IceBridge KT19 IR Surface Temperature, Version 2

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

M. Studinger. 2020. *IceBridge KT19 IR Surface Temperature, Version 2*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/UHE07J35I3NB. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/IAKST1B

National Snow and Ice Data Center

TABLE OF CONTENTS

1 DATA DESCRIPTION

1.1 Parameters

The KT19.85 sensor provides a measurement of the surface temperature of an object in degrees Celsius. For compensation purposes, the sensor also provides a measurement of its internal temperature, in degrees Celsius, which may vary as much as 30°C throughout the course of a flight. The surface temperature measurement provided has not had any correction applied for changes in internal temperature.

1.2 File Information

1.2.1 Format

The KT19 data files are in ASCII text format.

1.2.2 File Contents

Each row of the KT19 ASCII data file corresponds to a separate measurement record. The data file contains eight columns of data, with each column corresponding to a different variable describing the measurement, as shown in Table 1.

The files also contain a number of header lines beginning with a hashtag (#) and containing the settings used for acquisition (emissivity, response time, temperature units, etc.). The last header line describes the information found in each column of the data.

Table 1. Parameter Description

Parameter	Description	Units
Year	Year of measurement	Years
Day_Of_Year	Day of year of measurement	Days
Seconds_Of_Day	Seconds of day of measurement (UTC)	Seconds
Latitude	Latitude of GPS antenna	Decimal degrees
Longitude	Longitude of GPS antenna	Decimal degrees
Aircraft_Altitude_Above_Ellipsoid	Height of GPS antenna above WGS84 ellipsoid	Meters
KT19_Temperature	Surface temperature measured by the KT19	Degrees Celsius

Parameter	Description	Units
KT19_Internal_Temperature	KT19 instrument internal temperature	Degrees Celsius

1.2.3 Naming Convention

Files are named according to the following convention, which is described in more detail in Table 2:
IAKST1B_KT19_PROCESSED_YYYYMMDD_hhmmss_v2.txt

Example:
IAKST1B_KT19_PROCESSED_20140328_111042_v2.txt

Table 2. File Naming Convention

Variable	Description
IAKST1B	IceBridge KT19 IR Surface Temperature data product
KT19_PROCESSED	KT19 Level-1B processed data file
YYYY	Four-digit year of survey
MM	Two-digit month of survey
DD	Two-digit day of survey
hh	Two-digit hour for start of log file
mm	Two-digit minute for start of log file
ss	Two-digit second for start of log file
v2	Indicates data set Version 2

All dates and times included in the file names are based on machine local time.

Note: The time stamp in the file name does not necessarily reflect the start-time of the data. The time stamps within the data files (Seconds_Of_Day) are the only reliable way to determine the start and stop times of each survey.

1.3 Spatial Information

1.3.1 Coverage

Spatial coverage includes Arctic and Antarctic sea and land ice.

Arctic / Greenland:
Southernmost Latitude: 60° N
Northernmost Latitude: 90° N

Westernmost Longitude: 180° W
Easternmost Longitude: 180° E

Antarctic:
Southernmost Latitude: 90° S
Northernmost Latitude: 53° S
Westernmost Longitude: 180° W
Easternmost Longitude: 180° E

1.3.2 Resolution

The KT19 sensor is fitted with a lens that has a two-degree field of view. At 450 m above ground level, this produces an optical measurement footprint on the ground that is approximately 15 m in diameter. At a nominal aircraft speed of 125 m/s and a sampling frequency of 10 Hz, the centers of two consecutive spots will be 12.5 m apart along the aircraft ground track.

1.3.3 Geolocation

The KT19 data incorporate a GPS location that is referenced to the WGS 84 datum.

1.4 Temporal Information

1.4.1 Coverage

5 March 2012 to 17 May 2019

1.4.2 Resolution

IceBridge campaigns were conducted on an annually repeating basis. Arctic and Greenland campaigns were typically conducted during March, April, and May; Antarctic campaigns were typically conducted during October and November.

KT19 surface temperature measurements were collected for every science flight in the NASA IceBridge Arctic campaigns, with Version 2 of the data beginning on 5 March 2012. The KT19 collected surface temperature measurements at 10 Hz for the duration of each flight.

Note: Data collected on 5 and 06 March 2012 are from test flights.

2 DATA ACQUISITION AND PROCESSING

2.1 Instrumentation

The Heitronics KT19 Infrared Radiation Pyrometer measures infrared radiation wavelengths between 9.6 and 11.5 microns.

For all Arctic and Antarctic campaign data, the emissivity constant was set to 0.97. By assuming an emissivity of 0.97, a reasonable estimate for most sea and land ice, the radiation measurement can be directly converted to a measurement of the target's surface temperature. The KT19.85 model is designed for long-distance measurement of water, ice, and clouds, and has an effective measurement range from -50°C to 200°C, with a resolution of 0.01°C. The lens has a two-degree field of view, which yields a 15 m viewing footprint on the ground at 450 m above ground level. The response time of the KT19 detector is nominally set to 0.3 s to provide a good balance between measurement sensitivity and noise reduction for a measurement frequency of 10 Hz. For instrument accuracy and other instrument specifications, see the Wintronics KT19 Series II Infrared Thermometer website.

2.2 Acquisition

Data collection for the KT19 data occurred on a CappuccinoPC mini-PC running Ubuntu 10.4. The computer communicated with the KT19 sensor over the RS-232 interface and with a GPS-logging computer over Ethernet. The combination of these two data streams provided geolocated surface temperature measurements.

The collection and logging of the KT19 data were managed by a python script called KTlogger.py. After the KT19 sensor was powered on, the script issued initialization commands to the sensor to set the temperature units, response time, reference temperature method, and emissivity constant. After that, the script began the data collection loop, which queries the KT19 sensor at 10 Hz for the surface temperature, and at 0.5 Hz for internal temperature. This script also communicated with a separate GPS logging machine onboard the ATM GPS rack, which was running a program called linlogger. The linlogger program broadcasted a real-time GPS message over Ethernet at 2 Hz. All of the messages returned from the KT19, as well as the real-time GPS messages, were time stamped with machine local time and written to a log file as they arrived.

2.3 Processing

A processing script called KTproc.py loaded in all of the collected data from a flight and linearly interpolated the measurements to the frequency at which the KT19 surface measurements were collected. The interpolation used the machine local time stamp as the independent variable.

2.4 Errors and Limitations

On a few flights, the KT19.85 sensor would return an empty string when queried for a temperature measurement. As soon as the operator identified this error, the data file would be closed, power would be cycled to the sensor, and a new data file started. Therefore, some flights have more than one data file.

The Heitronics KT19 Infrared Radiation Pyrometer is a nadir-viewing optical instrument, so it measures the temperature of the first surface that appears below the aircraft. As long as no clouds are between the aircraft and the ice below, the surface measurement will correspond to the ice surface. However, if any clouds appear between the aircraft and the ice surface, then the KT19 temperature measurement will correspond to the cloud temperature. The KT19 data set does not contain any information about the presence of clouds. A secondary data set, such as *IceBridge DMS L1B Geolocated and Orthorectified Images* or *IceBridge CAMBOT L1B Geolocated Images*, can be used to identify the objects that were measured by the KT19.

3 VERSION HISTORY

Table 3 provides a version history for this data set.

Table 3. Version History

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
2.1	3 Dec 2024	5 Mar 2012 to 17 May 2019	All data files were renamed to append the version number (i.e., "_v2").

2.1	Jul 2021	5 Mar 2012 to 17 May 2019	Nine files were replaced so that Day_Of_Year parameter rolls over to the next day simultaneously with the Seconds_Of_Day parameter rolling from 86400 to zero on a survey carrying on past midnight. Version 2 previously had a 15-second delay between the two parameters. The replacement files are listed below: IAKST1B_KT19_PROCESSED_20120315_224555.txt IAKST1B_KT19_PROCESSED_20131118_213642.txt IAKST1B_KT19_PROCESSED_20131119_232224.txt IAKST1B_KT19_PROCESSED_20131120_204749.txt IAKST1B_KT19_PROCESSED_20131125_193048.txt IAKST1B_KT19_PROCESSED_20131127_220515.txt IAKST1B_KT19_PROCESSED_20170311_175249.txt IAKST1B_KT19_PROCESSED_20180408_182853.txt IAKST1B_KT19_PROCESSED_20180414_173320.txt
2.0		5 Mar 2012 to 17 May 2019	Improvement of the geolocation of the KT-19 footprints, due to replacing the coarse real-time GPS positions with post-processed differential GPS positions. The post-processed trajectories are the same as used for the ATM lidar processing.
1.0	10 Dec 2020	12 Oct 2011 to 17 May 2019	Initial release

4 RELATED DATA SETS

IceBridge CAMBOT L1B Geolocated Images
IceBridge DMS L1B Geolocated and Orthorectified Images

5 RELATED WEBSITES

Wintronics KT19 Series II Infrared Thermometer website
IceBridge data website at NSIDC

6 ACKNOWLEDGMENTS

The ATM project team would like to acknowledge the dedicated NASA P-3 flight crew, whose efforts allowed the safe and efficient collection of this data over some of the most isolated and extreme regions on this planet.

7 DOCUMENT INFORMATION

7.1 Publication Date

December 2020

7.2 Date Last Updated

December 2024