Data User Guide

SBU Meteorological Station IMPACTS

Introduction

The SBU Meteorological Station IMPACTS dataset consists of weather station data collected at two Stony Brook University (SBU) weather stations (1 mobile radar truck and 1 stationary site in Manhattan, New York City, New York) during the Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS) field campaign. IMPACTS was a three-year sequence of winter season deployments conducted to study snowstorms over the U.S. Atlantic Coast (2020-2023). The campaign aimed to (1) Provide observations critical to understanding the mechanisms of snowband formation, organization, and evolution; (2) Examine how the microphysical characteristics and likely growth mechanisms of snow particles vary across snowbands; and (3) Improve snowfall remote sensing interpretation and modeling to significantly advance prediction capabilities. The surface meteorological data variables include temperature, dew point, relative humidity, absolute humidity, mixing ratio, air pressure, windspeed, and wind direction. The dataset files are available from January 1 through February 27, 2020 in netCDF-4 and ASCII-CSV formats.

Citation

Kollias, Pavlos and Mariko Oue. 2020. SBU Meteorological Station IMPACTS [indicate subset used]. Dataset available online from the NASA Global Hydrometeorology Resource Center DAAC, Huntsville, Alabama, U.S.A. doi:
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Keywords:

NASA, GHRC, IMPACTS, SBU, SoMAS, ITPA, temperature, dew point, relative humidity, absolute humidity, mixing ratio, air pressure, windspeed, wind direction

Campaign

The Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS), funded by NASA's Earth Venture program, is the first comprehensive study of East Coast snowstorms in 30 years. IMPACTS will fly a complementary suite of remote sensing and in-situ instruments for three 6-week deployments (2020-2023) on NASA's ER-2 high-altitude aircraft and P-3 cloud-sampling aircraft. The first deployment began on January 17, 2020 and ended on March 1, 2020. IMPACTS samples U.S. East Coast winter storms using advanced radar, LiDAR, and microwave radiometer remote sensing instruments on the ER-2 and state-of-the-art microphysics probes and dropsonde capabilities on the P-3, augmented by ground-based radar and rawinsonde data, multiple NASA and NOAA satellites (including GPM, GOES-16, and other polar orbiting satellite systems), and computer simulations. IMPACTS addressed three specific objectives: (1) Provide observations critical to understanding the mechanisms of snowband formation, organization, and evolution; (2) Examine how the microphysical characteristics and likely growth mechanisms of snow particles vary across snowbands; and (3) Improve snowfall remote sensing interpretation and modeling to significantly advance prediction capabilities. More information is available from NASA's Earth Science Project Office's IMPACTS field campaign webpage.

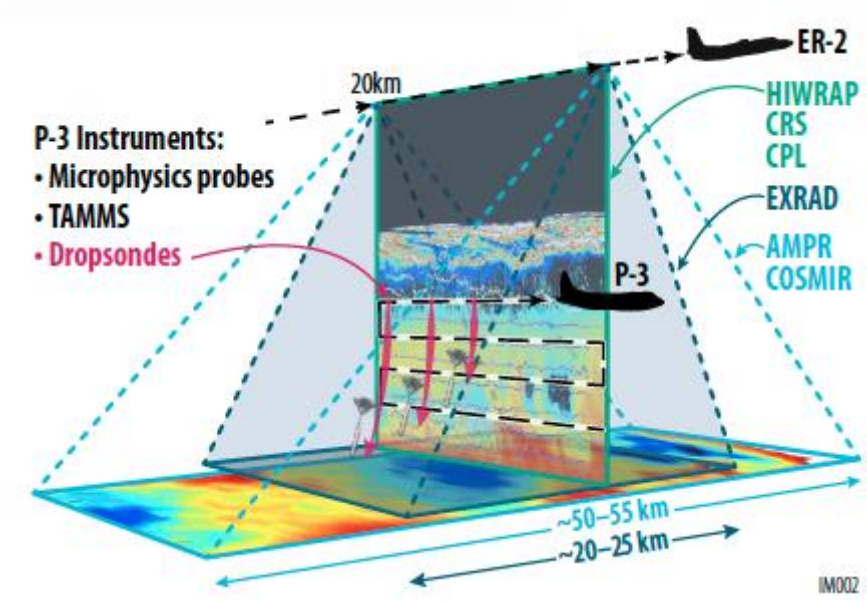

Figure 1: IMPACTS airborne instrument suite
(Image source: NASA IMPACTS ESPO)

Instrument Description

The Stony Brook University (SBU) meteorological stations included a mobile radar truck and a stationary site in Manhattan, NYC (Lat: 40.728, Lon: -74.007). The mobile radar truck was stationed at multiple locations during the campaign (Table 1). These stations provided surface meteorological data including pressure, temperature, humidity, wind speed, and wind direction. Both sites were equipped with the Airmar WeatherStation. This station can

be installed as a stationary or mobile sensor. The Airmar includes GPS, ultrasonic transducers to measure winds, a barometric pressure sensor, a relative humidity sensor, and a thermistor to measure temperature. More information about the Airmar Weather Station is available from the Airmar WeatherStation Instrument website.

Table 1: Mobile Radar Truck (RT) location

Variable	Latitude	Longitude
January 18 - 19th	40.965	-73.030
January 25 and February 7	40.897	-73.127
February 13	40.965	-73.030
February 24 - 27th	40.897	-73.127

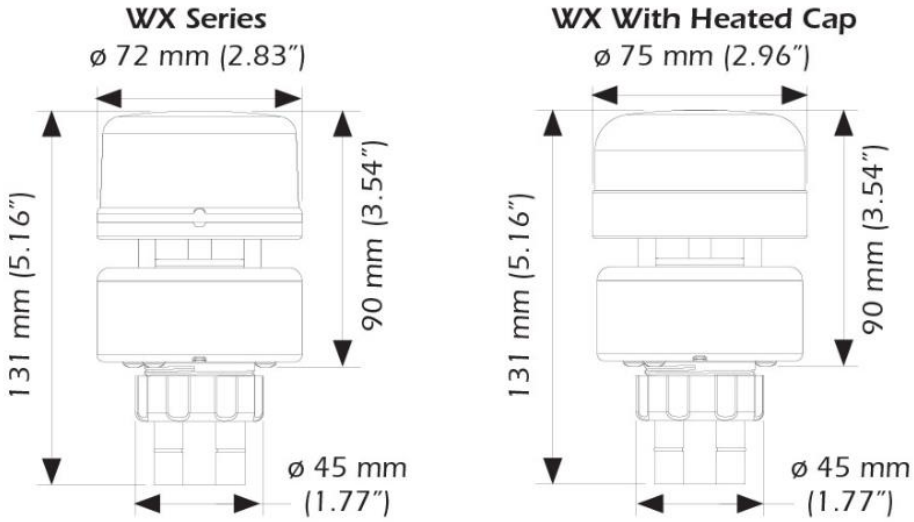

Figure 2: Airmar Weather Station Dimensional Drawing
(Image source: Airmar Technology Corporation)

Investigators

Pavlos Kollias
Stony Brook University, SoMAS
Stony Brook, NY

Mariko Oue
Stony Brook University, SoMAS
Stony Brook, NY

Data Characteristics

The SBU Meteorological Station IMPACTS dataset consists of meteorological surface measurements including temperature, dewpoint, wind speed and direction, and relative humidity. The dataset files are available in netCDF-4 and ASCII-CSV formats. The data are recorded once every minute and there is one file per day. The weather station data are available at a Level 1A processing level. More information about the NASA data processing levels are available on the EOSDIS Data Processing Levels webpage. The characteristics of this dataset are listed in Table 2 below.

Table 2: Data Characteristics

Characteristic	Description
Platform	Ground Station
Instrument	Airmar WeatherStation
Spatial Coverage	N: 40.965 , S: 40.718, E: -73.030, W: -74.017 (New York Coast)
Spatial Resolution	Point
Temporal Coverage	January 1, 2020 - February 27, 2020
Temporal Resolution	Daily
Sampling Frequency	1 minute
Parameter	Pressure, temperature, humidity, wind speed, wind direction
Version	1
Processing Level	1A

File Naming Convention

The SBU Meteorological Station IMPACTS dataset files are separated by station: "RT" for the mobile radar truck station and "MAN" for the Manhattan station. The RT files are stored in netCDF-4 format while the MAN files are stored in ASCII-CSV format. The datafiles are named using the following convention:

RT Data files: IMPACTS_SBU_airmarweather_YYYYMMDD_RT.nc
MAN Data files: IMPACTS_SBU_weatherdhs_YYYYMMDD_MAN.csv

Table 3: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
RT	Radar truck site
MAN	Manhattan site
.nc	netCDF-4 format
.csv	ASCII-CSV format

Data Format and Parameters

The SBU Meteorological Station IMPACTS dataset files are separated by weather station name. The RT data files are stored in netCDF-4 format while the MAN data files are stored in ASCII-CSV format. Each file contains one day of data. The data variables included in the RT data files are listed in Table 4 and the variables included in the MAN data files are listed in Table 5.

Table 4: RT netCDF-4 Data Fields

Field Name	Description	Data Type	Unit
time	Time (seconds since 1970-01-01 00:00:00)	float64	-
barometric_pressure	Barometric pressure	float32	bar
air_temperature	Air temperature	float32	°C
water_temperature	Water temperature	float32	°C
dew_point_temperature	Dewpoint temperature	float32	°C
relative_humidity	Relative humidity	float32	%
absolute_humidity	Absolute humidity	float32	%
wind_direction_true	Wind direction (true north)	float32	degrees
wind_direction_magnetic	Wind direction (magnetic north)	float32	degrees
wind_speed	Wind speed	float32	m/s

Table 5: MAN ASCII-CSV Data Fields

Field Name	Description	Unit
-	Date (YYYY-MM-DD)	-
-	Time (hh:mm:ss) in UTC	-
temperature	Temperature	°C
temperature Min	Minimum temperature	°C
temperature Max	Maximum temperature	°C
temperature Avg	Average temperature	°C
ext. temperature	External temperature	°C
wind heater temp.	Wind heater temperature	°C
R2S heater temp.	R2S heater temperature	°C
dewpoint	Dewpoint	°C
dewpoint Min	Minimum dewpoint	°C
dewpoint Max	Maximum dewpoint	°C
dewpoint Avg	Average dewpoint	°C
wind chill temp.	Wind chill temperature	°C
wet bulb temperature	Wet bulb temperature	°C
relative humidity	Relative humidity	%
relative humidity Min	Minimum relative humidity	%
relative humidity Max	Maximum relative humidity	%
relative humidity Avg	Average relative humidity	%

absolute humidity	Absolute humidity	g/m^3
absolute humidity Min	Minimum absolute humidity	g/m^3
absolute humidity Max	Maximum absolute humidity	g/m^3
absolute humidity Avg	Average absolute humidity	g/m^3
mixing ratio	Mixing ratio	g/kg
mixing ratio Min	Minimum mixing ratio	g/kg
mixing ratio Max	Maximum mixing ratio	g/kg
mixing ratio Avg	Average mixing ratio	g/kg
specific enthalpy	Specific enthalpy	kJ/kg
abs. air pressure	Absolute air pressure	hPa
abs. air pressure Min	Minimum absolute air pressure	hPa
abs. air pressure Max	Maximum absolute air pressure	hPa
abs. air pressure Avg	Average absolute air pressure	hPa
relative air pressure (QNH)	Relative air pressure (reduced to sea level)	hPa
relative air pressure (QNH) Min	Minimum relative air pressure (reduced to sea level)	hPa
relative air pressure (QNH) Max	Maximum relative air pressure (reduced to sea level)	hPa
relative air pressure (QNH) Avg	Average relative air pressure (reduced to sea level)	hPa
air density	Air density	kg/m^3
wind speed	Wind speed	m/s
wind speed Min	Minimum wind speed	m/s
wind speed Max	Maximum wind speed	m/s
wind speed Avg	Average wind speed	m/s
wind speed Vct	Vector wind speed	m/s
wind speed fast	Wind speed fast	m/s
wind speed std. dev.	Wind speed standard deviation	m/s
wind direction	Wind direction	degrees
wind direction Min	Minimum wind direction	degrees
wind direction Max	Maximum wind direction	degrees
wind direction Vct	Wind direction vector	degrees
wind direction fast	Wind direction fast	degrees
corr. wind direction	Corrected wind direction	degrees
wind dir. std. dev.	Wind direction standard deviation	degrees
wind value quality	Wind value quality	%
wind value quality fast	Wind value quality fast	%

Algorithm

The Airmar WeatherStation uses ultrasonic transducers to measure wind speed and direction by measuring the amount of time it takes an ultrasonic pulse of sound to travel between each of its sensors. The wind will affect the time taken for the pulses to arrive at

each sensor, allowing for the calculation of the wind speed and direction. For mobile applications, the Airmar WeatherStation calculates wind speed and direction based on the apparent wind (wind experienced by the sensor), speed of the vehicle, and the direction the vehicle is facing. Airmar also employs a thermistor to measure temperature. A thermistor is essentially a resistor whose resistance is based on temperature. More information about the Airmar WeatherStation instruments is available on the Airmar WeatherStation Instrument website.

Quality Assessment

The wind speed measured by Airmar has an accuracy of 5% at 10 m/s. Wind direction has an accuracy of ± 3° at 10 m/s. Air temperature has an accuracy of ± 1.1°C at 20°C. Relative humidity has accuracy of ± 5% RH at 0 - 90% RH at 20°C. Barometric pressure accuracy is ± 0.5 hPa at 25°C. More information about the Airmar WeatherStation instrument sensors is available on the Airmar WeatherStation Instrument website.

Software

The SBU Meteorological Station dataset files are stored in netCDF-4 and ASCII-CSV format. No special software is required to read these files however Panoply can be used to easily open and view the netCDF-4 files and spreadsheet software such as Microsoft Excel to view the ASCII-CSV files.

Known Issues or Missing Data

There are no known issues with these data or any known gaps in the dataset.

References

Airmar Technology Corporation. (2020). Airmar WeatherStation Instruments. http://www.airmar.com/weatherstation-info.html?category=WX

NASA IMPACTS ESPO. (2020). IMPACTS. https://espo.nasa.gov/impacts/content/IMPACTS

Related Data

All other datasets collected as part of the IMPACTS campaign are considered related and can be located by searching the term “IMPACTS” in the Earthdata Search.

Contact Information

To order these data or for further information, please contact:

NASA Global Hydrometeorology Resource Center DAAC
User Services
320 Sparkman Drive

Huntsville, AL 35805
Phone: 256-961-7932
E-mail: support-ghrc@earthdata.nasa.gov
Web: https://ghrc.nsstc.nasa.gov/

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