SMEX02 Tower-Based Radiometric Surface Temperature, Walnut Creek, Iowa, Version 1

USER GUIDE

How to Cite These Data

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

Jackson, T. and M. Cosh. 2003. *SMEX02 Tower-Based Radiometric Surface Temperature, Walnut Creek, Iowa, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/BJZU6IV9HUTE. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0186

National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

1.1 Format

Data are ASCII tab-delimited text files.

1.2 File Naming Convention

The first four digits identify the WC site in which the flux tower was located. If there are multiple towers in a field, another digit identifies the flux tower. For example, WC151 and WC152.

The following table lists each file name and the location of the corresponding tower.

File	Latitude	Longitude	Easting in m	Northing in m
WC03_Ts.txt	41.98381	-93.75497	437459	4648254
WC06_Ts.txt	41.93290	-93.75332	437547	4642600
WC13_Ts.txt	41.95215	-93.68766	443007	4644692
WC14_Ts.txt	41.94598	-93.69622	442292	4644013
WC151_Ts.txt	41.93782	-93.66313	445027	4643085
WC152_Ts.txt	41.93782	-93.66470	444897	4643086
WC161_Ts.txt	41.93414	-93.66270	445060	4642676
WC162_Ts.txt	41.93548	-93.66406	444949	4642826
WC23_Ts.txt	41.99245	-93.53582	455620	4649077
WC24_Ts.txt	41.99291	-93.52858	456219	4649124
WC25_Ts.txt	41.94227	-93.53938	455290	4643507
WC33_Ts.txt	41.97534	-93.64431	446619	4647239

1.3 Spatial Coverage

Southernmost Latitude: 41.9° N

Northernmost Latitude: 42.0° N

Westernmost Longitude: 93.8° W

Easternmost Longitude: 93.4° W

1.4 Temporal Coverage

Data were collected from 25 June 2002 to 12 July 2002.

1.4.1 Temporal Resolution

Data were gathered every 10 minutes.

1.5 Parameter or Variable

1.5.1 Parameter Description

Parameters in this data set include air temperature, vapor pressure, wind speed, and brightness temperatures. The following table describes all the columns in the data tables. Where the columns correspond to parameters, the units of measurement and sensors are also shown.

Column label/Parameter	Unit of Measurement	Description/Sensor
DOY		Day of year (Julian date)
Hour		Time stamp from data logger (Central Standard Time)
Decimal Time		Decimal time and midpoint of averaging period
Site		Tower location number
Air Temp	°C	Humidity and temperature probe
Vapor pressure (Ea)	mbar	Humidity and temperature probe
Wind speed	m/s	Anemometer
IRT Temp	°C	Surface brightness temperature from nadir-viewing sensor.
IRT Body	°C	Calculated temperature of sensor housing needed to correct for bias (see Apogee.
IRT Temp ground	°C	Surface brightness temperature from sensor under the canopy viewing (off nadir) ground soil surface.

Column label/Parameter	Unit of Measurement	Description/Sensor
IRT Body	°C	Calculated temperature of sensor housing needed to correct for bias (see Apogee.)

1.5.2 Parameter Source

The sources are twelve flux towers placed in crop fields in the study area.

1.5.3 Sample Data Record

The following sample comes from the data file "WC13_Ts.txt."

DOY	Hour	Decimal Time	Site	AirTemp (deg.C)	Ea (mbar)	WindSpd (m/s)	IRTTemp surface (deg. C)	IRT Body (deg. C)	IRTTemp ground	IRT Body
165	1030	10.417	13	19.55	12.85	6.79	24.89	20.55	24.20	21.99
165	1040	10.583	13	19.35	12.71	6.79	24.43	20.19	23.52	21.13
165	1050	10.750	13	19.32	12.09	6.79	24.13	20.11	23.20	21.01
165	1100	10.917	13	20.55	12.56	7.26	29.65	21.80	28.55	23.17
165	1110	11.083	13	21.16	12.23	7.26	31.28	22.47	30.18	24.53

2 DATA ACQUISITION AND PROCESSING

2.1 Theory of Measurements

Tower sampling was intended to provide continuous measurements of the surface temperature for a single target at each of the surface flux towers locations.

2.2 Derivation Techniques and Algorithms

The transmitted energy (E) is converted to temperature (T) via the Stefan-Boltzman Law, which states:

$E=\varepsilon\sigma T^4$, where ε is the emissivity of the object and σ is the Stefan-Boltzman constant (5.68×10^{-8} Joules m^{-2} $s^{-1}K^{-4}$)(Bugbee, et al., 1999.)

The instrument manufacturer (Apogee Instruments, Inc.) provides a formula to correct for the casing temperature of the instrument, called the sensor body (SB) temperature:

Corrected Target Temperature = Apparent Target Temperature -SEC

SEC = (0.25/P)*[(Apparent Target Temperature - H)^2-K]

where P, H, and K are related to the sensor body temperature T_{sb} as:

P=26.168+2.8291*T_{sb}-0.03329*T_{sb}^2 r^2=0.708

H=5.8075-0.08016*T_{sb}+0.00849*T_{sb}^2 r^2=0.674

K=-85.943+11.740*T_{sb}-0.08477*T_{sb}^2 r^2=0.893

The Apogee IRT manual contains more information about calibration and derivation techniques for their IRTs.

2.3 Sensor or Instrument Description

An infrared sensor was installed on each tower to provide surface temperature observation. This device recorded both the measured (radiometric) surface temperature and the sensor body (contact) temperature.

Infrared thermometers (IRTs) allow only a specific waveband, approximately 8 to 14 microns, to transmit to the IRT detector.

3 REFERENCES AND RELATED PUBLICATIONS

Bugbee, B., M. Droter, O. Monje, and B. Tanner, 1999. Evaluation and modification of commercial infrared-red transducers for leaf temperature measurement. *Adv. Space Res.*, Vol., 22, no.10, pp 1425-1434

Please see the SMEX02 site for more information, and the AMSR-E site to access data.

4 CONTACTS AND ACKNOWLEDGMENTS

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5 DOCUMENT INFORMATION

5.1 Publication Date

August 2003

5.2 Date Last Updated

14 April 2021