validation of Sentinel3-A/B SLSTR Operational and CCI products

- Ghent et al. (2024), The Operational and Climate Land Surface Temperature Products from the Sea and Land Surface Temperature Radiometers on Sentinel-3A and 3B, Remote Sensing, doi: 10.3390/rs16183403
- SLSTR LST Operational and LST\_cci products were validated against ground-based observations from 11 sites.
- LST\_cci has an improved, and more strict, cloud mask than the operation SL\_2\_LST product.
- LST\_cci met the 1 K requirement in accuracy and precision for day and night times for both sensors.

Average median and RSD of the validation of each dataset at the 11 sites.  
Data from Ghent et al. (2024)

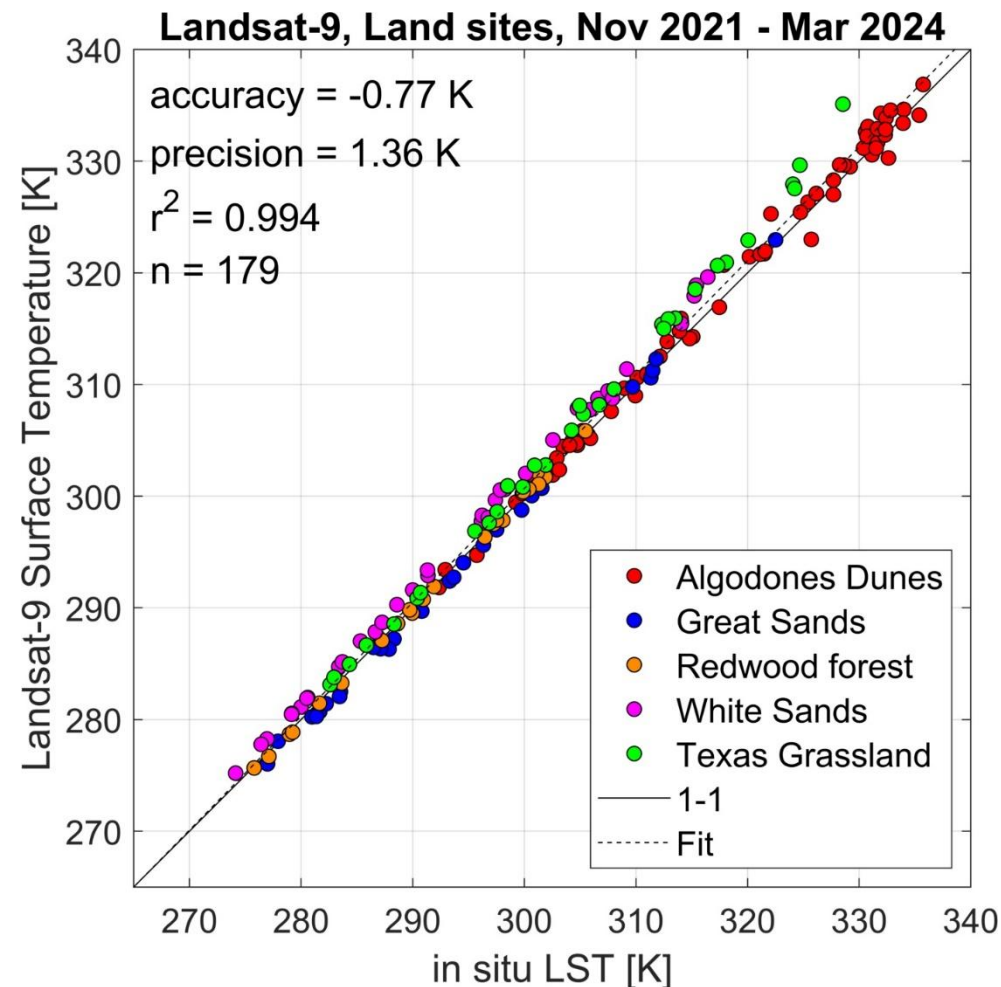
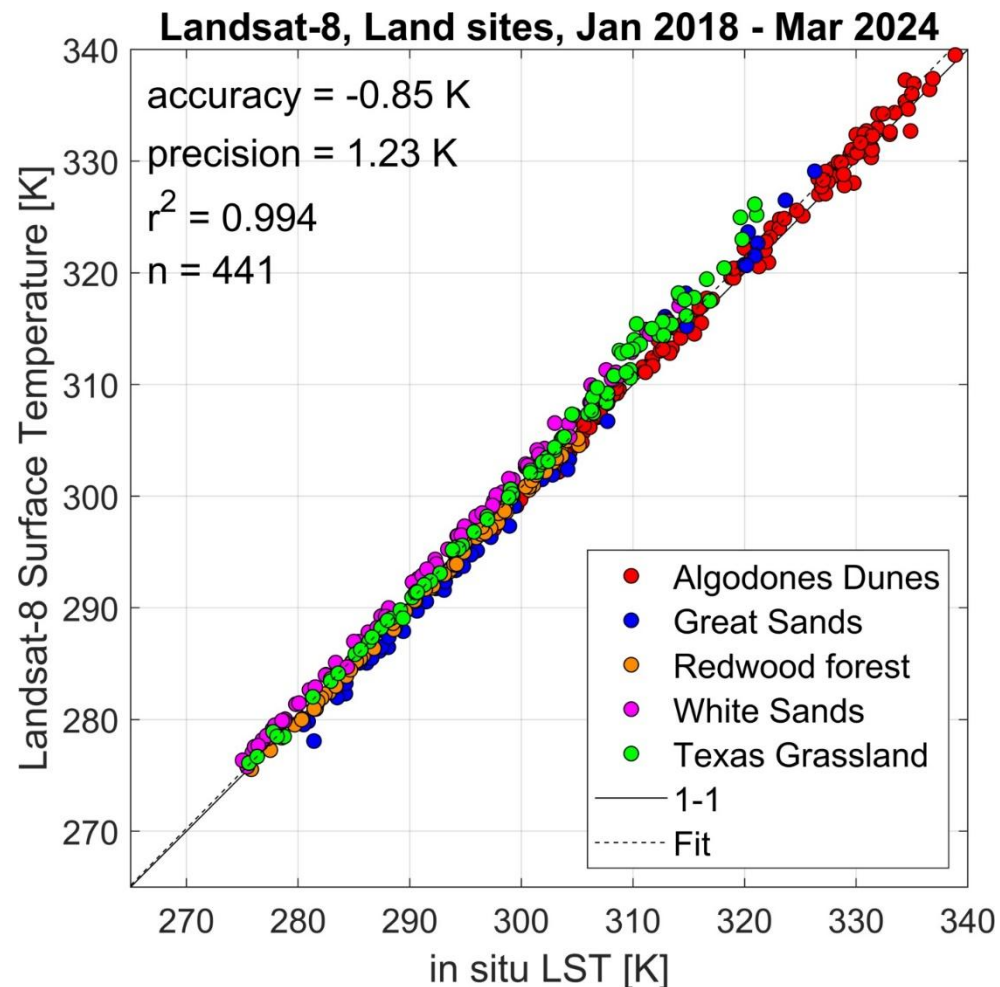
	Daytime		Nighttime	
	Median (K)	RSD (K)	Median (K)	RSD (K)
S3A - SL_2_LST	-1.2	3.0	0.3	1.4
S3B - SL_2_LST	-1.0	2.8	-0.1	1.5
S3A - LST_cci	0.7	1.7	0.6	0.9
S3B - LST_cci	0.9	1.7	0.7	0.8



Validation results over KIT Forest site for S3A-SL\_2\_LST (top-left), S3B-SL\_2\_LST (top-right), S3A-LST\_cci (bottom-left) and S3B-LST\_cci (bottom-right). Adapted from Ghent et al. (2024).

# Validation of Landsat 8 / 9

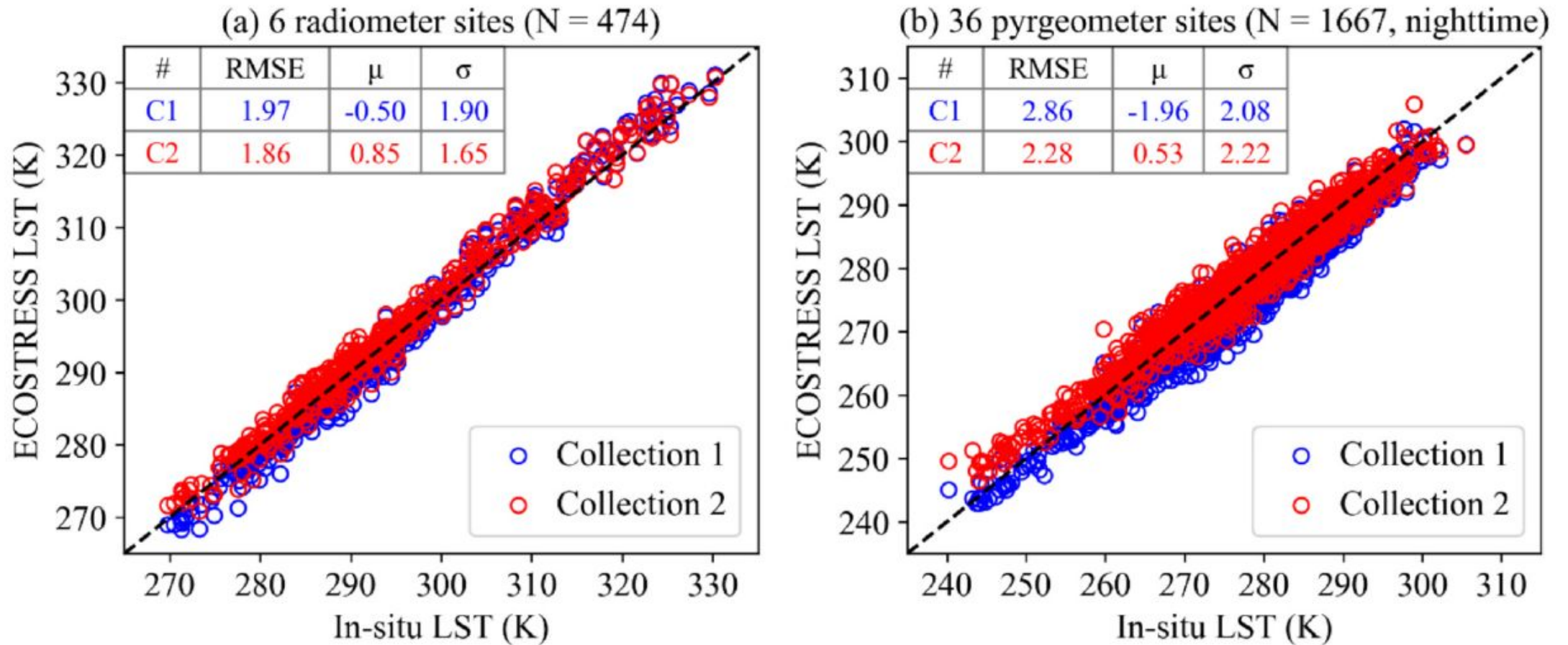
**Landsat 8 and 9 Surface Temperature products continue to show good agreement in terms of accuracy (<1 K) over a wide variety of different land targets**





# ECOSTRESS LST Validation: Comparison C1 & C2

Zhang et al. (2025), Global evaluation of high-resolution ECOSTRESS land surface temperature and emissivity products: Collection 1 versus Collection 2. Remote Sensing of Environment, 326, 114799. Doi: <https://doi.org/10.1016/j.rse.2025.114799>



# ECOSTRESS C2 Emissivity Validation

## Algodones Dunes, California

Composition: quartz



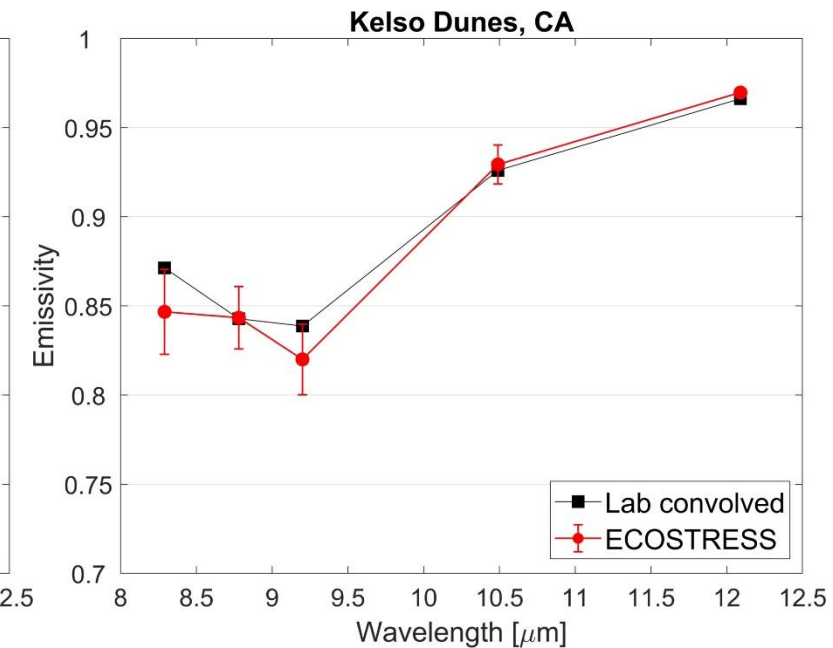
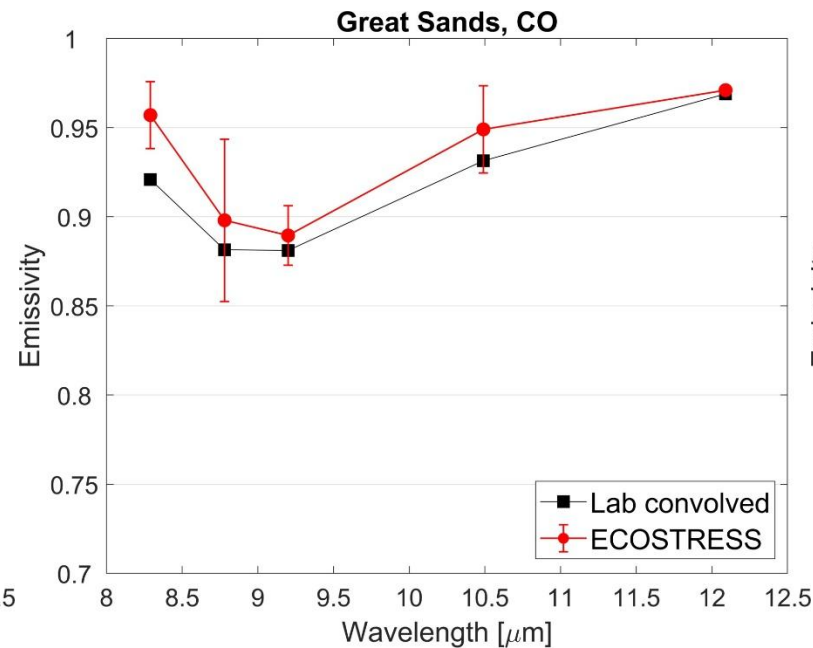
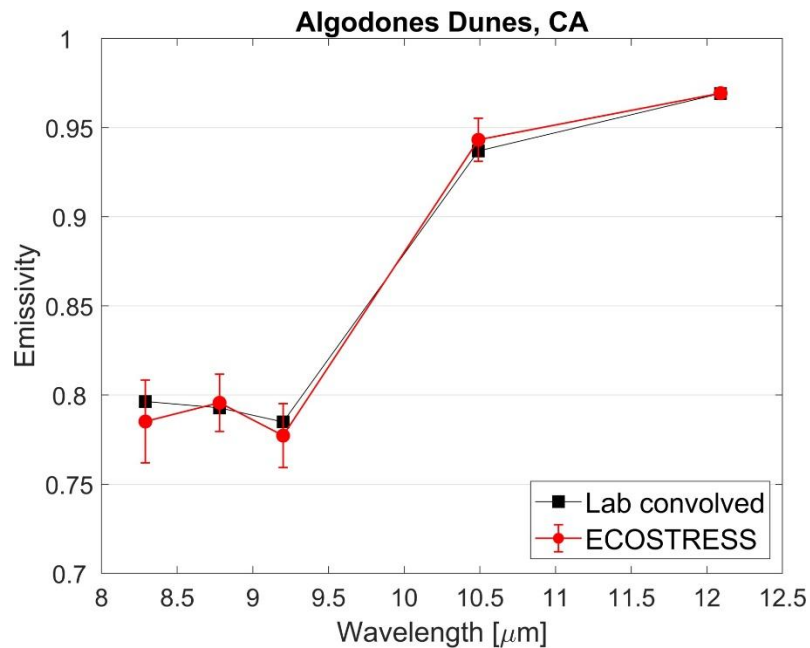
## Great Sands National Park, Colorado

Composition: quartz, potassium feldspar



## Kelso Dunes, California

Composition: quartz, K-feldspar



Emissivity validation results show accuracies at <2% on average for all bands at three pseudo-invariant sand dune sites

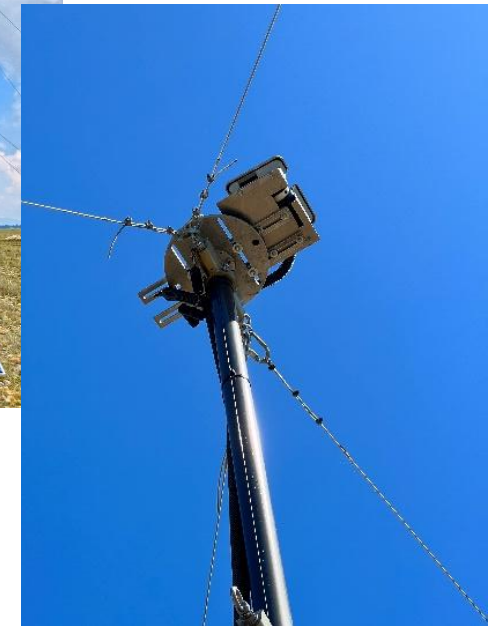
ECOSTRESS Collection 2 LSTE validation by Jet Propulsion Laboratory, California Institute of Technology:  
Glynn Hulley, Kerry Cawse-Nicholson, Simon Hook, Robert Radocinski, Robert Freepartner,



# TIRCalNet Study

## TIRCalNet Preparation Study

- Primary Goal: Prepare the roadmap for the TIRCalNet operations.
- Cooperation between TIRCalNet Preparation Study team (Uni. Leicester, KIT, RAL Space) and CNES and JPL.
- Study at La Crau site:
  - Characterization of site uncertainties.
  - Characterization of instruments uncertainties.
  - Characterization of atmospheric propagation approach.



# TIRCalNet Study

## First LST validation results at La Crau, France

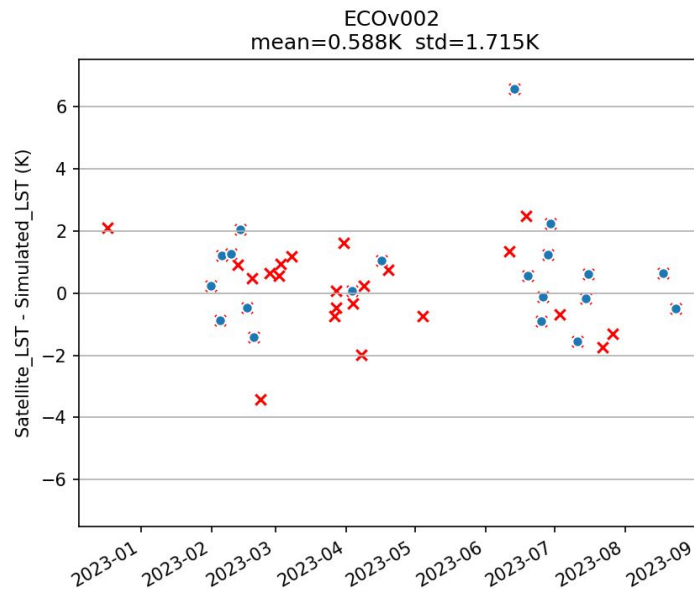
CNES decision to develop an instrumented site for thermal infrared sensors for future TIR missions, including CNES/ISRO mission TRISHNA, at La Crau, France in addition to the current RadCalNet site

- Dec 2022: Installation of a JPL radiometer (NASA/JPL)
- June 2023: Installation of a CIMEL CE312 radiometer (LOA)
- Feb 2024: Installation of KT15.99 with TRISHNA-like filters

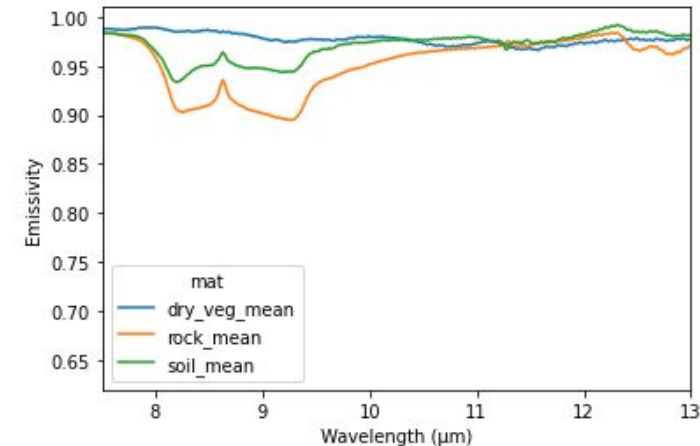


Slight positive bias + significant dispersion

Blue dots ☐ visual check of the image (cloud mask / radiometric artefacts)



Current processing: Emissivity derived from the fraction of vegetation and sample measurements (NASA JPL)



☐ Future processing: Emissivity estimation is the main area for improvement

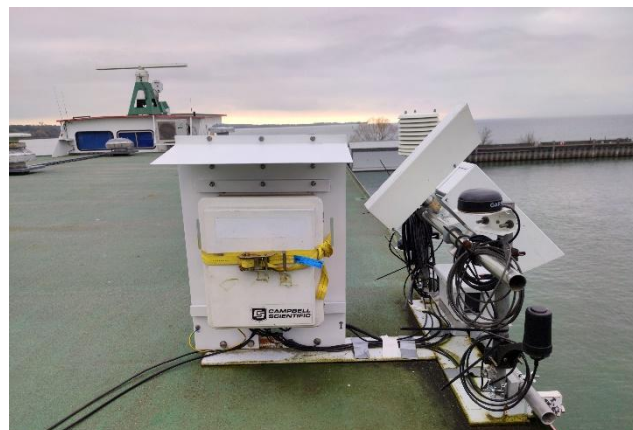
☐ Temperature/Emissivity separation using the CIMEL CE312 multi-spectral data



# JPL & Heitronics KT15.85 comparison

## In-situ comparison of TIR radiometers at Lake Constance

- JPL Radiometer (JPL Network)
  - Wavelength range: 8-14  $\mu\text{m}$
  - Field of view: 44°
  - Accuracy: 0.08 K
  - Self-calibrated with internal blackbody
- HEITRONICS KT15.85 (KIT Network)
  - Wavelength range: 9.6-11.5  $\mu\text{m}$
  - Field of view: 44°
  - Accuracy: 0.3 K
  - High long-term stability: <0.1 % per year



# Recent publications

- Zhang et al., 2025. Global evaluation of high-resolution ECOSTRESS land surface temperature and emissivity products: Collection 1 versus Collection 2. Remote Sensing of Environment, 326, 114799. Doi: 10.1016/j.rse.2025.114799
- Ghent et al., 2024. The Operational and Climate Land Surface Temperature Products from the Sea and Land Surface Temperature Radiometers on Sentinel-3A and 3B, Remote Sensing, doi: 10.3390/rs16183403
- Coll et al., 2024. Demonstrating the Suitability of the Radiance- Based Method for Assessing the Accuracy of MODIS Land Surface Temperature Products. IEEE Trans. Geosci. Remote Sens., 62, 4412915. Doi: 10.1109/TGRS.2024.3454377.
- Pérez-Planells et al., 2023. Retrieval Consistency between LST CCI Satellite Data Products over Europe and Africa. Remote Sensing, 15, 3281. Doi: 10.3390/rs15133281