ECOSTRESS

# Level-2 Land Surface Temperature Emissivity, and Cloud Mask update

*Glynn Hulley[1], Robert Freepartner[1], Gregory Halverson[1], Robert Radocinski[1], Gerardo Rivera[1], Simon Hook[1], Kerry Cawse-Nicholson[1], Frank Goettsche[2]*

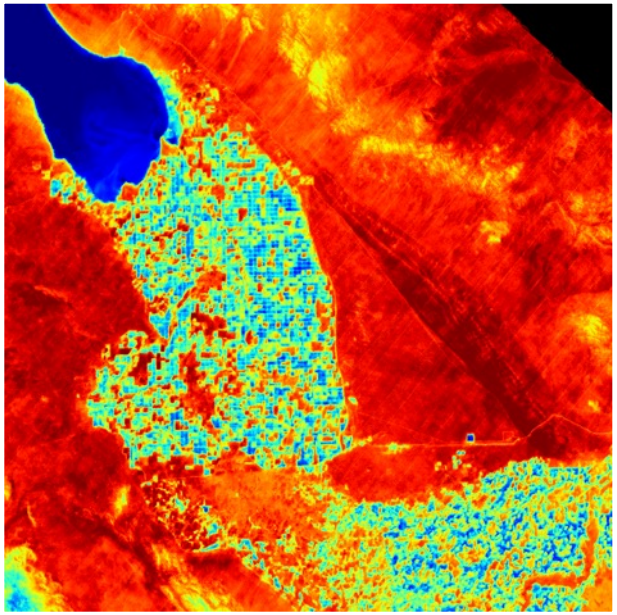
*1. Jet Propulsion Laboratory, California Institute of Technology*

*2. Karlsruhe Institute of Technology*

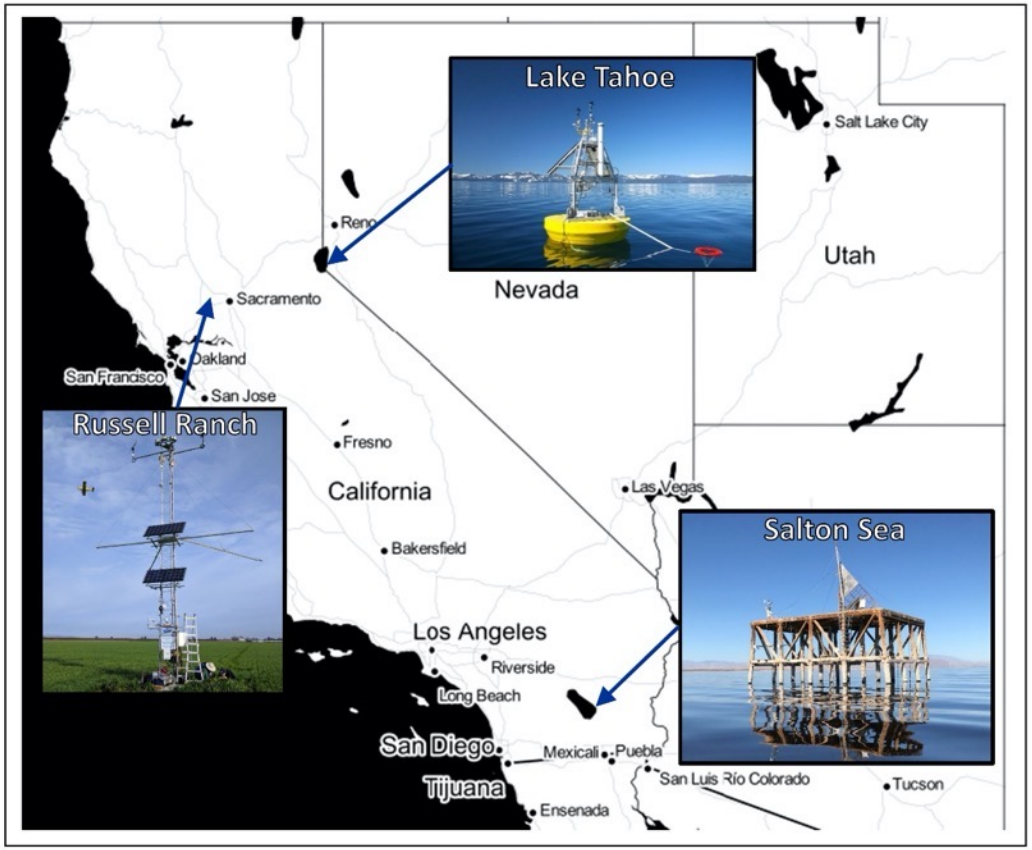
*(c) 2021 California Institute of Technology. Government sponsorship acknowledged.*

# Outline

1. Validation
2. L2 product updates
3. Cloud mask algorithm update

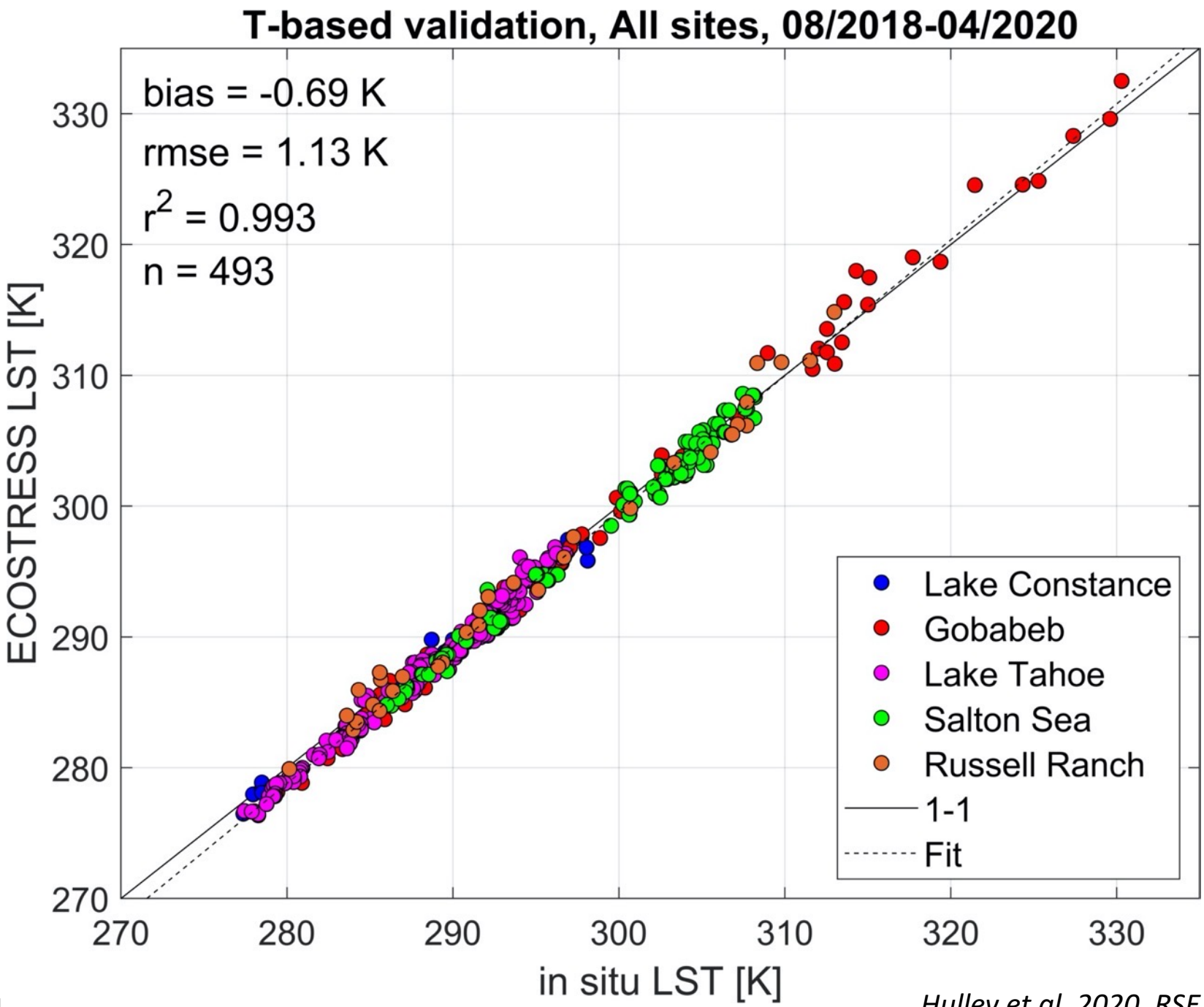


# Temperature-based validation sites



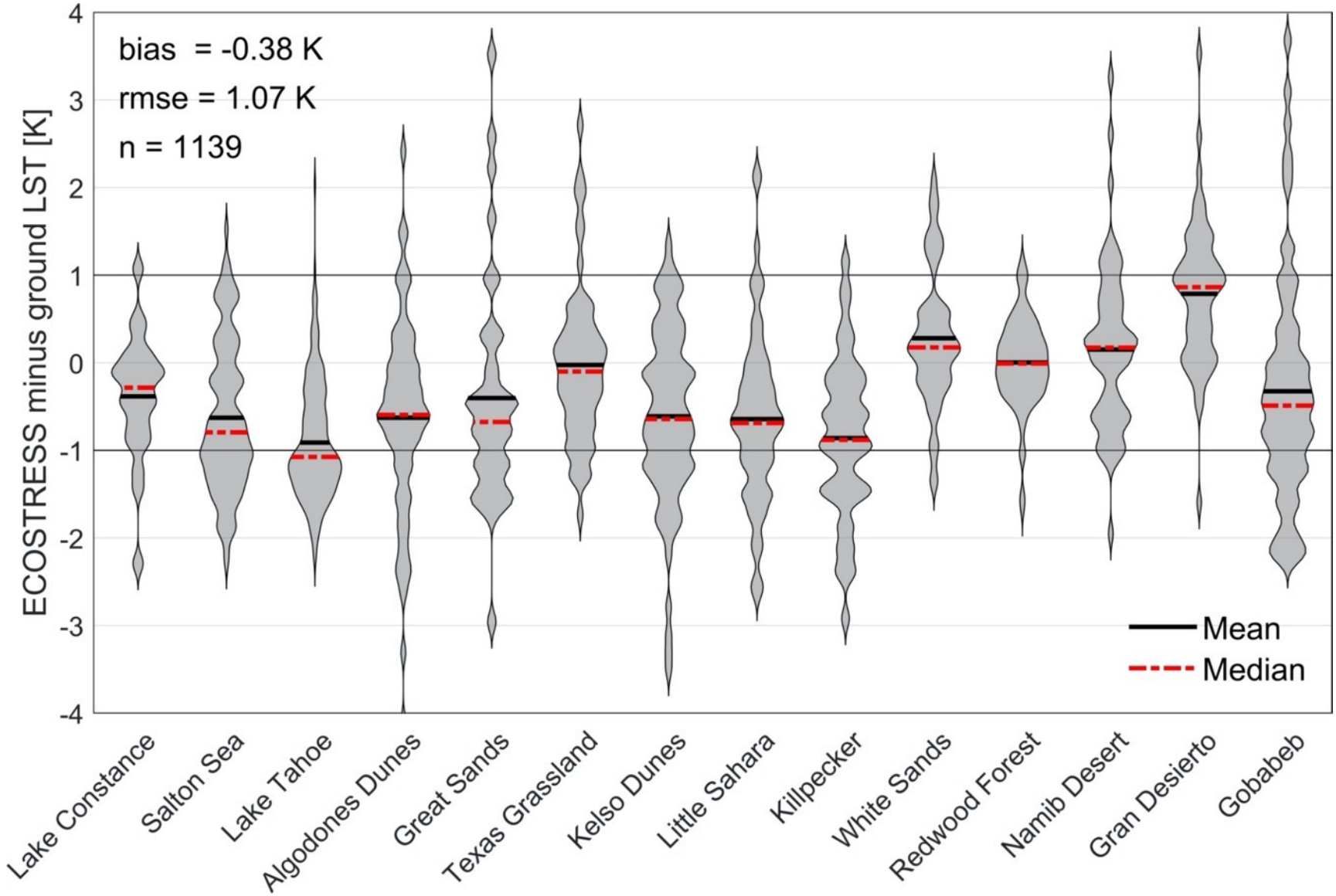

Gobabeb, Namibia

Lake Constance, Switzerland



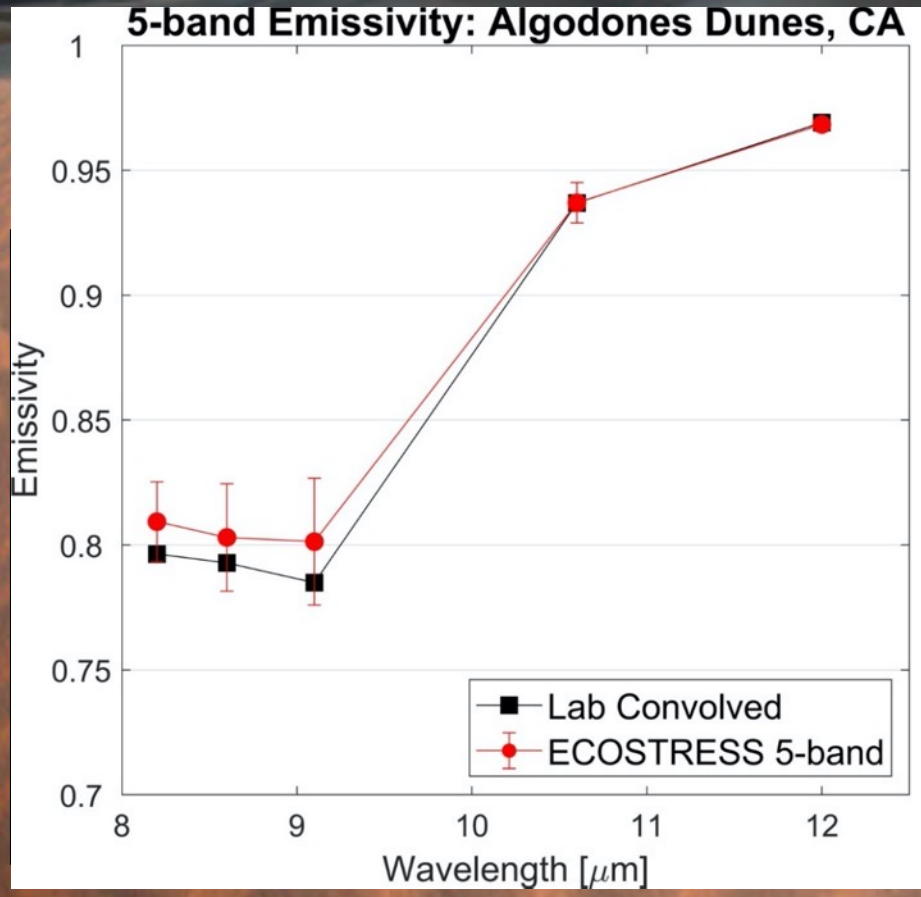

*Hulley et al. 2020, RSE*

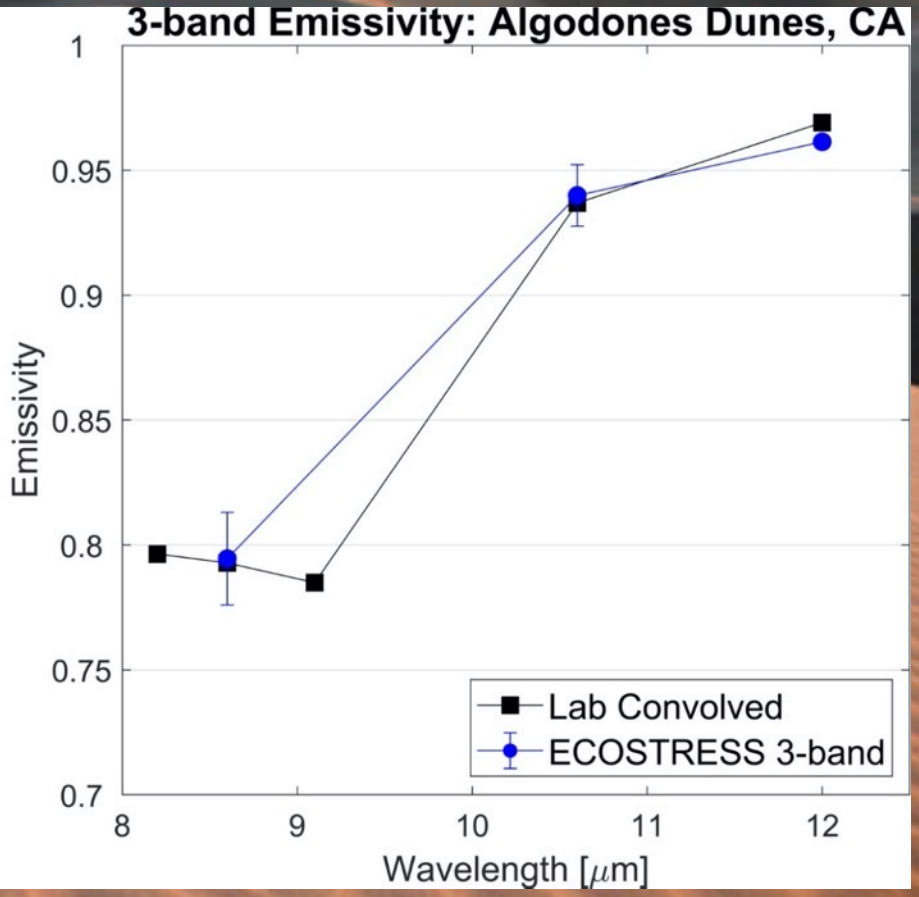
# LST validation summary: T-based and R-based sites

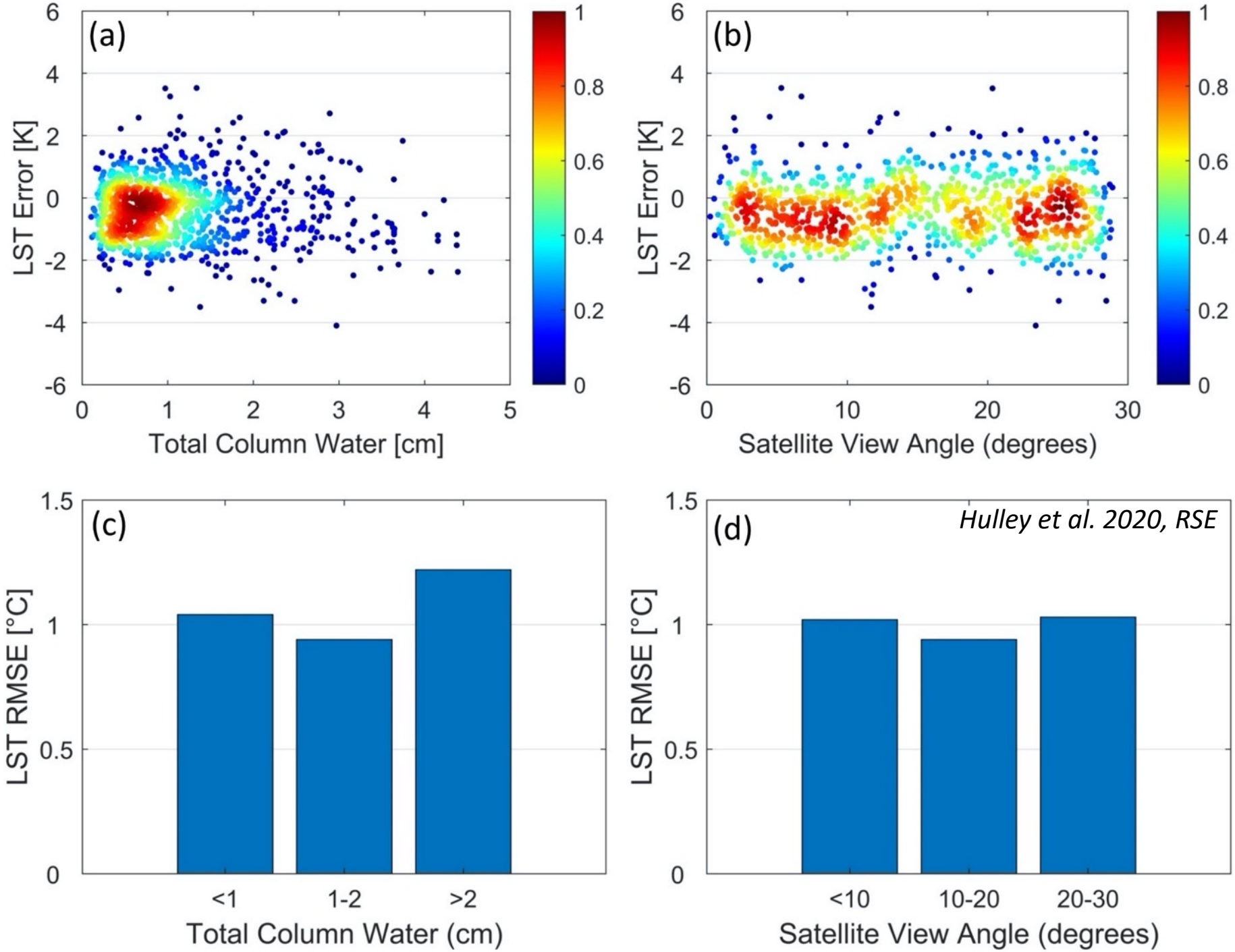



*Hulley et al. 2020, RSE*

# Algodones Dunes, CA




(a)
LST Error [K]
Total Column Water [cm]
(b)
LST Error [K]
Satellite View Angle (degrees)
(c)
LST RMSE [°C]
<1
1-2
>2
Total Column Water (cm)
(d)
Hulley et al. 2020, RSE
LST RMSE [°C]
<10
10-20
20-30
Satellite View Angle (degrees)

# L2 LSTE changes in Collection 2 (build 7)

- New, improved cloud mask algorithm
- L2_Cloud contents revised:
  - Data layers instead of bitmask (for ease of use)
  - Binary cloud mask of each test (0=clear, 1=cloud), and a combined final cloud mask
- L2_LSTE content changes
  - Binary cloud mask is added as additional layer (so users don't need to download L2_Cloud)
  - Water mask is added (0=land, 1=water)

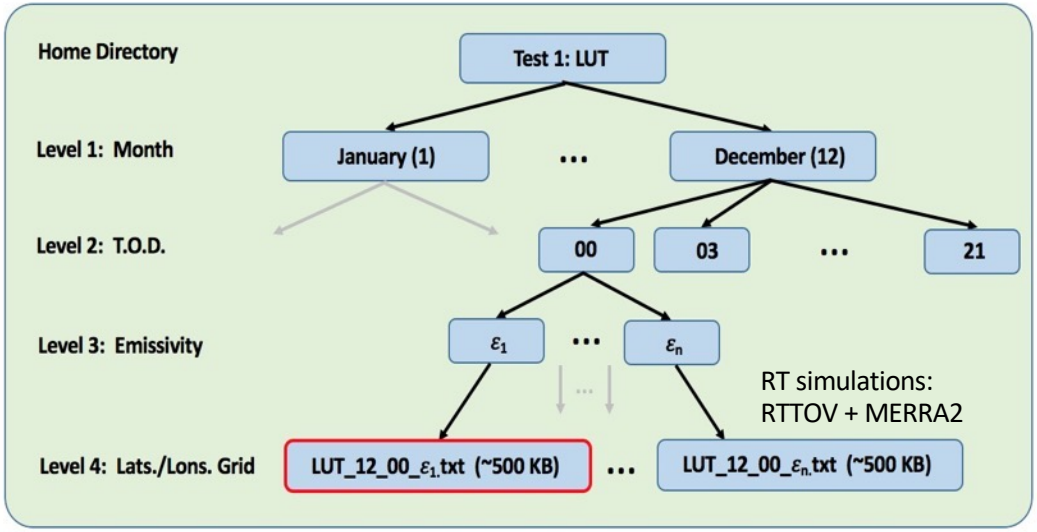

This document has been reviewed and determined not to contain export controlled technical data.

# L2 LSTE products in Collection 2

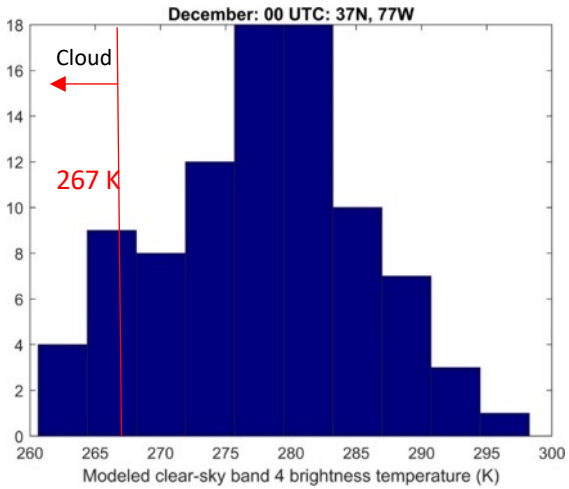
| Short name | Long name |
|---|---|
| ECO_L2_LSTE.002 | ECOSTRESS Swath Land Surface Temperature and Emissivity Instantaneous L2 Global 70 m |
| ECO_L2_CLOUD.002 | ECOSTRESS Swath Cloud Mask Instantaneous L2 Global 70 m |
| ECO_L2G_LSTE.002 | ECOSTRESS Gridded Land Surface Temperature and Emissivity Instantaneous L2 Global 70 m |
| ECO_L2G_CLOUD.002 | ECOSTRESS Gridded Cloud Mask Instantaneous L2 Global 70 m |
| ECO_L2T_LSTE.002 | ECOSTRESS Tiled Land Surface Temperature and Emissivity Instantaneous L2 Global 70 m<br>(100x100 km Sentinel tiles in UTM projection, cloud-optimized GeoTIFF) |

# Cloud mask statistical Look-Up-Table Approach in Collection 2

Example LUT selection for a scene at 37N, 77W in December at 00 UTC




Threshold = Q1 – 1.5*IQR
Q1 = 25th percentile
IQR = Interquartile range
(75-25th percentile)



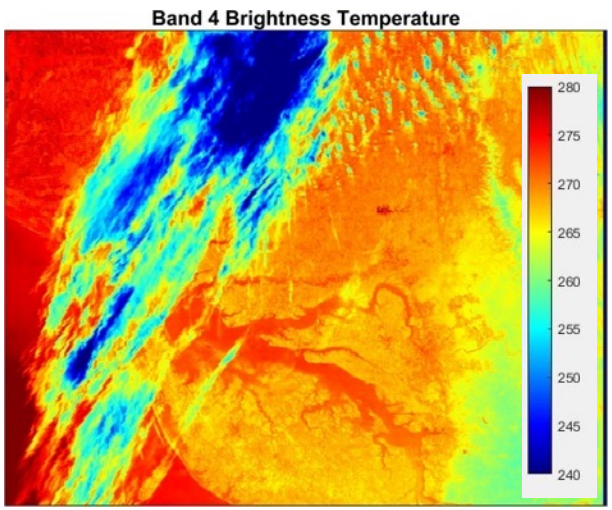

New V2 cloud mask uses a LUT approach based on MODTRAN clear-sky simulations of ECOSTRESS brightness temperatures (band 4, 10.6 micron) for a range of atmospheric and surface conditions including time of year, time of day, and emissivity.

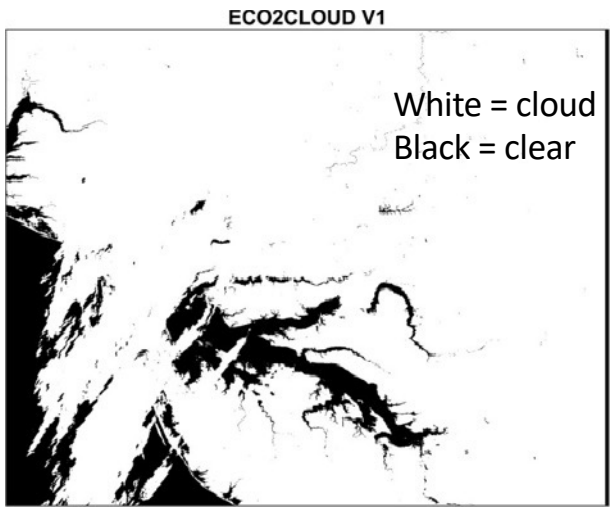
# Example 1: Cloud commission errors

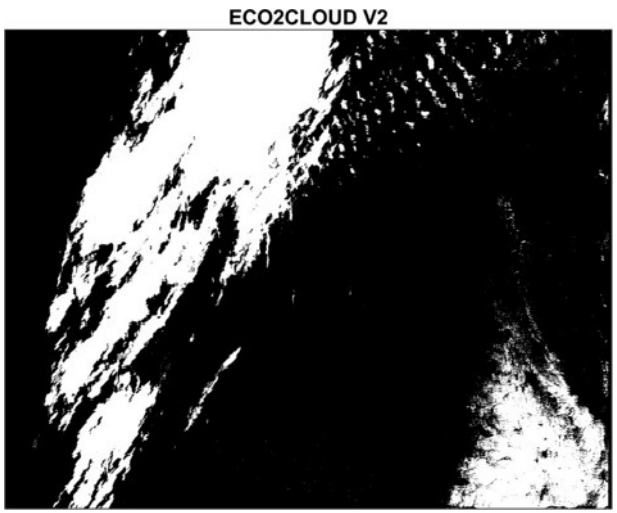
Band 4 brightness temperature (blues, greens = cold = cloud)

V1: Most of the scene has cloud commission errors (cloud overestimated = loss of usable L3 and L4 data)

V2: Much better agreement with visual appearance of clouds in brightness temperature image!



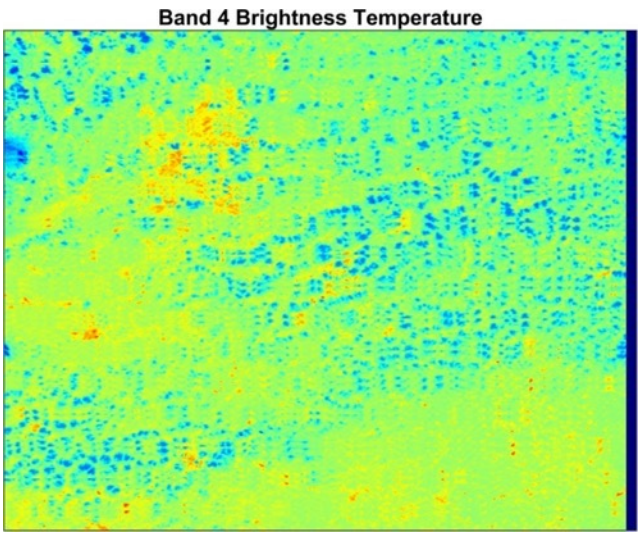



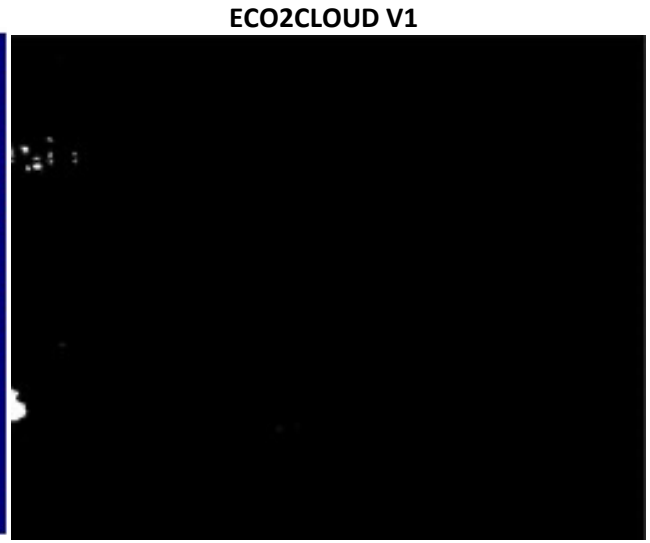



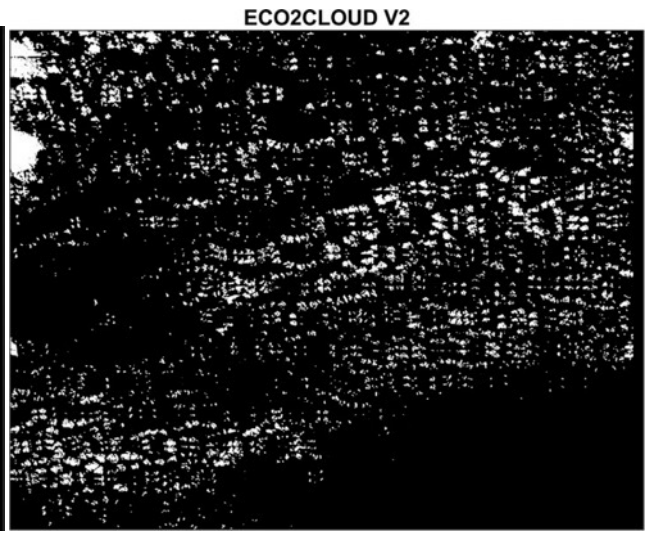
# Example 2: Cloud omission errors

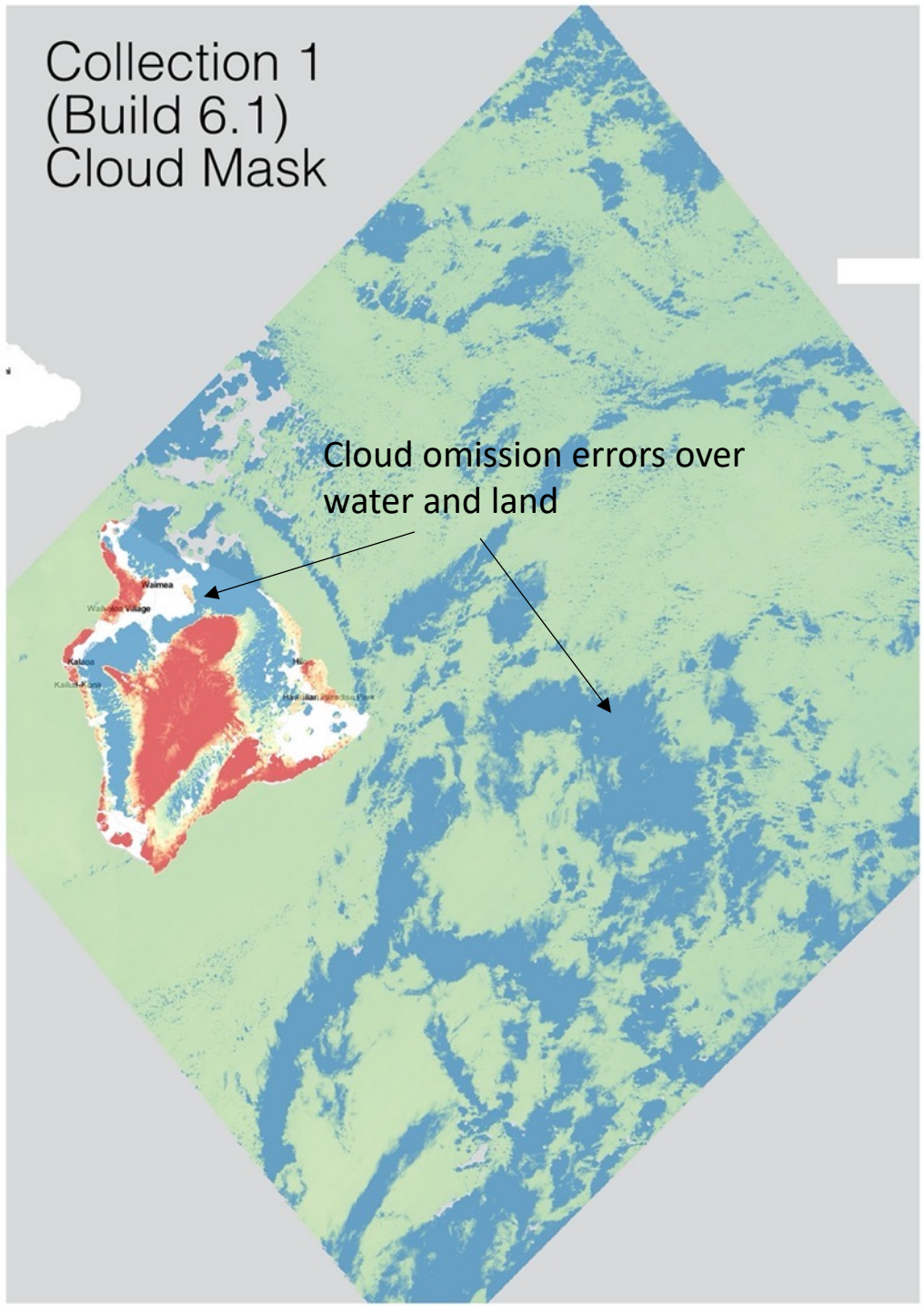
Most of the scene has cloud omission errors (cloud underestimated = potential bad and underestimated L3 ET data)

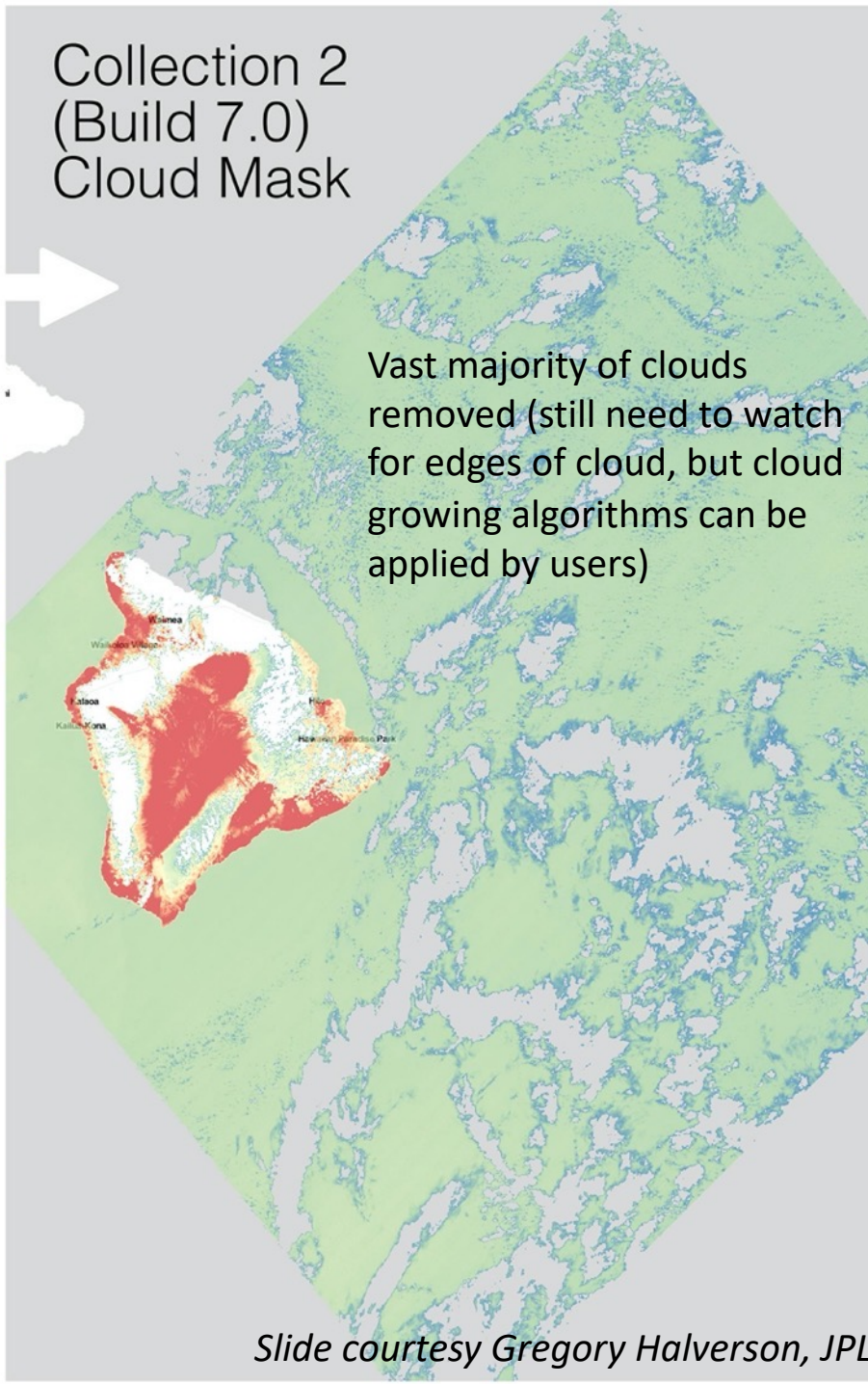
Big improvement in detection of low-level warmer clouds previously missed in v1






*Slide courtesy Gregory Halverson, JPL*

# Questions? glynn.hulley@jpl.nasa.gov

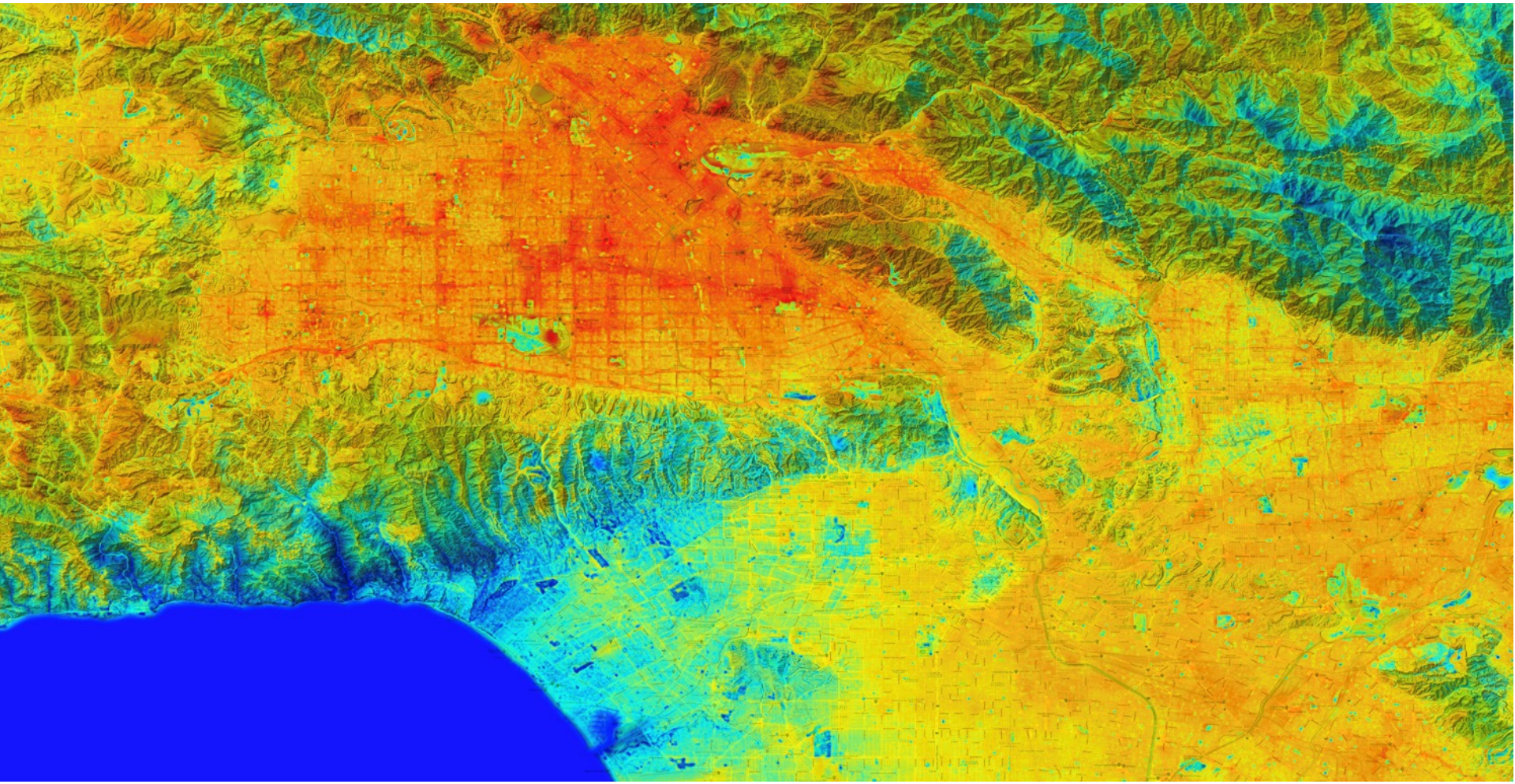


Image credit: John Noble