



## Data User Guide

# SBU Microwave Radiometer (MWR) IMPACTS

### Introduction

The SBU Microwave Radiometer (MWR) IMPACTS dataset consists of microwave radiometer data collected 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 dataset files are available from January 1, 2023, through March 6, 2023, in netCDF-4 format.

### Citation

Oue, Mariko. 2024. SBU Microwave Radiometer (MWR) IMPACTS [indicate subset used]. Dataset available online from the NASA Global Hydrometeorology Resource Center DAAC, Huntsville, Alabama, U.S.A. doi: <http://dx.doi.org/10.5067/IMPACTS/MWR/DATA101>

### Keywords:

NASA, GHRC, IMPACTS, SBU, MWR, microwave, radiometer, atmospheric precipitation

### 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](#).

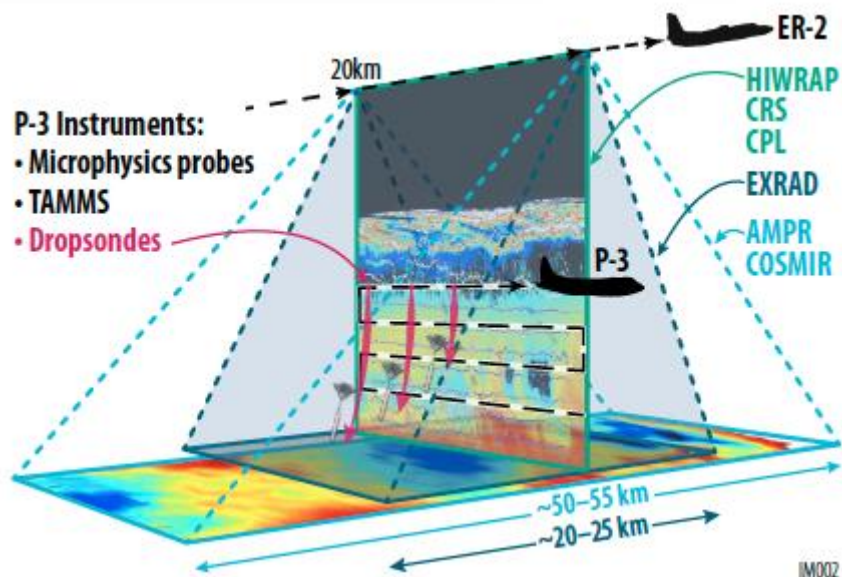


Figure 1: IMPACTS airborne instrument suite  
(Image source: [NASA IMPACTS ESPO](#))

## Instrument Description

The microwave radiometer (MWR) provides time-series measurements of column-integrated amounts of water vapor and liquid water. The instrument is a sensitive microwave receiver that detects the microwave emissions of the atmosphere's vapor and liquid water molecules at 23.8 and 31.4 GHz.

The key principle behind the instrument is the detection of microwave radiation emitted by molecules in the atmosphere. Different atmospheric components emit specific frequencies of microwave radiation, and by measuring these emissions, researchers can infer properties such as temperature, humidity, and cloud content.

Microwave radiometers are often deployed on satellites, aircraft, or ground-based platforms to gather valuable information about the Earth's atmosphere. They can provide crucial data for various applications, such as weather forecasting, climate monitoring, and atmospheric research.

More information about the microwave radiometer can be found at [SBU MWR](#), [NASA Airborne Science](#), and [Atmospheric Radiation Measurement \(ARM\) MWR](#).



Figure 2: SBU MWR  
(Image source: [SBU Instruments](#))

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## Data Characteristics

The SBU Microwave Radiometer (MWR) IMPACTS dataset consists of atmospheric precipitation, liquid water, water vapor, temperature, humidity, and cloud content data. The dataset files are available in netCDF-4 format. These data are available at a Level 2 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 1 below.

Table 1: Data Characteristics

| Characteristic | Description |
|----------------|-------------|
|----------------|-------------|

|                     |  |
|---------------------|--|
| Platform            | Ground Station   |
| Instrument          | Microwave Radiometer (MWR)   |
| Spatial Coverage    | N: 40.865, S: 865, E: -72.881, W: -72.881 (New York Coast)                                 |
| Temporal Coverage   | January 1, 2023 - March 6, 2023  |
| Temporal Resolution | Daily  |
| Sampling Frequency  | 1 minute   |
| Parameter           | liquid water, water vapor, temperature, humidity, cloud content, atmospheric precipitation |
| Version             | 1  |
| Processing Level    | 2  |

## File Naming Convention

The SBU Microwave Radiometer (MWR) IMPACTS dataset files are named using the following convention:

**Data files:** IMPACTS\_SBU\_MWR\_YYYYMMDD\_hhmmss.nc

Table 2: File naming convention variables

| Variable | Description             |
|----------|-------------------------|
| YYYY     | Four-digit year         |
| MM       | Two-digit month         |
| DD       | Two-digit day           |
| hh       | Two-digit hour in UTC   |
| mm       | Two-digit minute in UTC |
| ss       | Two-digit second in UTC |
| .nc      | netCDF-4 format         |

## Data Format and Parameters

The SBU Microwave Radiometer (MWR) IMPACTS dataset files are available in netCDF-4 format. The MWR data files contain one-day data. The data variables included in the data files are listed in Table 3.

Table 3: Data Fields

| Field Name              | Description                           | Unit |
|-------------------------|---------------------------------------|------|
| data_quality            | Data quality for integrated values    | -    |
| dq_liquid_water_profile | Data quality for liquid water profile | -    |
| dq_relative_humidity    | Data quality for relative humidity    | -    |
| dq_temperature_profile  | Data quality for temperature profile  | -    |
| dq_vapor_profile        | Data quality for vapor profile        | -    |
| height                  | Height above ground level             | km   |
| int_lwp                 | Integrated liquid water path          | mm   |
| int_vap                 | Integrated water vapor                | cm   |

|                           |  |                  |
|---------------------------|--|------------------|
| latitude                  | Latitude                               |                  |
| liquid_water_profile      | Liquid water content profile           | g/m <sup>3</sup> |
| longitude                 | Longitude                              |                  |
| Pressure                  | Pressure                               | hPa              |
| rain                      | rain_flag                              | -                |
| relative_humidity_profile | Relative humidity profile              | %                |
| relative_humidity         | Relative humidity                      | %                |
| temperature_air           | Air temperature                        | K                |
| temperature_ambient       | Ambient temperature                    | K                |
| temperature_profile       | Temperature profile                    | K                |
| time                      | Seconds since 1970-01-01 00:00:00 0:00 | s                |
| time_min                  | Minutes since 2023-01-01 00:00:00      | minutes          |
| vapor_profile             | Water vapor profile                    | g/m <sup>3</sup> |

## Software

These data files are stored in netCDF-4 format. No special software is required to read these files however [Panoply](#) can be used to easily open and view these data files.

## Known Issues or Missing Data

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

## References

Atmospheric Radiation Measurement (ARM) - Instruments (2022).

<https://www.arm.gov/capabilities/instruments/mwr>

NASA Airborne Science Program (2017).

[https://airbornescience.nasa.gov/category/type/Microwave\\_Radiometer](https://airbornescience.nasa.gov/category/type/Microwave_Radiometer)

Stoney Brook University - Radar Science

<https://you.stonybrook.edu/radar/observatory/ancillary-instruments/>

## Related Data

All other datasets collected as part of the IMPACTS campaign are related and can be located by searching "IMPACTS" in the [GHRC Search Portal](#).

## Contact Information

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

NASA Global Hydrometeorology Resource Center DAAC

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