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## In-situ Air Temperature and Relative Humidity in Greenbelt, MD, 2013-2015

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Documentation Revision Date: 2016-06-01

Data Set Version: V1

### Summary

This data set describes the temperature and relative humidity at 12 locations around Goddard Space Flight Center in Greenbelt MD at 15 minute intervals between November 2013 and November 2015. These data were collected to study the impact of surface type on heating in a campus setting and to improve the understanding of urban heating and potential mitigation strategies on the campus scale. Sensors were mounted on posts at 2 m above surface and placed on 7 different surface types around the centre: asphalt parking lot, bright surface roof, grass field, forest, and stormwater mitigation features (bio-retention pond and rain garden). Data were also recorded in an office setting and a garage, both pre- and post-deployment, for calibration purposes. This dataset could be used to validate satellite-based study or could be used as a stand-alone study of the impact of surface type on heating in a campus setting.

This data set includes 10 files in \*.csv format, 5 for temperature and 5 for relative humidity over different periods of time (pre-calibration in office and garage, field deployment, and post-calibration in office and garage). There are three companion files of which two are \*.csv files containing the Collection Log and the Collection Dates and one \*.pdf file showing the locations of the 12 loggers around the NASA Goddard Space Flight Center.

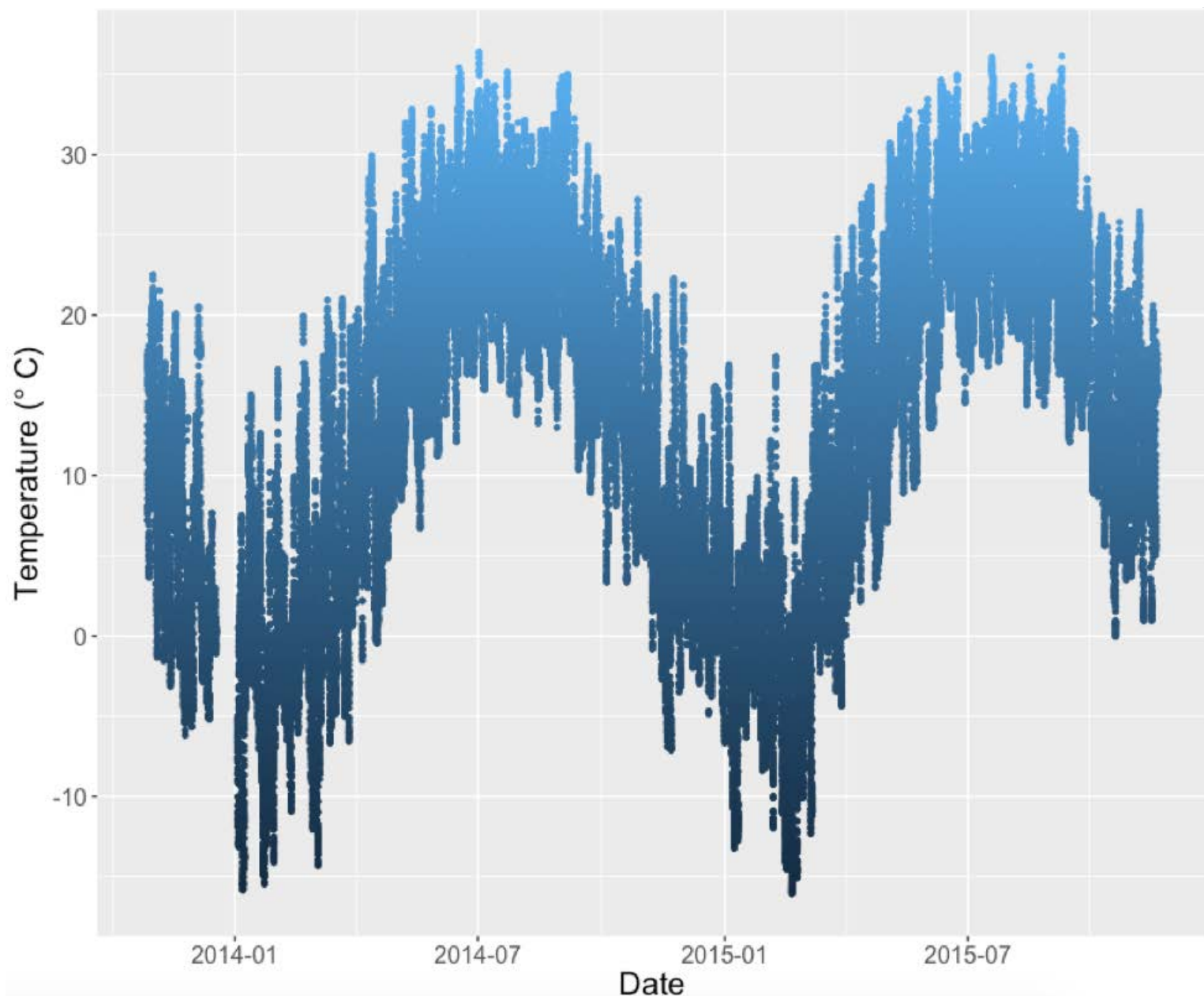


Figure 1: Temperature readings (degrees C) from Logger1 located in the Rain Garden near Building 32 on the Goddard Space Flight Center campus in Greenbelt, MD.

## Citation

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## 1. Data Set Overview

This data set describes the temperature and relative humidity at 12 locations around Goddard Space Flight Center in Greenbelt MD at 15 minute intervals between November 2013 and November 2015. These data were collected to study the impact of surface type on heating in a campus setting and to improve the understanding of urban heating and potential mitigation strategies on the campus scale. Sensors were mounted on posts at 2 m above surface and placed on 7 different surface types around the centre: asphalt parking lot, bright surface roof, grass field, forest, and stormwater mitigation features (bio-retention pond and

rain garden). The data files are organized by time period: office pre-calibration (20130905-20130918), garage pre-calibration (20130920-20131003), live data collection (20131028-20151119), garage post-calibration (20151129-20151212), and office post-calibration (20151215-20151228). This dataset could be used to validate satellite-based study or could be used as a stand-alone study of the impact of surface type on heating in a campus setting.

## 2. Data Characteristics

This data set includes 10 files in \*.csv format, 5 for temperature and 5 for relative humidity over different periods of time (pre-calibration in office and garage, field deployment, and post-calibration in office and garage). There are three companion files of which two are \*.csv files containing the Collection Log and the Collection Dates and one \*.pdf file showing the locations of the 12 loggers around the NASA Goddard Space Flight Center.

**Site boundaries:** (All latitude and longitude given in decimal degrees)

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Goddard Space Flight Center, Greenbelt MD	-76.8569	-76.8401	39.0000	39.9926



 Bioretention Pond	 Field 2	 Parking Lot 1	 Roof 1	 Pond	 Woods 2
 Rain Garden	 Field 1	 Parking Lot 2	 Roof 2	 Woods 1	 Woods 3

Figure 2. Data logger locations

Table 1. Data logger locations

Data Logger Locations	Latitude	Longitude
Rain garden by Building 32	38.9943	-76.8409
Parking lot #2, furthest from Building 6	38.9932	-76.855
Pond by salt dome	38.9993	-76.8453

Parking lot #1, closest to B6	38.9933	-76.8555
Field #1, closest to B6	38.9926	-76.8561
Field #2, furthest from B6	38.9926	-76.8551
Bioretention pond, upper lot by B32	38.9952	-76.8415
Roof#1, closest to door	38.9932	-76.8567
Roof#2, furthest from door	38.9934	-76.8567
Woods#1, between B32&B33	38.9943	-76.8401
Woods#2, by employee gate	38.9984	-76.8622
Woods#3, off Cobe road, marked by log	39.0001	-76.8569

**Table 2. Data and companion files**

File Name	Description
Temperature_20130905-20130918_preCal_office.csv	Pre-calibration temperature data at office
Temperature_20130919-20131021_preCal_garage.csv	Pre-calibration temperature data at garage
Temperature_20131028-20131119_GSFC.csv	Live temperature data collection
Temperature_20151129-20151212_postCal_garage.csv	Post-Calibration temperature data at garage
Temperature_20151215-20151228_postCal_office.csv	Post-Calibration temperature data at office
RelativeHumidity_20130905-20130918_preCal_office.csv	Pre-calibration relative humidity data at office
RelativeHumidity_20130919-20131021_preCal_garage.csv	Pre-calibration relative humidity data at garage
RelativeHumidity_20131028-20131119_GSFC.csv	Live relative humidity data collection
RelativeHumidity_20151129-20151212_postCal_garage.csv	Post-Calibration relative humidity data at garage
RelativeHumidity_20151215-20151228_postCal_office.csv	Post-Calibration relative humidity data at office
<b>Companion Files:</b>	
Collection_Dates.csv	The dates when data were collected by the loggers
Collection_Log.csv	Log of events recorded for the study period
Logger_Names_Location.pdf	Names and spatial locations of the 12 loggers

**Table 3. Data fields in the temperature files**

Data Field	Units	Description
Date_Time	yyyy-mm-dd hh:mm	Date and time of the data collection
Logger1	°C	Temperature measured by the logger at Rain garden by Building 32

Logger2	°C	Temperature measured by the logger at Parking lot #2, furthest from Building 6
Logger3	°C	Temperature measured by the logger at Pond by salt dome
Logger4	°C	Temperature measured by the logger at Parking lot #1, closest to B6
Logger5	°C	Temperature measured by the logger at Field #1, closest to B6
Logger6	°C	Temperature measured by the logger at Field #2, furthest from B6
Logger7	°C	Temperature measured by the logger at Bioretention pond, upper lot by B32
Logger8	°C	Temperature measured by the logger at Roof#1, closest to door
Logger9	°C	Temperature measured by the logger at Roof#2, farthest from door
Logger10	°C	Temperature measured by the logger at Woods#1, between B32&B33
Logger11	°C	Temperature measured by the logger at Woods#2, by employee gate
Logger12	°C	Temperature measured by the logger at Woods#3, off Cobe road, marked by log

**Table 3. Data fields in the relative humidity files**

Data Field	Units	Description
Date_Time	yyyy-mm-dd hh:mm	Date and time of the data collection
Logger1	%	Relative Humidity measured by the logger at Rain garden by Building 32
Logger2	%	Relative Humidity measured by the logger at Parking lot #2, furthest from Building 6
Logger3	%	Relative Humidity measured by the logger at Pond by salt dome
Logger4	%	Relative Humidity measured by the logger at Parking lot #1, closest to B6
Logger5	%	Relative Humidity measured by the logger at Field #1, closest to B6
Logger6	%	Relative Humidity measured by the logger at Field #2, furthest from B6
Logger7	%	Relative Humidity measured by the logger at Bioretention pond, upper lot by B32

Logger8	%	Relative Humidity measured by the logger at Roof#1, closest to door
Logger9	%	Relative Humidity measured by the logger at Roof#2, farthest from door
Logger10	%	Relative Humidity measured by the logger at Woods#1, between B32&B33
Logger11	%	Relative Humidity measured by the logger at Woods#2, by employee gate
Logger12	%	Relative Humidity measured by the logger at Woods#3, off Cobe road, marked by log

### 3. Application and Derivation

This dataset could be used as a validation dataset for a satellite-based study or could be used as a stand-alone study of the impact of surface type on heating in a campus setting.

### 4. Quality Assessment

Uncertainty in the data was not quantified, however the pre- and post-deployment data could be used to estimate the variation between and among sensors since all loggers were in the same environment during these periods.

### 5. Data Acquisition, Materials, and Methods

Twelve “HOBO U23 Pro v2 External Temperature/Relative Humidity Data Logger - U23-002” were used to record data at the NASA Goddard Space Flight Center (GSFC). The loggers were programmed to record temperature and humidity at 15 minute intervals beginning at the start of an hour. In this way all loggers were recording at the same time. The loggers were mounted on posts at 2 meters height above the ground with the actual logger mounted inside a radiation shield to minimize direct sunlight on the probe. The twelve loggers were deployed on 7 different surface types around the center: asphalt parking lot, bright surface roof, grass field, forest, and stormwater mitigation features (bio-retention pond and rain garden).



Figure 3. Data logger mounted at the rain garden location on GSFC campus.

The data were collected over 5 periods of time: office pre-calibration (20130905-20130918), garage pre-calibration (20130920-20131003), live data collection (20131028-20151119), garage post-calibration (20151129-20151212), and office post-calibration (20151215-20151228). The loggers were initialized in the office in September 2013. They were placed in a box with ventilation for 2 weeks on a shelf to assess the amount of agreement between the loggers in a controlled environment. The box was moved to a garage with no temperature controls for an additional 2 weeks prior to being deployed in the field in late October 2013. Data was downloaded every 2 – 3 weeks. A portable data shuttle was used to download data in the field and transfer it to a PC and a log of observations and dates of download was maintained. The loggers were retrieved in November 2015 after collecting data for 2 years continuously. Upon retrieval the loggers were placed in a box and stored in the same garage for 2 weeks. The box was moved to the climate controlled office for 2 more weeks after which data collection stopped. The information collecting during the pre- and post- deployment can be used to determine sensor to sensor agreement both before deployment and after retrieval.

## 6. Data Access

This data is available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

[In-situ Air Temperature and Relative Humidity in Greenbelt, MD, 2013-2015](#)

Contact for Data Center Access Information:

- E-mail: [uso@daac.ornl.gov](mailto:uso@daac.ornl.gov)
- Telephone: +1 (865) 241-3952

## 7. References

Carroll, M. L., Brown, M. E., Wooten, M. R., Donham, J. E., Hubbard, A. B., and Ridenhour, W. B.: In-situ air temperature and humidity measurements over diverse landcovers in Greenbelt, MD Nov. 2013–Nov. 2015, Earth Syst. Sci. Data Discuss., doi:10.5194/essd-2016-13, in review, 2016.



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