Data User Guide

SBU Pluvio Precipitation Gauge IMPACTS

Introduction

The SBU Pluvio Precipitation Gauge IMPACTS dataset consists of precipitation intensity and precipitation accumulation collected using the OTT Pluvio2 weighing rain gauge during the Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS) campaign. NASA's Earth Venture program funded IMPACTS is the first comprehensive study of East Coast snowstorms in 30 years. 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. Data files in this dataset are available in ASCII-CSV format from January 7, 2020, through March 2, 2023.

Citation

Kollias, Pavlos and Maiko Oue. 2020. SBU Pluvio Precipitation Gauge 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/PLUVIO/DATA101

Keywords:

NASA, GHRC, IMPACTS, SBU, snowstorm, pluvio, rain gauge, precipitation, precipitation intensity, precipitation accumulation

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.

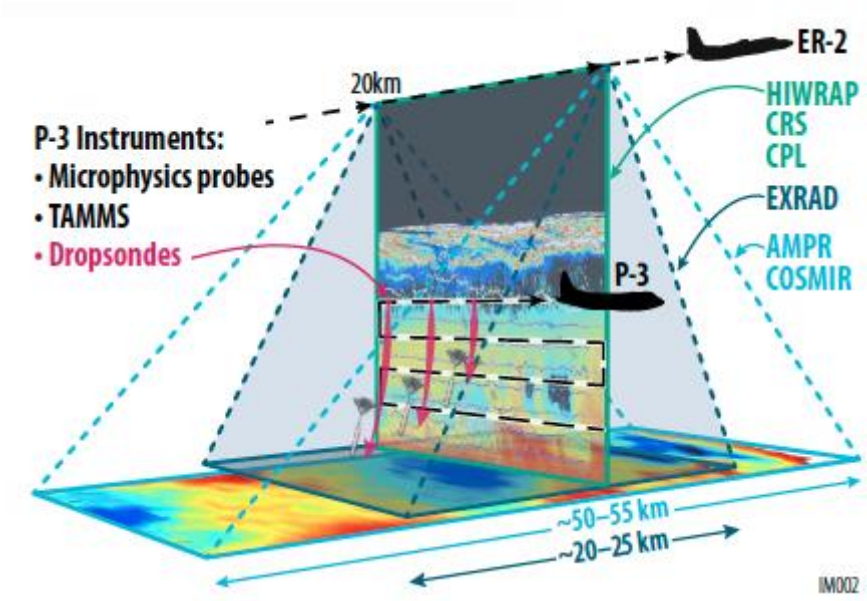

Figure 1: IMPACTS airborne instrument suite
(Image source: NASA IMPACTS ESPO)

Instrument Description

The Pluvio2 is a weighing precipitation gauge produced by OTT Hydromet in Kempten, Germany that continuously monitors liquid, solid, and mixed precipitation accumulation. To provide the best possible data, the load cell and sensor electronics are hermetically sealed against the environment. The Pluvio2 model 400 (Pluvio400) instrument has a 400 cm^2 opening for precipitation collection and can reliably measure in all weather conditions even for small amounts of precipitation. The minimal threshold is 0.1 mm/min and data are reported in 1-minute intervals. Rainfall intensity does not affect the instrument's measurement accuracy. Precipitation values are reported in millimeters per minute (mm/min) and millimeters per hour (mm/hr). More information about the Pluvio2 can be

found at OTT Pluvio^2 - Weighing Rain Gauge and Operating instructions Precipitation Gauge OTT Pluvio^2.

Figure 2: Image of Pluvio2 instrument
(Image source: OTT Pluvio^2 - Weighing Rain Gauge)

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Data Characteristics

The SBU Pluvio Precipitation Gauge IMPACTS dataset consists of precipitation intensity and precipitation accumulation estimates every 1 minute. Data files are in ASCII-CSV format at a Level 1A processing level. More information about the NASA data processing levels is available on the EOSDIS Data PRocessing Levels webpage.

Table 1: Data Characteristics

Characteristic	Description
Platform	Ground stations
Instrument	Pluvio2 Weighing Rain Gauge
Spatial Coverage	N: 40.907, S: 40.856, E: -72.871, W: -73.138 (Stony Brook, New York)
Spatial Resolution	Point
Temporal Coverage	January 7, 2020 - March 2, 2023
Temporal Resolution	Daily
Sampling Frequency	1 minute
Parameter	precipitation intensity and precipitation accumulation
Version	1
Processing Level	1A

File Naming Convention

The SBU Pluvio Precipitation Gauge IMPACTS dataset files are in ASCII-CSV format and have the following naming convention:

Data files: IMPACTS_SBU_pluvio_YYYYMMDD.csv

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
.csv	ASCII-CSV data file

Data Format and Parameters

The SBU Pluvio Precipitation Gauge IMPACTS consists of precipitation intensity and precipitation accumulation estimates. The data files are in ASCII-CSV format. Tables 3 describe how these measurements are organized in each file, as well as their units.

Table 3: Variables in ASCII-CSV data files

Column	Description	Units
A	Date in YYYYMMDD where, YYYY: Four-digit year MM: Two-digit month DD: Two-digit day	-
B	Time in hh:mm:ss where, hh: Two-digit hour in UTC mm: Two-digit minute in UTC ss: Two-digit second in UTC	UTC
C	Decimal hour since midnight	hr

D	Intensity real-time. Moving precipitation growth over the last minute before the sampling interval. This measured value is particularly suited, for example, for the exact determination of intensity with heavy precipitation and for alarm management, but not for daily and monthly totals.	mm/hr
E	Accumulation real-time and non-real-time. This value is a combination of real-time and non-real-time output. This value provides the benefit of faster real-time output together with subsequent non-real-time output delivering the maximum accuracy possible. It shows the accumulated amount of precipitation over the sampling interval. If the amount of precipitation exceeds the threshold, the instrument outputs the measurement result in real-time. Otherwise, it collects the fine precipitation of a maximum of one hour and outputs the measured value in non-real-time. If the fine precipitation does not reach the threshold within an hour, there will be no output. This measured value is similar to the behavior of a precipitation gauge with a tipping bucket. This measured value is particularly suited for daily or monthly totals and for alarm management.	mm
F	Accumulation non-real-time. This measured value outputs the sum of the correct amounts of precipitation over the sampling interval with a fixed output delay of 5 minutes. Due to better filtering, this value provides a more precise precipitation sum. Fine precipitation is collected over a maximum of one hour and output after reaching the threshold. If the fine precipitation does not reach the threshold within an hour, there will be no output. This value is particularly suited for daily and monthly totals.	mm
G	Total non-real-time accumulation. This measured value outputs the sum of the correct amounts of precipitation since the last device started with a fixed output delay of 5 minutes. For this purpose, the individual accumulation non-real-time values are totalled. This value is particularly suited for daily or monthly totals, as well as for tracking the plausibility of the accumulation non-real-time and accumulation real-time and non-real-time values.	mm
H	Bucket real-time. This value outputs the currently measured, unfiltered bucket content. It corresponds to the measured weight raw data and is subjected to higher uncertainty with regard to temperature and wind impact. The measured value is particularly suited for quick reference measurements of the weighing mechanism and for determining the current bucket level.	mm

I	Bucket non-real-time. This value outputs the currently measured, filtered bucket content. It corresponds to the filtered weight value and is subjected to uncertainty with regard to temperature impact. The value is particularly suited for determining the content of the bucket and for calculating the evaporation behavior.	mm
J	Temperature of load cell. Internal temperature of the load cell for compensating for the temperature change. This value is only relevant to internal purposes and generally differs from the current ambient temperature by several degrees C.	Degrees C
K	Heater Status*	-
L	Instrument Status*	-
M	Temperature electronics unit	Degrees C
N	Voltage	V
O	Temperature of orifice ring rim	Degrees C

*More information in the *Quality Assessment* section below

Algorithm

Every six seconds, the precipitation gauge determines the weight of the collecting bucket including its content using a resolution of 0.001 mm. The difference between this measured value and the basic weight of the empty collecting bucket gives the current bucket content. A special filter algorithm prevents incorrect measurement results in the process from effects such as wind. The difference between the current bucket content and the previous one gives the precipitation intensity in mm/hr. These 6-second values for the precipitation intensity are added to the accumulated precipitation amount by the instrument. More information about the algorithm used in this dataset can be found in the Operating instructions Precipitation Gauge OTT Pluvio^2 documentation.

Quality Assessment

Tabes 4-5 show the warning and alert flags of the heater and instrument, respectively. 'W' stands for 'Warning', and 'A' stands for 'Alert'.

Table 4: Heater Status Flags

Value	Description
0	Office rim heater working properly
1	W: temperature of orifice ring rim > 40 deg C
2	A: temperature of orifice ring rim < -20 deg C
4	A: temperature sensor not connected
8	A: temperature sensor short-circuited
16	A: Communication to rim heater module is defective
32	A: Orifice rim heater self-test failed
64	W: orifice rim heater temporarily disabled
128	W: orifice rim heater disabled or not present

Table 5: Instrument Status Flags

Value	Description
0	Precipitation gauge working properly
1	W: bucket level >/ 80%
2	W: USB interface is/was connected
4	W: restart due to power failure
8	W: restart due to firmware
16	W: weight change out of range
32	W: supply voltage < 7 V
64	A: weight measurement unstable
128	A: weight measurement incorrect
256	A: weight below minimum
512	A: weight above maximum
1024	A: no weight calibration

Software

These data are in ASCII-CSV format, so no software is required to view these data.

Known Issues or Missing Data

There are no known issues or missing data with this dataset.

References

OTT. OTT Pluvio^2 - Weighing Rain Gauge. https://www.ott.com/products/accessories-109/ott-pluvio2-weighing-rain-gauge-963/

OTT. Operating Instructions OTT Pluvio^2 - Weighing Rain Gauge. https://www.ott.com/download/operating-instructions-precipitation-gauge-ott-pluvio2/

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. The Pluvio was also used in other field campaigns as listed below:

GPM Ground Validation Pluvio Precipitation Gauge GCPEx (http://dx.doi.org/10.5067/GPMGV/GCPEX/PLUVIO/DATA301)

GPM Ground Validation Pluvio Precipitation Gauges OLYMPEX (http://dx.doi.org/10.5067/GPMGV/OLYMPEX/PLUVIO/DATA301)

GPM Ground Validation Pluvio Precipitation Gauge LPVEx
(http://dx.doi.org/10.5067/GPMGV/LPVEX/PLUVIO/DATA301)

Contact Information

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

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