



Meltpond2000 Polarimetric Scanning Radiometer Sea Ice Brightness Temperatures, Version 1

USER GUIDE

How to Cite These Data

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

Klein, M., A. J. Gasiewski, D. J. Cavalieri, and T. Markus. 2004. *Meltpond2000 Polarimetric Scanning Radiometer Sea Ice Brightness Temperatures, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center.
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National Snow and Ice Data Center

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1 DATA DESCRIPTION

The Meltpond2000 project was the first in a series of Arctic and Antarctic aircraft campaigns to validate sea ice algorithms developed for the Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E), primarily to quantify errors in AMSR-E sea ice products resulting from the presence of melt ponds. The objective was to compare sea ice concentrations derived from AMSR-E algorithms but using Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave/Imager (SSM/I) radiances, with coincident observations from aircraft sensors and high-resolution satellite imagery. A secondary objective of the mission was to develop a microwave capability to discriminate between melt ponds and sea water using low-frequency microwave radiometers (Cavalieri 2000).

The Arctic field campaign was conducted between 25 June 2000 and 6 July 2000 from Thule, Greenland, with five eight-hour-long flights in a U.S. Navy P-3 Orion aircraft over melting ice floes in Baffin Bay and the Canadian Arctic. The P-3 carried several sensors operated by the NOAA Environmental Technology Laboratory's (ETL's) Microwave Radiometry Group, including two Polarimetric Scanning Radiometers (PSR/A and PSR/C), a Scanning Low-Frequency Microwave Radiometer (SLFMR), and an infrared scanner bore sighted to each PSR.

1.1 Parameters

1.1.1 Unit of Measurement

Brightness temperatures (T_B s) are given in Kelvins.

1.1.2 Sample Data Record

A sample T_B map is provided at the end of the Software and Tools section of this document.

1.2 File Information

1.2.1 Format

Data are provided as MATLAB files; MATLAB version 5.3 or greater is required to view these data. For a summary of the MATLAB file structure in this data set, please refer to [Meltpond 2000 PSR Processing - Final Report](#) (PDF file, 857 KB), under the heading "Level 2.3a data format description for PSR/A, PSR/C, and SLFMR instruments."

Data files (*.mat) range from 24 KB to 32 MB. The full data set is approximately 647 MB.

1.2.2 Directory Structure

This data set contains the following directories:

Directory	Description
2000_0626 2000_0627 2000_0629 2000_0630 2000_0705	Flight code directories indicate the year, month, and day of the beginning of the flight. Within each of these directories is a " level2.3a " subdirectory that contains data files (*.mat) from PSR sensors and a " level2.3a_slfmr " subdirectory that contains data files (*.mat) from the SLFMR sensor.
display_23a	Contains MATLAB version 5.3 executable files (*.m) necessary to render T_B maps from PSR and SLFMR data.
documents	Contains a file called "Final_Processing_Report.pdf," which is Klein and Gasiewski (2002) appended with Klein et al. (2001).

1.2.3 Naming Convention

Data files are named "L23axxxx.mat" where xxxx represents the serial number of the flight maneuver. Please refer to [Meltpond 2000 PSR Processing - Final Report](#) (PDF file, 857 KB) for a list of maneuvers and their corresponding times and locations.

1.3 Spatial Information

1.3.1 Coverage

Southernmost Latitude: 68.966944
 Northernmost Latitude: 76.421944
 Westernmost Longitude: -105.021944
 Easternmost Longitude: -63.196944
 Minimum Altitude: 4500 ft
 Maximum Altitude: 19000 ft

Table 1. Meltpond2000 Flight Paths

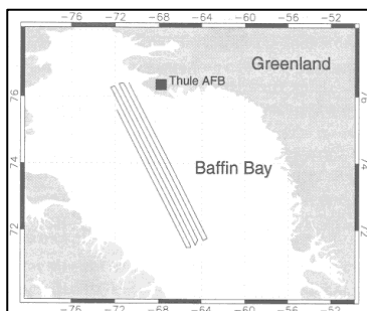


Figure 1. June 26

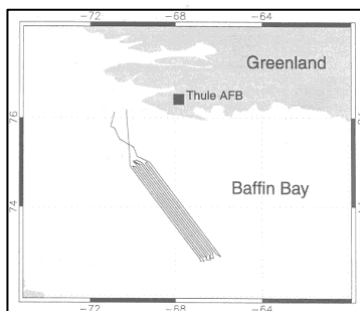


Figure 2. June 27

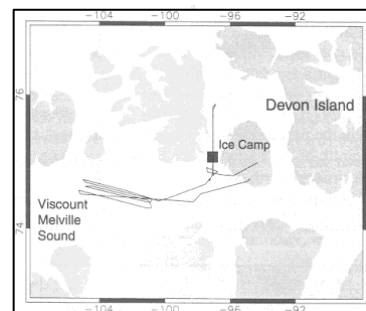


Figure 3. June 29

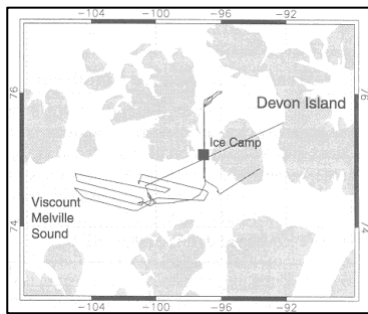


Figure 4. June 30

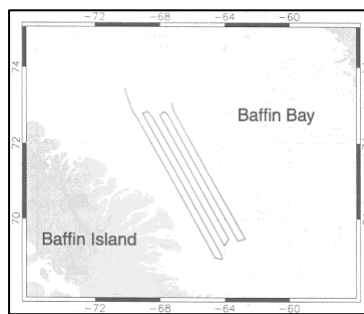


Figure 5. July 5

The Goddard Space Flight Center's (GSFC) [Meltpond2000](#) site also provides maps of the Meltpond2000 region and flight paths.

1.3.2 Resolution

Resolution varies by sensor, as shown in the following table (from Klein and Gasiewski 2002)

Table 2. Meltpond2000 Flight Summary

Date	Region	Altitude	Sensor	Channels	Resolution
2000-06-26	Baffin Bay	5800 m	PSR/A	10.7 GHz, 18.7 GHz, 21 GHz	2 km
				37 GHz, 89 GHz	0.6 km
			SLFMR	1.413 GHz	3.3 km
2000-06-27	Baffin Bay	1400 m	PSR/A	10.7 GHz, 18.7 GHz, 21 GHz	0.5 km
				37 GHz, 89 GHz	0.13 km
			SLFMR	1.413 GHz	0.8 km
2000-06-29	Viscount Melville Sound Ice Camp	1500 m and 300 m	PSR/A	10.7 GHz, 18.7 GHz, 21 GHz	0.5 km
				37 GHz, 89 GHz	0.13 km
			SLFMR	1.413 GHz	0.8 km
2000-06-30	V Melville Sound Ice Camp	4600 m and 300 m	PSR/C	5.985 GHz, 6.485 GHz, 6.925 GHz, 7.325 GHz	2 km
			SLFMR	1.413 GHz	2.6 km
2000-07-05	Baffin Bay	6400 m	PSR/C	5.985 GHz, 6.485 GHz, 6.925 GHz, 7.325 GHz	2.7 km
			SLFMR	1.413 GHz	3.6 km

1.4 Temporal Information

1.4.1 Coverage

Five eight-hour-long flights provided T_B measurements on 26, 27, 29, 30 June 2000, and 5 July 2000.

2 DATA ACQUISITION AND PROCESSING

2.1 Acquisition

For each of the flights, only one PSR (A or C) was flown because of the availability of only one PSR positioner. The June 26 flight over Baffin Bay, at an altitude of 5,800 m, coincided with visible Landsat-7 and Terra Moderate Resolution Imaging Spectroradiometer (MODIS) data, covering many SSM/I footprints. The June 27 flight over Baffin Bay, at an altitude of 1,400 m, allowed a Navy ice observer to have a better view of surface conditions while still covering several SSM/I footprints. (SSM/I data were run through the AMSR-E sea ice algorithm to calculate ice concentration.) This flight was nested within the June 26 flight pattern. The July 5 flight over Baffin Bay used the PSR/C scanhead in order to map the ice cover with a low-frequency radiometer.

The June 29 and June 30 flights were made at an altitude of 300 m over the Canadian ice camp near Resolute Bay in the Canadian Archipelago. This allowed the highest possible spatial resolution with the microwave radiometers. Because of the low altitude, the sensors were operated in stare mode to provide uninterrupted measurements along the flight track. On June 29, the P-3 carried the PSR/A scanhead; on June 30, it carried the PSR/C. Canadian researchers at the ice camp collected coincident ice surface and meteorological data, including melt pond temperatures, as part of the Collaborative-Interdisciplinary Cryospheric Experiment (C-ICE). These ice camp flights were made in combination with flights over Viscount Melville Sound, along tracks consistent with surface measurements. The first flight over Viscount Melville Sound was at 1,500 m altitude, and the second flight was at 4,600 m altitude (Cavalieri 2000).

2.2 Quality, Errors, and Limitations

Data in the T_B maps are not compensated for incident angle variations caused either by aircraft roll and pitch or, in the case of the SLFMR, by the cross-track scanning mode. Although the PSR scans at fixed angles, aircraft pitch and roll variations influence the incident angle by as much as $\pm 3^\circ$ in angle, or roughly ± 7 K for vertical and ± 4 K for horizontal polarization over water. All channels worked well providing approximately 0.5 K to 1 K root-mean-square (RMS) noise for 20 ms integration. One exception was the 89 GHz vertical channel, which was not calibrated due to

spurious noise (Klein et al. 2001). The 89 GHz noise is presumed to be from iron epoxy debris on the sensor.

2.3 Instrumentation

2.3.1 Description

A U.S. Navy P-3 Orion aircraft carried the following sensors from NOAA ETL:

- PSR/A: Fully polarimetric channels at 10.7 GHz and 18.7 GHz; tri-polarimetric channels at 37 GHz and 89 GHz; dual-polarimetric channel at 21.5 GHz.
- PSR/C: C-band radiometer with vertically and horizontally polarized channels at 6 GHz, 6.5 GHz, and 7.325 GHz; fully polarimetric channel at the AMSR-E band of 6.92 GHz.
- Infrared scanners: These were boresighted with each PSR scanhead and operated in the range of 9.5-11 μm .
- SLFMR: 1.4 GHz (L-band), vertically polarized.

The two PSR sensors covered the full range of AMSR-E frequencies (6.9 GHz to 89.0 GHz). In addition, the P-3 carried NASA GSFC video and digital cameras.

The PSR has three main components: a scanhead, a positioner, and aircraft control and acquisition electronics. Several scanning modes are programmable, including conical, cross-track, and along-track. The preferred scanning mode of the PSR during Meltpond2000 was full-conical (360° in azimuth) with a 55° incident angle.

The SLFMR is a cross-track scanning radiometer operating at a center frequency of 1.41 GHz with a bandwidth of 100 MHz. The electronically steerable scan consists of eight vertically polarized beams (four on port and four on starboard) with incident angles varying from 6° to 47° from nadir. During the Meltpond2000 campaign, only the four outermost beams were available due to an electronic failure, so only data with incident angles of 36° and 47° on both sides of the aircraft were available (Klein et al. (2001)).

The following table from Klein et al. (2001) lists channels and polarizations for the scanheads.

Table 3. Instruments and Channels Used in Meltpond2000

Channel Frequency	Polarization	Scanhead
1.413 GHz	Vertical	SLFMR
5.985 GHz	Vertical, horizontal	PSR/C
6.485 GHz	Vertical, horizontal	
6.925 GHz	Vertical, horizontal	
7.325 GHz	Vertical, horizontal	

Channel Frequency	Polarization	Scanhead
10.7 GHz	Vertical, horizontal	PSR/A
18.7 GHz	Vertical, horizontal	
21.5 GHz	Vertical, horizontal	
37 GHz	Vertical, horizontal	
89 GHz	Vertical (noisy), horizontal	
9.5 μm - 11 μm		PSR/A and PSR/C
RGB video camera		PSR/A and PSR/C
More detailed information about the PSR is available from NOAA ETL .		

3 SOFTWARE AND TOOLS

Data are provided as MATLAB files; MATLAB version 5.3 or greater is required to view these data. The MATLAB programs to display TB maps are available via [HTTPS](https://www.nsidc.org/data/meltpond2000). Download all files to your computer, organizing them in the same directory structure as on the [HTTPS site](https://www.nsidc.org/data/meltpond2000). The full data set is approximately 647 MB. Then perform the following steps, which were tested at NSIDC on a Windows 2000 PC.

1. Edit the file "setrootdir.m" (found in the "display_23a" directory) so the variable "rootdir" indicates the proper path to your root directory.

Special note for UNIX users: these Matlab executables were originally written for a Windows PC platform. To run them correctly on a Unix or Linux server, change the backslashes (\) to forward slashes (/) in the following line of code in "mainshelldisp23a.m":

```
cd([rootdir dirstrg '\ leveldir \SL']);
```

2. Edit the MATLAB path to point to the directory "display_23a." To do this, open MATLAB, select File, Set Path, and Add with Subfolders. Type the path to the "display_23a" directory, click Save, and then Close.
3. At the MATLAB prompt, type "mapl23a". The program asks you to select an instrument (PSR or SLFMR), followed by the available dates, and flight codes available for that date. (Please refer to [Meltpond 2000 PSR Processing - Final Report](#) (PDF file, 857 KB) for a list of maneuvers and their corresponding times and locations.)
4. The program prompts you for one or more channels to display. Several channel groups are provided in the command line. The next variables that can be selected are the minimum and maximum TBs for the range of the color map. If you define the minimum color temperature, you will be asked for the maximum; otherwise, the program automatically assigns these values. If you

select auto-range calculation, the program attempts to fit a Gaussian probability function to the TB histogram and computes the color range individually for each channel using the Gaussian parameters with a range factor. The range factor sets the color range relative to the mean by the indicated number of standard deviations. It defaults to 0.6, but you can modify it according to your needs. Autocalculation is useful for scenes where the TBs fall within a narrow range of values.

5. You can display a portion of a maneuver by selecting a sample of scans from all scans available. For conical scanning, one full scan means one full rotation around the azimuth axis with front and back views.

6. You can produce either individual maps (one image for each channel) or composite images of all channels and views in a single map.

7. Finally, you can select new latitude and longitude corners if you prefer. If you have installed the MATLAB Mapping Toolbox, you can choose whether to include U.S. state boundaries on the final map.

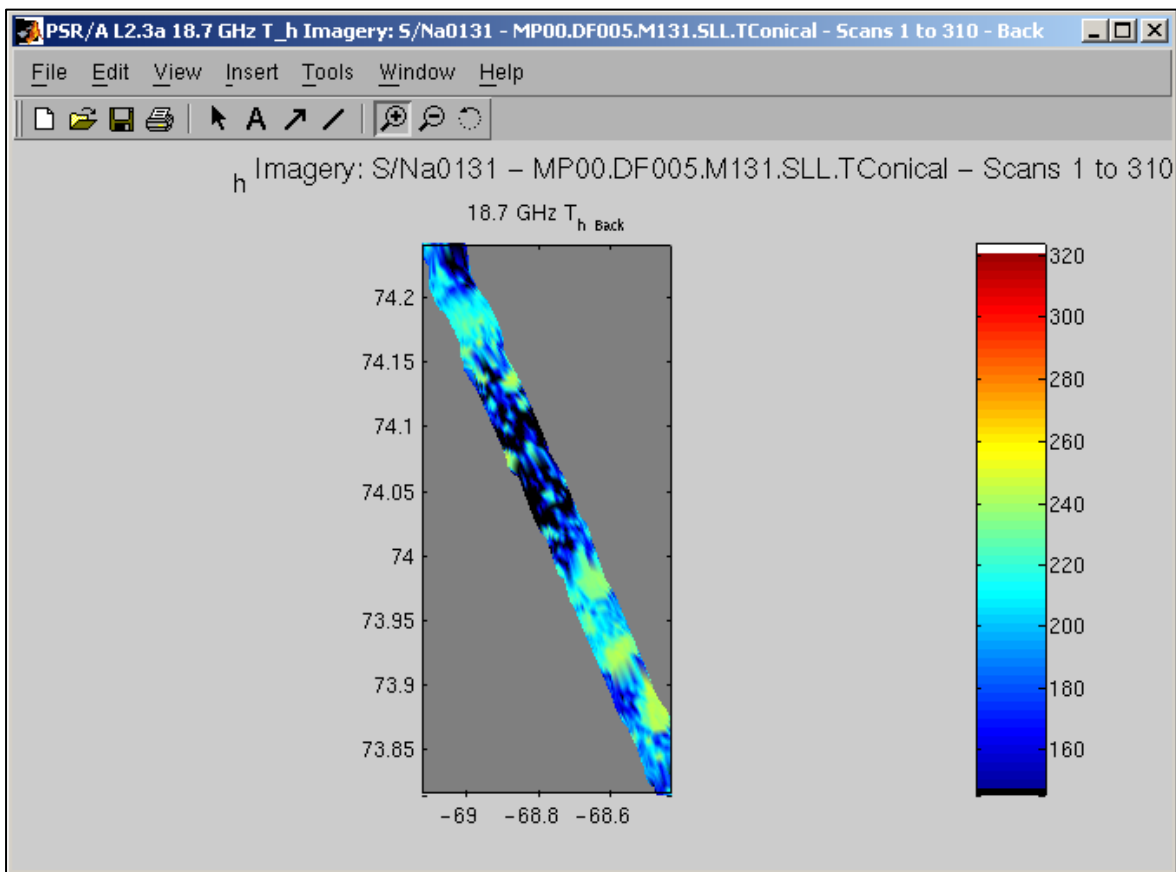


Figure 6. Screen capture of an individual T_B map generated from the file "L23a0131.mat," 27 June 2000, at 18.7 GHz.

4 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Publication Date

February 2004

6.2 Date Last Updated

18 May 2021