Land Surface Temperature Maps of New Mexico Cities

Contents

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1. Data sources:

The ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) is a thermal sensor onboard International Space Station (ISS) to measure the surface temperature. It includes a thermal infrared (TIR) multispectral scanner with five spectral bands in the TIR region (8-12 μm) at a spatial resolution of ~70 meters. It has been launched since 29th June 2018.

The link to the product description, including general product quality, known issues, and algorithm description can be found here: https://lpdaac.usgs.gov/products/eco2lstev001/

LST layers from the ECOSTRESS level-2 version 1 product (ECO2LSTE.001) were downloaded from the Application for Extracting and Exploring Analysis Ready Samples (AppEEARS) portal over urban areas within the New Mexico state. The ECOSTRESS LST product is atmospherically corrected and derived from five thermal bands using a physics-based Temperature and Emissivity Separation (TES) algorithm (G. C. Hulley and Hook 2018).

Link to AppEEARS: https://appeears.earthdatacloud.nasa.gov/

2. Data selection

Summer-season (May-September, 2018-2022) clear-sky images that cover the identified urban domains are collected.

All cities in New Mexico identified by CENSUS2010 (US Census TIGER 2010 Urban area product: https://catalog.data.gov/dataset/tiger-line-shapefile-2018-2010-nation-u-s-2010-census-urban-area-national) are considered. The urban domains are grouped into 7 sub-regions: Albuquerque, Carlsbad-Roswell, Clovis, El Paso, Farmington, Gallup, and Lovington-Eunica. Each region includes one or more cities. The corresponding images and GeoTIFF files are organized by individual regions.

We only consider the clear-sky and high-quality images (i.e., without any calibration issues) that represent a daytime and a nighttime pattern of land surface temperature, respectively for each urban domain. Daytime and nighttime images were defined as images obtained from 7 AM until 6 PM (Mountain Daylight Time, MDT) and 6 PM until 7 AM (MDT), respectively.

3. Preprocessing

The archived LST images (GeoTIFF) files are calibrated and converted to Celsius degrees (ºC). According to the product manual, the LST uncertainties are generally <1.5 ºC.

All data are reprojected to the State Plane NAD83 (National Spatial Reference System) 2011 with unit in meters (https://epsg.io/6528). The details are summarized as below.

Table 1. NAD83 (2011) projection / New Mexico Central datum (EPSG: 6528)

Parameters	Values
Coordinate System	State Plane Coordinate System
Projection	Transverse Mercator projection
Datum	1983 North America Datum (NAD83) 2011
Unit	Meter
Ellipsoid	GRS 1980
Prime meridian	Greenwich
Data source	EPSG
Area of use	United States – New Mexico regions: counties of Bernalillo; Dona Ana; Lincoln; Los Alamos; Otero; Rio Arriba; Sandoval; Santa Fe; Socorro; Taos; Torrance; Valencia.

All cloudy and cloud-contaminated pixels or missing pixels are masked out in the final images. These pixels are assigned as N/A (i.e., not available in such pixels) in the geotiff files and shown as white in the thematic maps.

ECO2LSTE.001 products have issues of geometric distortion for some images, we also manually georeferenced the images if needed to ensure that each pair of urban LST maps is well aligned spatially.

4. Known issues

ECO2LSTE.001 products have issues with calibration (see an example in Figure 1), thus, some images, particularly nighttime images have uneven artificial strips over the images. Thus, we try to select images with minimal impact of calibration and clouds (e.g., more than 98% clear-sky pixels, etc.) for each city domain. Note that these impacts are not completely excluded from the final images.

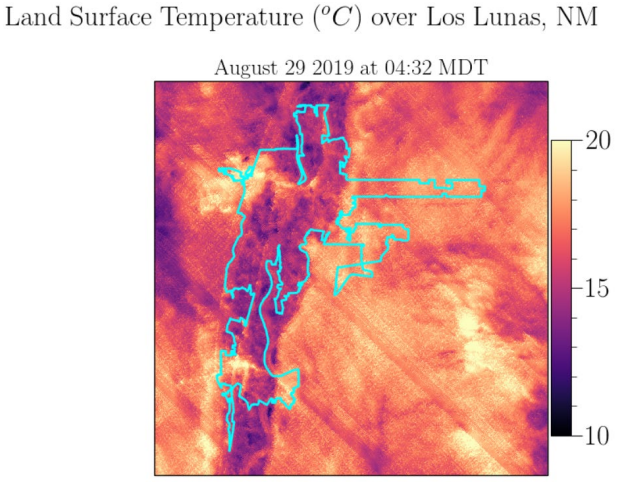

Figure 1. An example of ECOSTRESS image over Los Lunas, NM with calibration issue at night (04:32 AM MDT)

5. Examples of thematic maps of day/night LST over each city

Thematic maps for selected high-quality ECOSTRESS LST images were generated and listed in the following section. The thematic maps were produced using the specific temperature scale for each specific image to have a meaningful representation of LST.

Examples of thematic maps (.png files) associated with geotiff files were organized in the complied folder in the following structure (**Figure 2**). **Table 1** (Appendix) shows the metadata (date, time), link to the geotiff, and thematic maps for each city. If no high-quality image is available for a specific city, it leaves as blank.

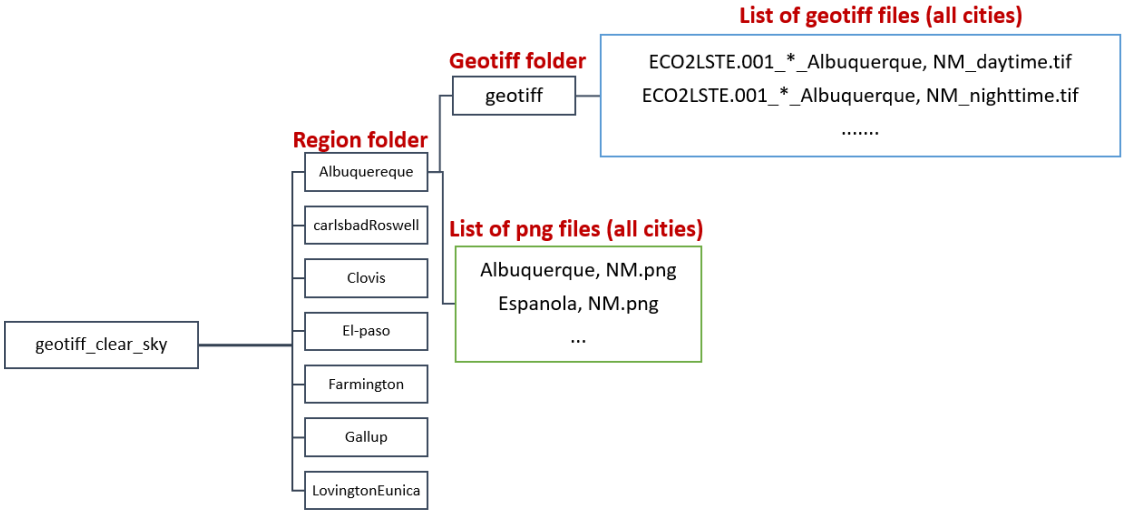

Figure 2. The folder structure of thematic maps (in .png) and geotiff (in .tif) files for each city

6. Appendix

Table 1. Metadata of ECOSTRESS LST images for each city. Cities with no high-quality images available will be leave as blanks.

Region	City	Date (mm/dd/yyyy)	Time (hh:mm:ss) (MDT)
Albuquerque	White Rock, NM		
Albuquerque	Taos, NM	8/29/2018	13:03:54
Albuquerque	Taos, NM	7/18/2019	21:12:40
Albuquerque	Las Vegas, NM		
Albuquerque	Pojoaque, NM	8/29/2018	13:03:54
Albuquerque	Pojoaque, NM	6/11/2020	18:18:22
Albuquerque	Santa Fe, NM	6/12/2019	11:34:35
Albuquerque	Santa Fe, NM	7/18/2019	21:12:40
Albuquerque	Albuquerque, NM	6/19/2020	15:08:48
Albuquerque	Albuquerque, NM	7/16/2022	4:00:01
Albuquerque	Espanola, NM	6/29/2019	12:06:35
Albuquerque	Espanola, NM	6/11/2020	18:18:22
Albuquerque	Santo Domingo Pueblo, NM		
Albuquerque	Eldorado at Santa Fe, NM		
Albuquerque	Los Lunas, NM	6/25/2019	13:48:07
Albuquerque	Los Lunas, NM	5/16/2020	21:12:52
Albuquerque	Edgewood, NM		
Albuquerque	Socorro, NM		
Albuquerque	Los Alamos, NM		
Carlsbad Roswell	Carlsbad, NM	6/6/2022	11:53:41
Carlsbad Roswell	Carlsbad, NM	7/10/2022	22:16:14
Carlsbad Roswell	Artesia, NM	5/30/2020	23:02:59
Carlsbad Roswell	Artesia, NM	8/5/2021	12:36:33
Carlsbad Roswell	Roswell, NM	8/20/2020	14:49:38

Carlsbad Roswell	Roswell, NM	7/10/2022	22:16:14
Clovis	Clovis, NM	7/28/2021	15:41:30
Clovis	Clovis, NM	5/17/2022	19:52:45
Clovis	Portales, NM		
El-Paso	Silver City, NM	8/14/2018	11:29:41
El-Paso	Silver City, NM	6/10/2020	19:06:33
El-Paso	Tularosa, NM		
El-Paso	Las Cruces, NM	8/14/2018	11:29:41
El-Paso	Las Cruces, NM	5/23/2021	2:03:02
El-Paso	Deming, NM		
El-paso	Holloman AFB, NM		
El-Paso	Bayard, NM		
El-Paso	Truth or Consequences, NM		
El-Paso	Vado, NM		
El-paso	Chaparral, NM		
El-Paso	Ruidoso, NM		
El-paso	El Paso, TX--NM		
El-paso	Alamogordo, NM		
Farmington	Shiprock, NM	6/11/2020	18:17:30
Farmington	Shiprock, NM	6/8/2022	11:54:11
Farmington	Bloomfield, NM	6/11/2020	18:17:30
Farmington	Bloomfield, NM	8/27/2021	11:29:25
Farmington	Aztec, NM		
Farmington	Farmington, NM	8/13/2018	12:22:09
Farmington	Farmington, NM	5/24/2019	19:11:06
Farmington	Kirtland, NM	6/11/2019	12:23:35
Farmington	Kirtland, NM	7/20/2022	19:02:54
Gallup	Gallup, NM	8/13/2018	12:22:09
Gallup	Gallup, NM	8/4/2020	21:02:41
Gallup	Grants, NM		
Gallup	Window Rock, AZ--NM		

Gallup	Fort Defiance, AZ--NM		
LovingtonEunica	Lovington, NM		
LovingtonEunica	Eunice, NM		
LovingtonEunica	Hobbs, NM	7/23/2019	18:43:03
LovingtonEunica	Hobbs, NM	8/3/2019	14:30:04

7. References

Hulley, Glynn C., and Simon J. Hook. 2018. “ECOSTRESS LEVEL-2 Land Surface Temperature and Emissivity Algorithm Theoretical Basis Document (ATBD).” https://lpdaac.usgs.gov/documents/1324/ECO2_LSTE_ATBD_V1.pdf.

Hulley, Glynn, and Robert Freepartner. 2019. “Level 2 Product User Guide.” *JPL Publication D-103137* 2: 1–19.