



**Jet Propulsion Laboratory**  
California Institute of Technology

# ECOSTRESS: Science Summary

Kerry Cawse-Nicholson, Simon Hook, Glynn Hulley, Christine Lee, Gregory Halverson, Dana Freeborn, Gerardo Rivera, and the ECOSTRESS Team

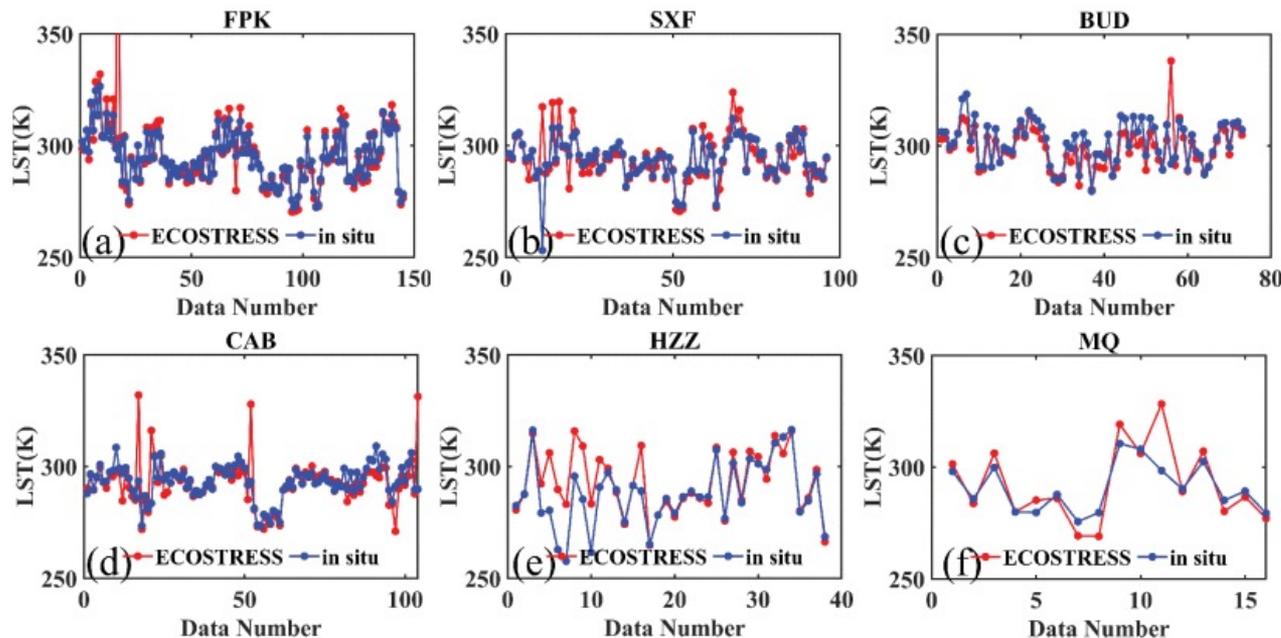
Jet Propulsion Laboratory, California Institute of Technology



*Credit: NASA*

# Validation of the ECOSTRESS Land Surface Temperature Product Using Ground Measurements

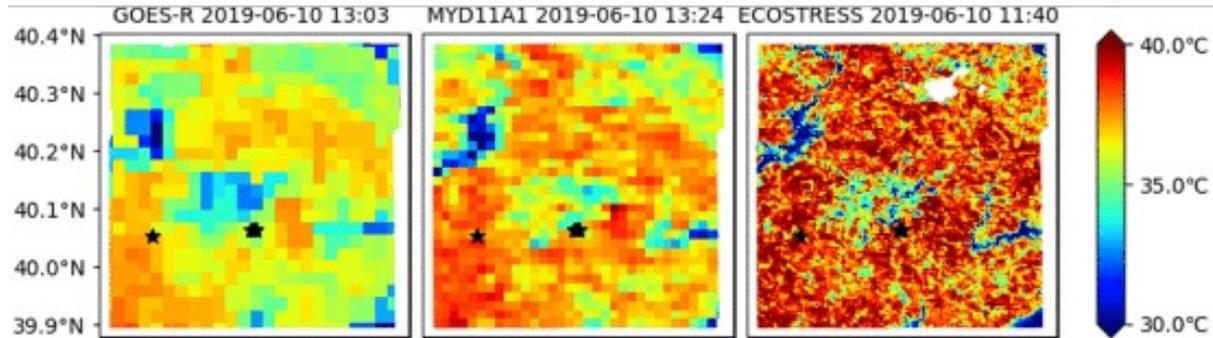
Xiangchen Meng<sup>1</sup>, Associate Member, IEEE, Jie Cheng<sup>1</sup>, Senior Member, IEEE, Beibei Yao, and Yahui Guo<sup>1</sup>



ECOSTRESS matched well to field data at SURFRAD, BSRN, and TPDC sites, with  $\sim 1$  K bias. Outliers were due to solar panel intrusion, striping, and unmasked clouds.

## Evaluation of Four New Land Surface Temperature (LST) Products in the U.S. Corn Belt: ECOSTRESS, GOES-R, Landsat, and Sentinel-3

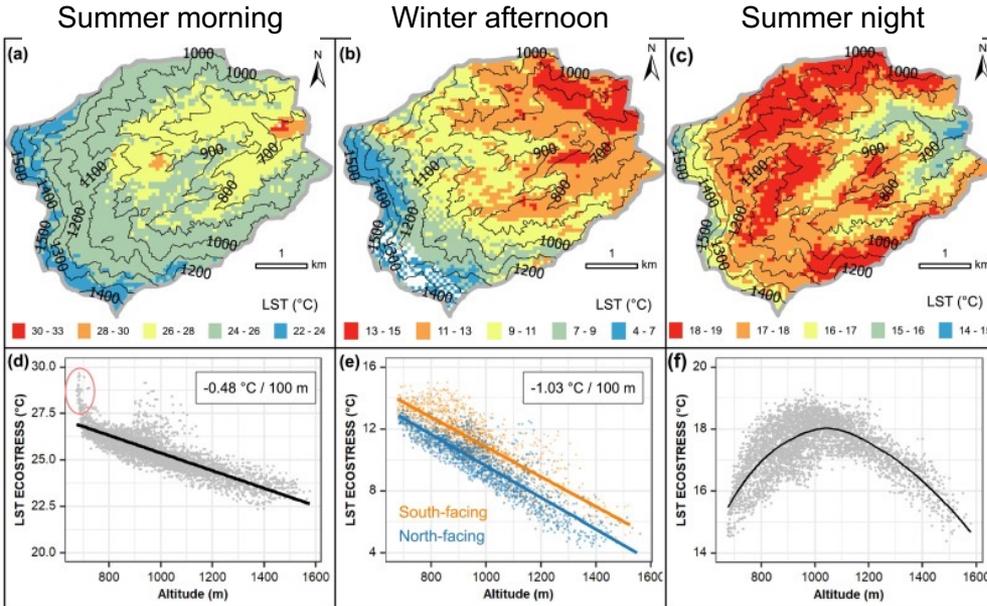
Kaiyuan Li , Kaiyu Guan, Chongya Jiang , Sheng Wang, Bin Peng, and Yaping Cai , *Student Member, IEEE*



The evaluation results indicate that MOD11A1, MYD11A1, and ECOSTRESS are of good quality during daytime among all the evaluated LST data. MOD11A1 and MYD11A1 have similar overall bias around  $-0.83$  °C, a RMSE around  $2.85$  °C, and a standard deviation of  $2.73$  °C. ECOSTRESS LST has an overall absolute bias  $< 0.9$  °C, RMSE  $< 2.15$  °C, and standard deviation  $< 1.95$  °C.

## An evaluation of ECOSTRESS products of a temperate montane humid forest in a complex terrain environment

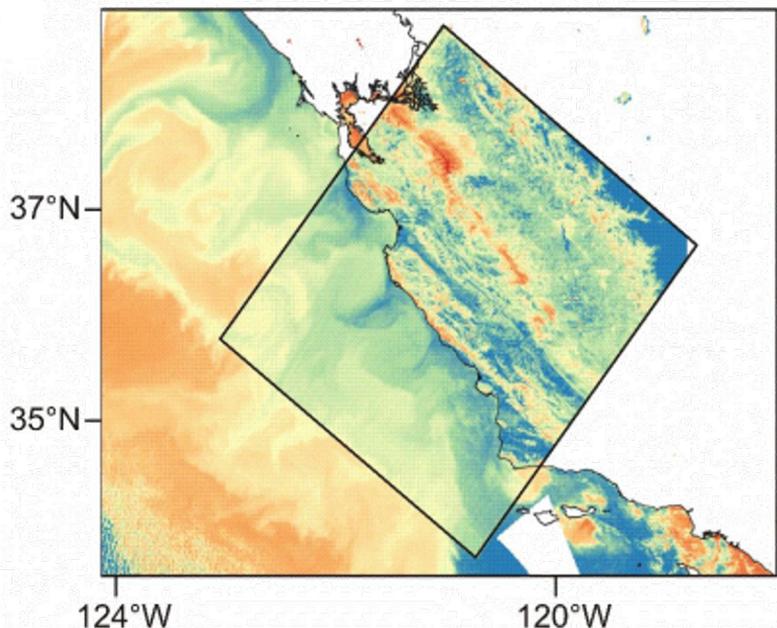
Ning Liu <sup>a, b</sup>, A. Christopher Oishi <sup>b</sup>, Chelcy Ford Miniati <sup>b, 1</sup>, Paul Bolstad <sup>a</sup>



First comprehensive validation of ECOSTRESS LST & ET on a complex mountain terrain. LST compared well against air temperature across elevation and aspect. ECOSTRESS overestimated ET because of the net radiation upscale method. ECOSTRESS LST & ET captured important spatially-explicit diurnal variability.

Article

## Global Intercomparison of Hyper-Resolution ECOSTRESS Coastal Sea Surface Temperature Measurements from the Space Station with VIIRS-N20

Nicolas Weidberg <sup>1,2,\*</sup>, David S. Wetthey <sup>1</sup> and Sarah A. Woodin <sup>1</sup>

ECOSTRESS ocean temperatures have a consistent 1.01 °C negative bias relative to VIIRS-N20, although deviation in brightness temperatures within the 10.49 and 12.01  $\mu\text{m}$  bands were much smaller. Standard bias-correction methods using already validated and well-known algorithms can be applied to ECOSTRESS SST data, yielding highly accurate products of ultra-high spatial resolution for studies of biological and physical oceanography in a time when these are needed to properly evaluate regional and even local impacts of climate change.

# Earth and Space Science

Research Article |  Open Access |  

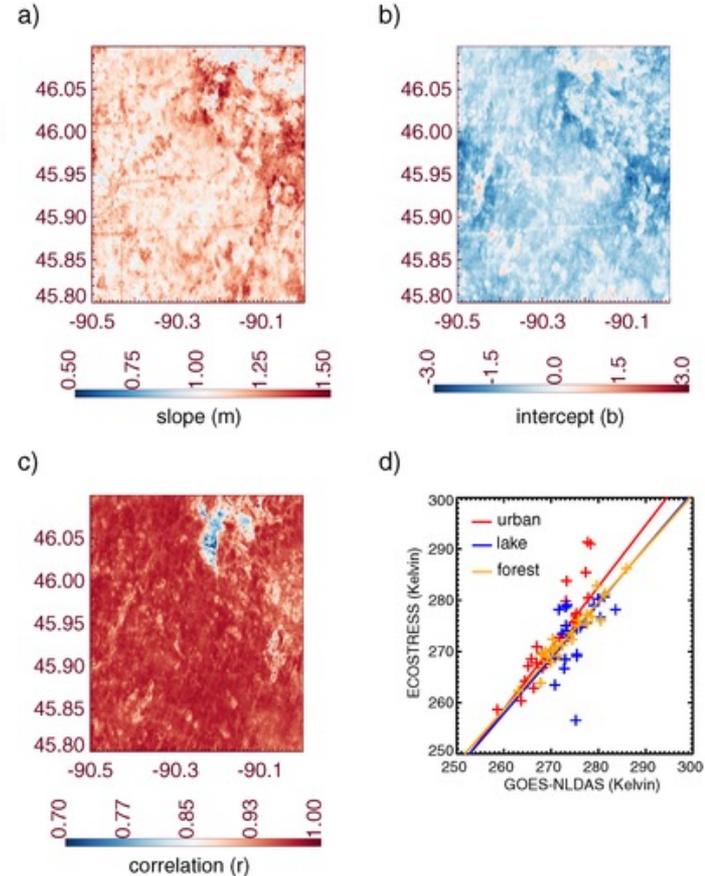
## Multi-Sensor Approach for High Space and Time Resolution Land Surface Temperature

Ankur R. Desai , Anam M. Khan, Ting Zheng, Sreenath Paleri, Brian Butterworth, Temple R. Lee, Joshua B. Fisher, Glynn Hulley, Tania Kleynhans, Aaron Gerace, Philip A. Townsend, Paul Stoy, Stefan Metzger

First published: 04 September 2021 | <https://doi.org/10.1029/2021EA001842>

Variation in LST over space and time at scales of meters and hours influence processes in the atmosphere, soils, vegetation, and water. Data fusion from different sources is needed to understand these processes.

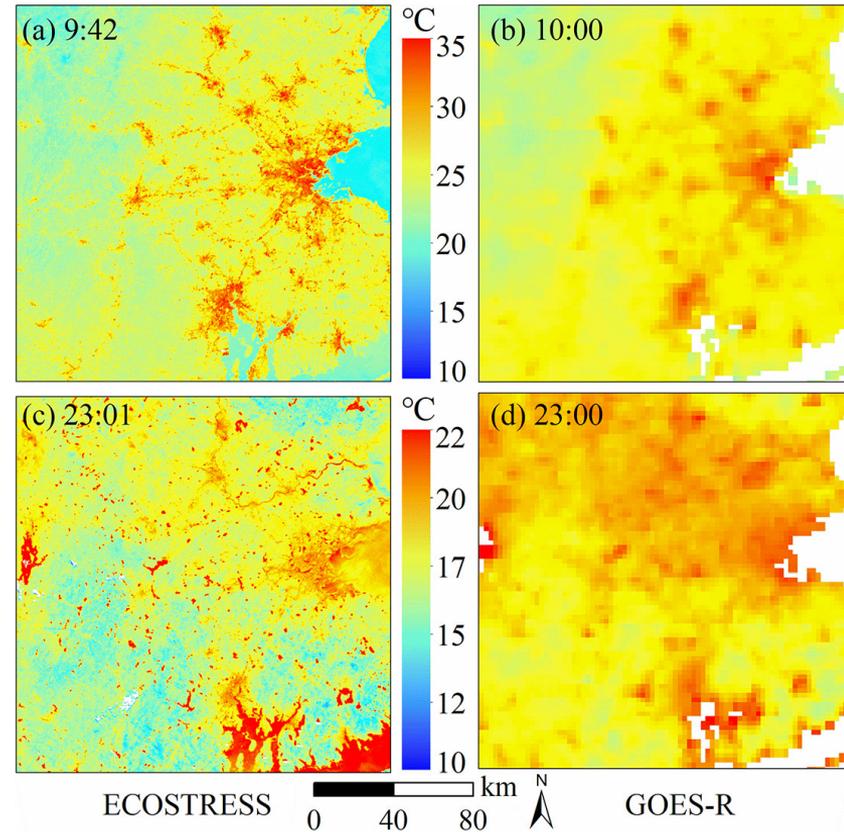
ECOSTRESS provides differences in mean LST within the sub grid of a single GOES pixel (intercept) and changes in the diel amplitude (slope).



## Combining GOES-R and ECOSTRESS land surface temperature data to investigate diurnal variations of surface urban heat island

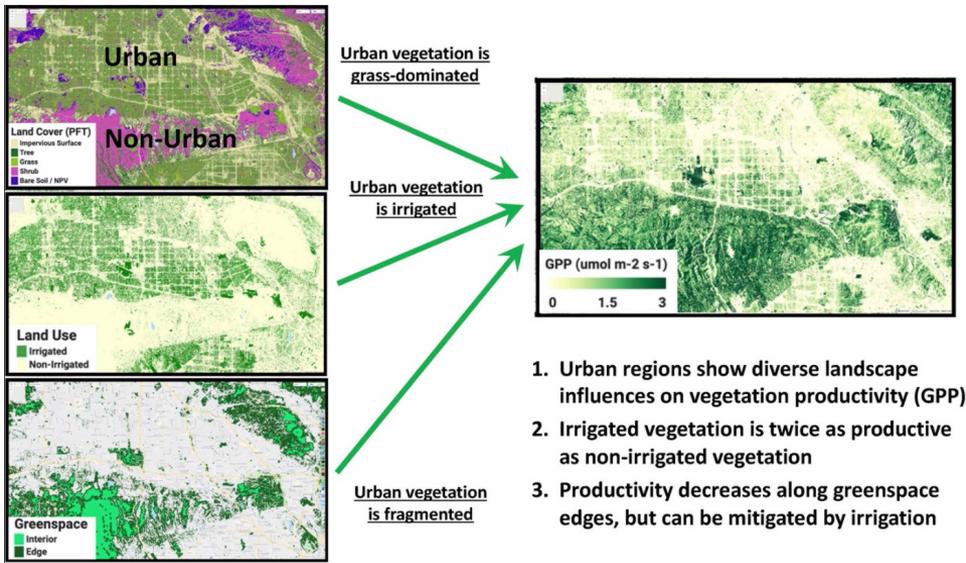
Yue Chang <sup>a, b</sup>, Jingfeng Xiao <sup>b, \*</sup>, Xuxiang Li <sup>a, \*</sup>, Decheng Zhou <sup>c</sup>, Yiping Wu <sup>a</sup>

Compared with GOES-R data, ECOSTRESS LST is suitable for monitoring the diurnal variations of intracity thermal environment at the subdistrict (or neighborhood) scale. Our study highlights the value of the combined use of geostationary satellite and ECOSTRESS LST in exploring the diurnal cycling of the SUHI, and can help inform urban planning and land-based climate mitigation policies in the context of climate change.



# Diverse biosphere influence on carbon and heat in mixed urban Mediterranean landscape revealed by high resolution thermal and optical remote sensing

Nicholas C. Parazoo <sup>a</sup>, Red Willow Coleman <sup>b</sup>, Vineet Yadav <sup>a</sup>, E. Natasha Stavros <sup>c</sup>, Glynn Hulley <sup>a</sup>, Lucy Hutyra

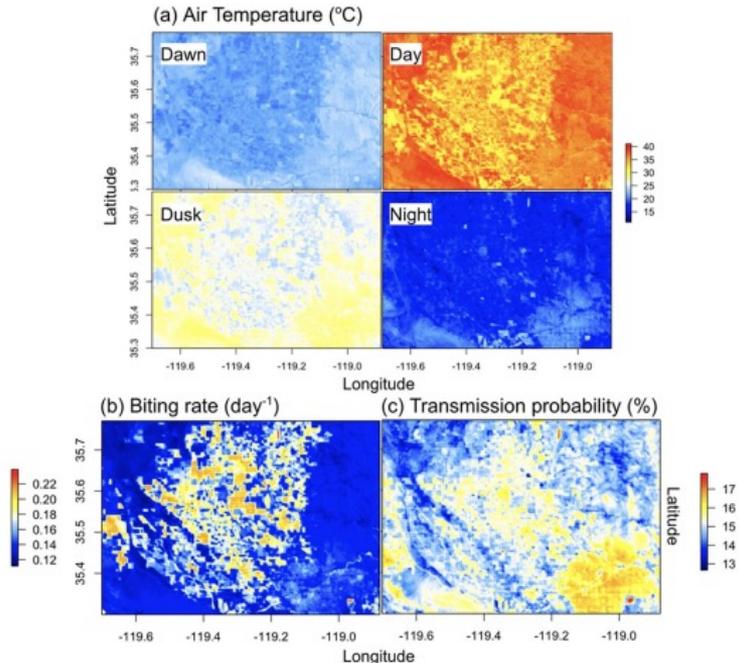


1. Urban regions show diverse landscape influences on vegetation productivity (GPP)
2. Irrigated vegetation is twice as productive as non-irrigated vegetation
3. Productivity decreases along greenspace edges, but can be mitigated by irrigation

Results show that land use and landscape fragmentation have a significant influence on urban GPP and canopy temperature within the water-limited Mediterranean SoCAB climate. Cooling from irrigation alleviates strong warming along greenspace edges within 100 m of impervious surfaces, and increases GPP by a factor of two, compared to non-irrigated edges.

ENVIRONMENTAL RESEARCH  
LETTERS

## LETTER

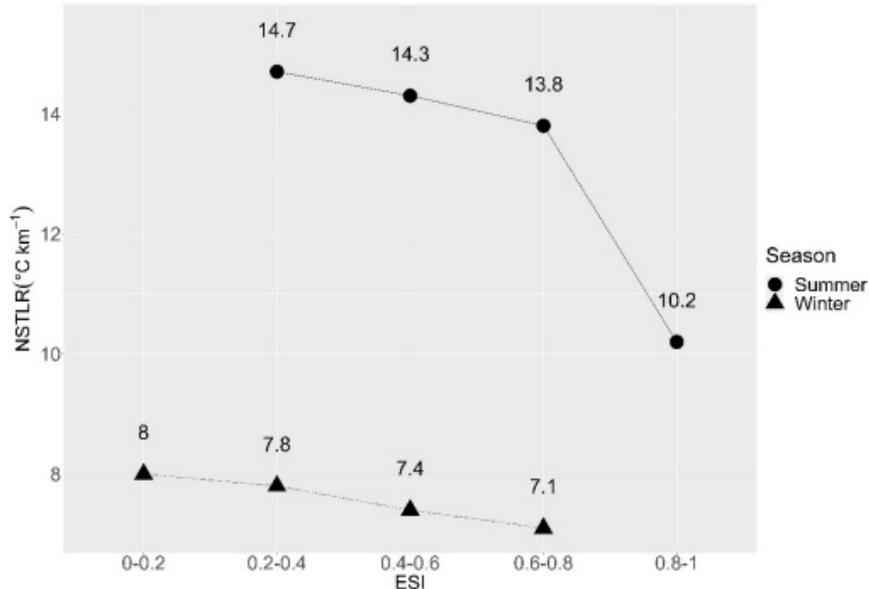
Micro-climate to macro-risk: mapping fine scale differences  
in mosquito-borne disease risk using remote sensingAnna Boser<sup>1</sup> , Daniel Sousa<sup>2</sup> , Ashley Larsen<sup>1</sup>  and Andrew MacDonald<sup>1</sup> 

The study leveraged high resolution land surface temperature (LST) measurements, in conjunction with established relationships between air temperature and MBD risk factors like mosquito biting rate and transmission probability, to produce fine resolution (70 m) maps of MBD risk components. We focus our case study on West Nile virus (WNV) in the San Joaquin Valley of California, where temperatures vary widely across the day and the diverse agricultural/urban landscape

Article

## Analysis of Near-Surface Temperature Lapse Rates in Mountain Ecosystems of Northern Mexico Using Landsat-8 Satellite Images and ECOSTRESS

Marcela Rosas-Chavoya <sup>1</sup>, Pablito Marcelo López-Serrano <sup>2,\*</sup>, José Ciro Hernández-Díaz <sup>2</sup>,  
Christian Wehenkel <sup>2</sup> and Daniel José Vega-Nieva <sup>3</sup>



An essential variable to studied thermal and climatic conditions in mountainous area is near-surface temperature lapse rate (NSTLR), defined as the rate of change in temperature by elevation. Observed NSTLR in this study was lower in areas with higher ESI for both seasons. These results suggest that areas with the higher water availability have lower thermal gradients and this effect is stronger in summer season.

# Geophysical Research Letters

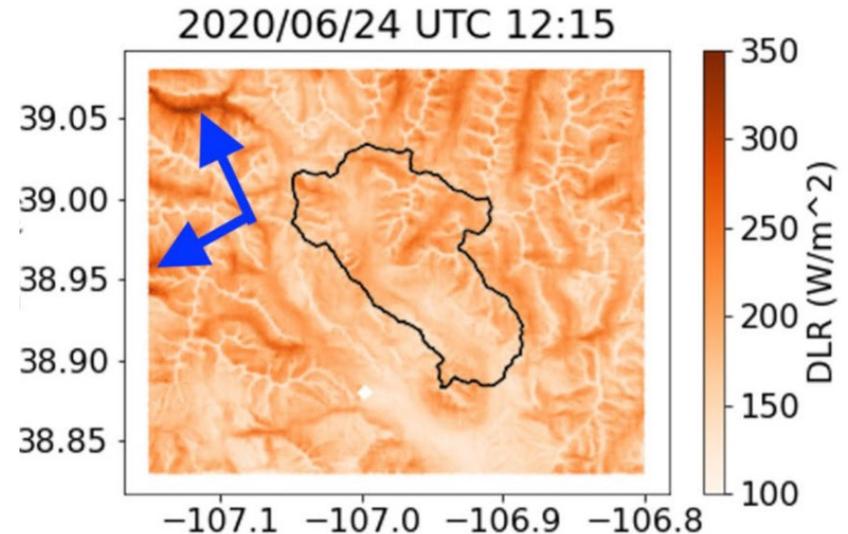
RESEARCH LETTER

10.1029/2021GL094605

## Three-Dimensional Surface Downwelling Longwave Radiation Clear-Sky Effects in the Upper Colorado River Basin

D. R. Feldman<sup>1</sup>, M. Worden<sup>1,2</sup>, N. Falco<sup>1</sup>, P. J. Dennedy-Frank<sup>1</sup>, J. Chen<sup>1</sup>, B. Dafflon<sup>1</sup>, and H. Wainwright<sup>1</sup>

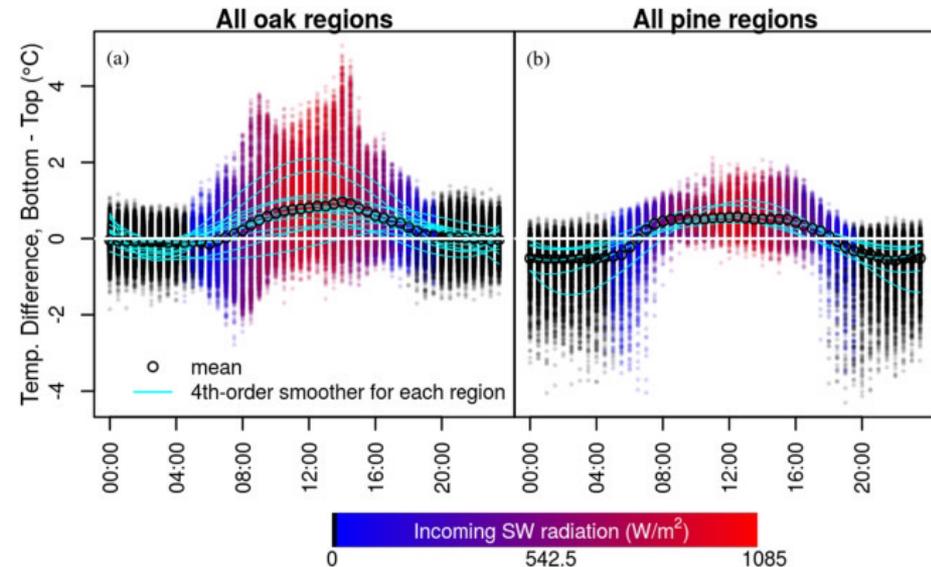
The effects of emitted radiation from exposed land are often neglected in snow-melt models. This study used ECOSTRESS LST in a 3-D longwave radiation model, and found that this represents 20-30% of the surface longwave flux. The common omission of this effect in atmospheric radiation models leads to an underestimation of DLR in complex terrain, especially at higher elevations, which has significant implications for mountainous ecohydrology simulations.



## What lies beneath: Vertical temperature heterogeneity in a Mediterranean woodland savanna

Miriam R. Johnston <sup>a, R, E</sup>, Ana Andreu <sup>b, c</sup>, Joseph Verfaillie <sup>b</sup>, Dennis Baldocchi <sup>b</sup>, Paul R. Moorcroft <sup>a</sup>

Study found consistent patterns of vertical thermal heterogeneity both within tree canopies and between ecosystem over- and under-stories. The daytime difference between the top and bottom thirds of blue oak canopies was, on average,  $0.48^{\circ}\text{C}$  – and sometimes several times larger. Notably, canopy tops are cooler, likely associated with the under-story grass reaching daytime temperatures often exceeding over-story temperatures by  $10^{\circ}\text{C}$ .





**Jet Propulsion Laboratory**  
California Institute of Technology

---

[jpl.nasa.gov](https://jpl.nasa.gov)

[kcawseni@jpl.nasa.gov](mailto:kcawseni@jpl.nasa.gov)