

Global daily 0.05° spatiotemporal continuous land surface temperature dataset (2002-2020)

Description documentation

1. Abstract

Land surface temperature (LST) is a key parameter in the study of surface energy balance and is widely used in meteorology, climate, hydrology, agriculture, and ecology. As an important means to obtain LST observation at global and regional scales, satellite (thermal infrared) remote sensing is vulnerable to cloud cover and other atmospheric interference, resulting in temporal and spatial discontinuity of LST remote sensing products, which greatly limits the application of LST remote sensing products in related research fields.

The preparation of this dataset first reconstructs the LST from the ideal clear-sky Terra/Aqua MODIS products based on the empirical orthogonal function interpolation method, then uses the cumulative distribution function matching method to fuse ERA5-Land reanalysis data information to all-weather conditions. This method makes full use of the spatio-temporal information of the original MODIS remote sensing products and reanalysis data to alleviate the influence of clouds on the estimation of LST, and finally reconstruct a high-quality global 0.05° spatiotemporally continuous ideal clear-sky and all-weather LST dataset.

This dataset not only realizes a spatio-temporally seamless coverage, but also has good validation accuracy. The reconstructed LST data under ideal clear-sky conditions in the experimental regions of seventeen land cover types over the world achieved an average correlation coefficient (R) of 0.971, with the Bias from -0.001 K to 0.049 K, and the root mean square error (RMSE) from 1.436 K to 2.688 K. Validation results of the reconstructed all-weather LST data with the in-situ measurements showed an average R of 0.895, with the Bias from 0.025 K to 2.599 K, and the RMSE from 4.503 K to 7.299 K.

The temporal resolution of this dataset is 4 times a day; the spatial resolution is 0.05°; the temporal span is 2002-2020 with a global coverage.

2. Data details

2.1 Data format

HDF5 format

2.2 Data file naming

(1) Global 0.05° spatiotemporal continuous ideal clear-sky land surface temperature dataset, file naming:

<MOD11C1(MYD11C1)_YYYYDDD_Clear-sky>.h5, MOD11C1(MYD11C1) represents the MODIS LST product of Terra (Aqua) sun-synchronous satellite,

<YYYY> is the year, <DDD> represents the day of year, and <Clear-sky> represents it's ideal clear-sky MODIS LST product.

(2) Global 0.05° spatiotemporal continuous all-weather land surface temperature dataset, file naming:

<MOD11C1(MYD11C1)_YYYYDDD_All-weather>.h5,
MOD11C1(MYD11C1) represents the MODIS LST product of Terra (Aqua) sun-synchronous satellite, <YYYY> is the year, <DDD> represents the day of year, and <All-weather > represents it's all-weather MODIS LST product.

2.3 Data spatial range

180°E-180°W, 90°N-90°S, Global coverage

2.4 Data temporal span

2002-2020

2.5 Data spatial resolution

0.05°

2.6 Data temporal resolution

4 times a day (Terra/Aqua satellites observe twice a day, Day/Night)

2.7 Projection

geographic projection

2.8 File memory

A single HDF5 file is about 30MB, there are a total of 27392 files, about 814131MB

2.9 Data storage

Table 1. Detailed information of the global spatiotemporally continuous land surface temperature data set.

Scientific data set	Number Type	Unit	Fill Value	Scale factor	Add offset
LST_Day_CMG	uint16	K	0	0.02	0
QC_Day	uint8	none	0	none	none
Day_view_time	uint8	hrs	0	0.2	0
Day_view_angl	uint8	deg	255	1.0	-65.0
LST_Day_filled_flag	uint8	none	0	none	none
LST_Night_CMG	uint16	K	0	0.02	0
QC_Night	uint8	none	0	none	none
Night_view_time	uint8	hrs	0	0.2	0
Night_view_angl	uint8	deg	255	1.0	-65.0
LST_Night_filled_flag	uint8	none	0	none	none

The dataset uses two folders MODIS_LST_Clear-sky and MODIS_LST_All-weather to store ideal clear-sky land surface temperature data and all-weather land surface temperature data. Each folder has two subfolders, MOD11C1 and MYD11C1, which are used to store corresponding Terra and Aqua satellite data. The data is compressed and stored year by year.

2.10 Use data

The data can be read in various programming languages such as Matlab, Python, IDL, etc., and can also be visualized in Panoply. When reading data from a scientific data set, it needs to be multiplied by its corresponding scale factor.

3. Data Reference

赵天杰, 余沛. (2021). 全球逐日 0.05°时空连续地表温度数据集 (2002-2020) . 国家青藏高原科学数据中心 , DOI: 10.11888/Meteoro.tpd.271663. CSTR: 18406.11.Meteoro.tpd.271663.

Zhao, T., Yu, P. (2021). Global daily 0.05 ° spatiotemporal continuous land surface temperature dataset (2002-2020). National Tibetan Plateau Data Center, DOI: 10.11888/Meteoro.tpd.271663. CSTR: 18406.11.Meteoro.tpd.271663.

4. Data statement

When users use the data, please declare the source of the data in the text, and quote the citation method provided by this data in the reference section. The data provider shall not be liable for any direct, indirect, special, incidental or consequential losses caused by the use (or inability to use) these data. This data is only used by users for academic research purposes, and it is forbidden to use it for commercial purposes and other purposes. The data may not be transferred to any third party, and all consequences arising therefrom shall be borne by the data user.

5. Contact

Name: Tianjie ZHAO

Institution: Aerospace Information Research Institute, Chinese Academy of Sciences

E-mail addresses: zhaotj@aircas.ac.cn

Name: Pei YU

Institution: Henan Polytechnic University

E-mail addresses: 211904020032@home.hpu.edu.cn