PSR/A Multiband Polarimetric Imaging, Wakasa Bay, Japan, Version 1

USER GUIDE

How to Cite These Data

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

Stankov, B. and A. J. Gasiewski. 2005. *PSR/A Multiband Polarimetric Imaging, Wakasa Bay, Japan, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/EKIEIOJKGDRK. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0267

National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

This data set represents one in a series of aircraft campaigns to validate rainfall algorithms developed for the Advanced Microwave Scanning Radiometer (AMSR) sensor aboard the ADEOS-II satellite and the AMSR-Earth Observing System (AMSR-E) sensor aboard NASA's Aqua satellite. The AMSR/AMSR-E Wakasa Bay Field Campaign was conducted over Wakasa Bay, Japan, and was designed to:

1. Validate both AMSR and AMSR-E shallow rainfall and snowfall retrievals.
2. Extend the database of rainfall properties needed to implement a comprehensive physical validation scheme.
3. Extend understanding of rainfall structures through new remote sensing technology.

The Wakasa Bay Field Campaign was extended into 2003 with joint research observations by the Japan Aerospace Exploration Agency (JAXA, Contractor: Mitsubishi Electric Corporation), AMSR precipitation validation team, and the NASA AMSR-E team.

This data set includes brightness temperatures collected from the NOAA Environmental Technology Laboratory's (ETL's) Polarimetric Scanning Radiometer (PSR/A), an airborne multiband, conical-scanning, imaging radiometer system mounted to a NASA P-3 aircraft.

Table 1. Summary of Wakasa Bay 2003 Flights

Region Observed	Date	Observation Times (UTC)	# of Flight Lines	% Time PSR Operated	Flight Altitude (km MSL)
Sea of Japan	2003-01-14	02:51 - 09:18	1,1	0	7, 0.15
Honshu	2003-01-15	03:03 - 06:49	4	80	7
Western Pacific	2003-01-19	02:58 - 09:52	2, 1, 1, 1, 1, 1	95	7, 5, 4, 3, 2, 0.15
Western Pacific	2003-01-21	02:05 - 08:26	2, 1, 1	95	7, 3, 0.15
Western Pacific	2003-01-23	06:23 - 10:54	2, 2	100	7, 3
Honshu	2003-01-26	03:27 - 04:48	4	100	7
Sea of Japan	2003-01-27	02:08 - 07:34	5, 1	100	7, 5
Sea of Japan	2003-01-28	02:25 - 08:07	5, 1	100	7, 5

Region Observed	Date	Observation Times (UTC)	# of Flight Lines	% Time PSR Operated	Flight Altitude (km MSL)
Sea of Japan	2003-01-29	02:14 - 06:37	5, 1	100	7, 5
Sea of Japan	2003-01-30	02:06 - 07:19	5, 1	100	7, 5
Honshu	2003-02-01	03:14 - 04:31	2	100	7
Western Pacific	2003-02-03	02:00 - 06:24	3, 1	100	7, 0.15
TOTAL		62:17	60		

Brightness temperature data were processed to Level2.3a (L23a) and are provided to AMSR-E Validation scientists for use in intercomparisons with surface-based and satellite-based data collected during the January/February 2003 field campaign. The letter "a" stands for a subset of PSR data provided to outside users.

The PSR/A scanhead operated in both conical and cross-track scan mode. The conical mode used an incidence angle of 55 degrees from nadir. PSR imaging occurred at medium altitude (approximately 22,000 ft MSL) during flight lines that crossed maritime and orographic precipitation. Both snow and moderate to light rain were observed. Several low-altitude (approximately 700 ft MSL) lines were also flown for surface emission studies. See Section 1.7 Temporal Coverage for more detailed information about each flight.

1.1 Format

Data are provided in two formats: MATLAB and binary with an ASCII header file.

MATLAB version 6.1 or greater is required to view the MATLAB files, which are organized as shown in the tables below. Users must configure the file "`setrootdir.m`" (in the "display_23a" directory) to include the proper local directory where PSR data files are stored.

Binary files ("`L23axxxx.bin`") contain data written out as a long line of sequential points of binary data in the order described in the following tables. Indices in a three-dimensional PSR/A data matrix indicate (1) scan, (2) sample within a scan, and (3) data type as explained in the tables below. Each binary file has an associated ASCII header file ("`L23axxxx.txt`"). An example of an ASCII header is as follows:

```
PSR/A
```

```
Julian day at the beginning of the flight: 28

PSR scanhead type: PSRA

Maneuver serial number: 1308

Size of sceneL23a data matrix is (numscans,numsamples,numchannels):
sceneL23a(486,125,28)

Binary data file: C:\PSR\WBAY03\2003_0128\level2.3a\SL\L23a1308.bin is written
as real*8 (double) i.e., floating point; 64 bits
```

Table 2. PSR/A Data Type (order of variables in the third dimension)

Data Plane	Description
sceneL23a(:,:,1)	10.7v GHz vert. polarization brightness temperature (T_B)
sceneL23a(:,:,2)	10.7h GHz horiz. polarization brightness temperature (T_B)
sceneL23a(:,:,3)	18.7v GHz vert. polarization brightness temperature (T_B)
sceneL23a(:,:,4)	18.7h GHz horiz. polarization brightness temperature (T_B)
sceneL23a(:,:,5)	21.5v GHz vert. polarization brightness temperature (T_B)
sceneL23a(:,:,6)	21.5h GHz horiz. polarization brightness temperature (T_B)
sceneL23a(:,:,7)	37.0v GHz vert. polarization brightness temperature (T_B)
sceneL23a(:,:,8)	37.0h GHz horiz. polarization brightness temperature (T_B)
sceneL23a(:,:,9)	89.0v GHz vert. polarization brightness temperature (T_B)
sceneL23a(:,:,10)	89.0h GHz horiz. polarization brightness temperature (T_B)
sceneL23a(:,:,11)	10.0 um Infrared brightness temperature (T_B)
sceneL23a(:,:,12)	Scanhead encoder position azimuth
sceneL23a(:,:,13)	Scanhead encoder position elevation
sceneL23a(:,:,14)	High data rate attitude data pitch
sceneL23a(:,:,15)	High data rate attitude data roll
sceneL23a(:,:,16)	Latitude
sceneL23a(:,:,17)	Longitude
sceneL23a(:,:,18)	Heading
sceneL23a(:,:,19)	Altitude (ft)
sceneL23a(:,:,20)	Ambient Temperature
sceneL23a(:,:,21)	Ground Speed
sceneL23a(:,:,22)	Hardware trigger value
sceneL23a(:,:,23)	Time stamp (sec from the beginning of the day)

Data Plane	Description
sceneL23a(:,:,24)	True azimuth angle
sceneL23a(:,:,25)	True elevation angle
sceneL23a(:,:,26)	Polarization angle
sceneL23a(:,:,27)	Pixel terrain geolocated latitude (dd.ddd)
sceneL23a(:,:,28)	Pixel terrain geolocated latitude (dd.ddd)

Table 3. Additional Variables Present in each PSR/A WBAY03 Level 2.3a File

ssn	Serial number of maneuver (see: WBAY03_DataDelivery_060704.pdf)
firstday	Julian day on which the flight began
scanhead	Type of PSR scanhead (e.g., PSRA for CLPX02)
description	Text string indicating PSR maneuver ID

1.2 File and Directory Structure

Data are available from NSIDC with the following directory structure:

Directory	Description
2003_0119 2003_0121 2003_0123 2003_0126 2003_0127 2003_0128 2003_0129 2003_0130 2003_0201 2003_0203	Flight code directories indicate the year, month, and day of the beginning of the flight. Each of these contains "level2.3a" directories, followed by "CAT" (constant-angle turns) and "SL" (straight-and-level) directories with MATLAB data files (*.mat), binary data files (*.bin), and ASCII headers (*.txt). The "SL" directories also contain browse images of T_B maps in JPEG format.
display_23a	Contains MATLAB Version 6.1 executable files (*.m) necessary to render T_B maps from PSR/A data. Users must configure the file "setrootdir.m" (located in the display_23a directory) to include the proper local directory where PSR data files are stored.

1.3 File Naming Convention

"`L23axxxx.mat`" are data files in MATLAB format, corresponding to a maneuver with serial number xxxx. "`L23axxxx.bin`" are data files in binary format, corresponding to a maneuver with serial number xxxx. Binary data are identical to the MATLAB data, except the binary files have accompanying header files ("`L23axxxx.txt`"). Serial numbers for each maneuver are listed on page 12 in a data delivery report that accompanies this data set, PSR/A Multiband Polarimetric Imaging During Wakasa Bay (WBAY03) Field Campaign (PDF file, 2.8 MB).

1.4 File Size

File sizes range from 300 bytes (text files) to 60 MB (MATLAB and binary files).

1.5 Volume

Total data volume is approximately 3.43 MB.

1.6 Spatial Coverage

The Wakasa Bay coordinates are:

Southernmost Latitude: 30° N
Northernmost Latitude: 42° N
Westernmost Longitude: 132° E
Easternmost Longitude: 151° E

1.6.1 Spatial Resolution

Spatial resolution varies from 0.3 km to 2.2 km, depending on the channel and type of scan, as the following table shows:

Table 4. PSR/A Scanhead Characteristics

Band (GHz)	Polarizations	Beamwidth	Surface Resolution (km) at 22,000' MSL observing altitude	
			Conical Scan	Cross-Track Scan (nadir)
10.6 - 10.8	v,h	8°	2.2	0.9
18.6 - 18.8	v,h	8°	2.2	0.9
21.4 - 21.7 (H_2O_v)	v,h	8°	2.2	0.9
36 - 38	v,h	2.3°	0.6	0.3
86 - 92	v,h	2.3°	0.6	0.3
9.6 - 11.5 µm IR	v+h	7°	1.9	0.8

1.7 Temporal Coverage

Data are available from 19 January 2003 to 03 February 2003. Flights occurred on 14 and 15 January, but no data are distributed for these dates at this time. Following are summaries of all

flights, quoted from PSR/A Multiband Polarimetric Imaging During Wakasa Bay (WBAY03) Field Campaign.

14 January 2003: ~6.0-hour snow showers mapping mission over Sea of Japan (Fig. 1). PSR/A scanhead was not operating due to a problem with the 89 GHz receiver.

15 January 2003: ~4-hour snow showers mapping mission over the mountains of Honshu, just north of Tokyo and along the Sea of Japan coast. PSR/A scanhead operated well but the tempscan data were not recorded. Data processing for this flight will require more attention and thus we are not providing them in this data delivery.

19 January 2003: ~7.0-hour rainstorm mapping mission. Rainstorm started south of Honshu and moved northeastward to Western Pacific while deepening explosively. Seven observation lines at various altitudes and with PSR/A scanning in cross-track or conical mode were completed.

21 January 2003: ~6.0-hour mission to observe frontal rain bands associated with eastmoving low pressure area that formed over the Kanto plain during night with rain and snow reported in local area. Even reports of thunder-snow were recorded. The low moved rapidly over the Western Pacific Ocean generating copious rain.

23 January 2003: ~4.0-hour mission to observe eastward moving cold front and frontal rain/snow bands. A low had passed out of the Yellow sea, across Kyushu and along the southern edge of Honshu with a cold front trailing out of the low. The low tracked to the NE and deepened explosively.

26 January 2003: ~1.5-hour mission to observe land background in clear air and with conical scanning mode during the AMSR-E overpass.

27 January 2003: ~5.0-hour Wakasa Bay rain data flight to observe light rain and snow over Sea of Japan during the AMSR-E overpass.

28 January 2003: ~5.5-hour over roughly the same area as on 27 January 2003 to observe snow over water that was a result of strong onshore flow with scattered snow showers all along the central Sea of Japan coast of Honshu.

29 January 2003: ~4.5-hour over roughly the same area as on 27 and 28 January 2003 to observe snow over water. Strong northwesterly flow over all of the Sea of Japan produced extensive areas of heavier snow off the coast of Honshu.

30 January 2003: ~5.0-hour over roughly the same area as on 27, 28, and 29 January 2003 to observe snow over water. However, snow was observed in the Wakasa Bay but did not extend too far over the Sea of Japan.

01 February 2003: ~1.0-hour Wakasa Bay data flight to observe snow covered land background in clear air and using conical scanning mode.

03 February 2003: ~4.0-hour flight over the SE Pacific Ocean to observe rain over the water that was associated with a low southwest of Kanto region.

1.8 Parameter or Variable

1.8.1 Parameter Description

This data set contains calibrated brightness temperatures (TBs) in Kelvins.

2 SOFTWARE AND TOOLS

2.1 Software and Tools

MATLAB version 5.3 or greater is required to view MATLAB data. The MATLAB programs to display T_B maps are available via HTTP. Users must configure the file "setrootdir.m" (located in the display_23a directory) to include the proper local directory where PSR data files are stored.

Also included is a MATLAB file, "ReadBinL23aFile.m", which is an example of how to read binary and text files. The information in this file is intended to help users in designing their own data-reading routine using the software of their choice.

3 DATA ACQUISITION AND PROCESSING

3.1 Sensor or Instrument Description

A U.S. Navy P-3 Orion aircraft carried the PSR/A sensor. The PSR/A has fully polarimetric channels at 10.7 GHz and 18.7 GHz; tri-polarimetric channels at 37 GHz and 89 GHz; and a dual-polarimetric channel at 21.5 GHz. See Section 1.6.1 Spatial Resolution section of this document for a table of PSR/A scanhead characteristics. Also see the NOAA Environmental Laboratory's Polarimetric Scanning Radiometer Instrument Description.

4 REFERENCES AND RELATED PUBLICATIONS

Stankov, B., A.J. Gasiewski, M. Klein, V. Leuski, V. Irisov, and B. Weber. 2003. *PSR/A multiband polarimetric imaging during Wakasa Bay (WBAY03) field campaign: data delivery report to NASA PIs*. Boulder, CO: NOAA Environmental Laboratory, Division of Microwave Systems Development. Unpublished report.

4.1 Related Data Collections

AMSR-E Validation Data

AMSR-E Data at NSIDC

Wakasa Bay Weather Forecast Maps

5 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Publication Date

June 2005

6.2 Date Last Updated

24 May 2021

APPENDIX A - POLARIMETRIC SCANNING RADIOMETER (PSR) DESCRIPTION

The Polarimetric Scanning Radiometer (PSR) is a versatile airborne microwave imaging radiometer developed by the Georgia Institute of Technology and the NOAA Environmental Technology Laboratory. This instrument obtains polarimetric microwave emission imagery of the Earth's oceans, land, ice, clouds, and precipitation. The PSR is the first airborne scanned polarimetric imaging radiometer suitable for post-launch satellite calibration and validation of a variety of future spaceborne passive microwave sensors. The capabilities of the PSR for airborne simulation are continuously being expanded through the development of new mission-specific scanheads to provide post-launch simulation of a variety of existing and future U.S. sensors, including Compact Microscope Imaging System (CMIS), Advanced Technology Microwave Sounder (ATMS), Advanced Microwave Sounding Unit (AMSU), WindSat, Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI), RAMEX, and GEM.

For more information, see NOAA's Polarimetric Scanning Radiometer Instrument Description web page.