

AMSR-E Cryospheric Validation Data

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1 AMSR-E VALIDATION OVERVIEW

1.1 About Validation Campaigns

The AMSR-E validation effort addressed data quality through several comprehensive calibration and validation programs. These programs characterized and documented the accuracy and precision of AMSR-E observations and their derived products.

Pre-launch activities demonstrated the stability of the instrument software and began to demonstrate the validity of the retrieved products with in situ ground truth data. Post-launch efforts concentrated on validating the retrieved products using in situ data.

The validation effort produced three types of products: cryospheric data, including snow, ice, and sea ice; rainfall data; and soil moisture data.

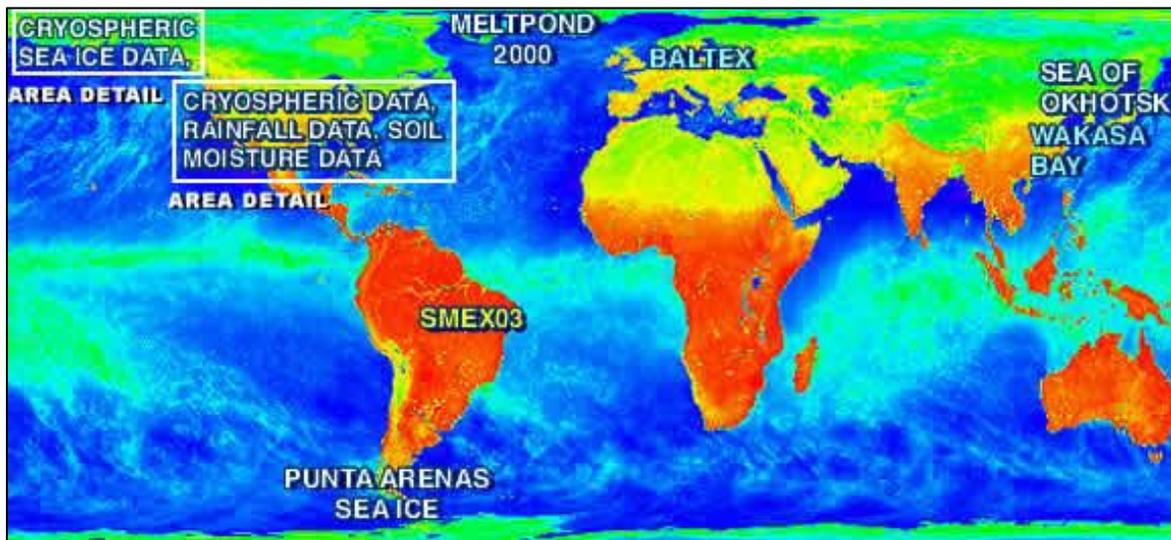


Figure 1. Global map depicting the locations of the 2002-4 AMSR-E validation campaigns, including area detail for regional study areas in North America.

1.2 Cryospheric Data Validation Overview

The AMSR-E cryospheric data validation program included snow and sea ice campaigns to validate AMSR-E measurements of the following parameters: sea ice concentration, sea ice temperature, snow depth, brightness temperatures, and snow water equivalent. There were six cryospheric validation campaigns in total: Meltpond, Cold Land Processes Experiment (CLPX), AMSRICE03, AMSRICE06, West Antarctic Sea Ice Campaign, and the East Antarctic Sea Ice Campaign. A summary of each campaign is provided in this document.

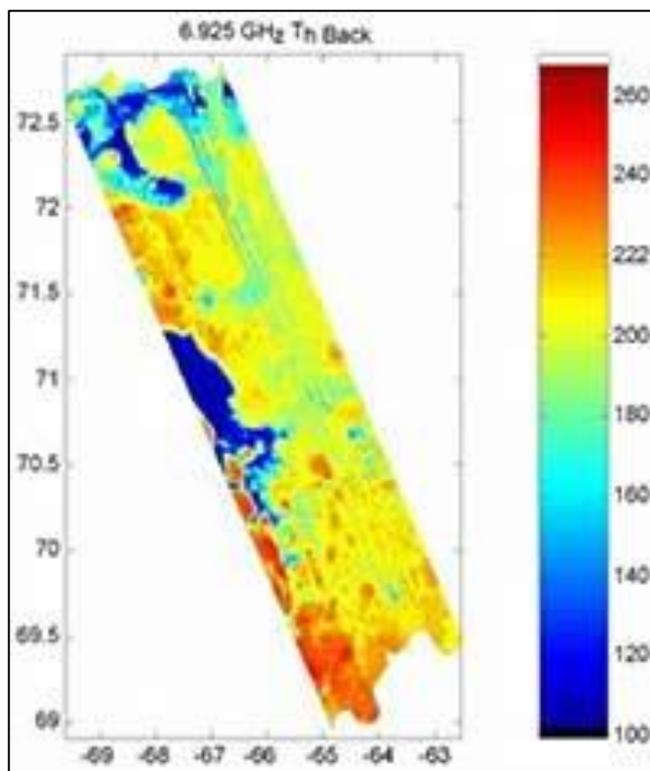


Figure 2. Polarimetric Scanning Radiometer imagery of ice floes within Baffin Bay on 7 July 2000. Open water areas are distinguished by cold brightness temperatures. Image derived from the [Meltpond2000 Polarimetric Scanning Radiometer Sea Ice Brightness Temperatures](#) data set.

1.3 Cryospheric Validation Campaigns Schedule

AMSR-E Cryospheric Validation campaigns schedule, shown here, demonstrates the broad range of these calibration studies in terms of both temporal and geographic coverage.

- Meltpond2000: 25 June - 6 July 2000
- Cold Land Processes Experiment (CLPX)
 - CLP IOP 1: 19 - 24 February 2002
 - CLP IOP 2: 25 - 30 March 2002
 - CLP IOP 3: 19 - 27 February 2003
 - CLP IOP 4: 25 March - 2 April 2003
- Alaska Sea Ice: 3 – 23 March 2003
- Beaufort Sea: April/May 2002
- Sea of Okhotsk, Japan: 4, 11 February 2003
- Beaufort/Northern Bering Seas: 6 - 23 March 2003
- Bering and Chukchi Seas: February/March 2005
- East Antarctic Sea Ice: September - October 2003
- West Antarctic (Punta Arenas) Sea Ice: August 2003/October 2004

2 MELTPOND2000 SEA ICE CAMPAIGN

Meltpond2000 was a sea ice validation program for AMSR-E that focused on differentiating melting arctic ice from surface pack ice, as well as between melt ponds and open sea water; it used airborne passive microwave sensors to assess the accuracy of AMSR-E's spaceborne measurements. The campaign consisted of a series of aircraft flights over melting arctic ice, using the Polarimetric Scanning Radiometer (PSR/A or PSR/C denoting analog or C band frequency, respectively), during June and July 2000. The PSR was the first airborne scanned polarimetric imaging radiometer for post-launch satellite calibration and validation of passive microwave sensors. The aircraft also carried the Scanning Low-Frequency Microwave Radiometer (SLFMR) and Infrared (IR) scanning radiometer. The objective of the campaign was to quantify the errors in proposed AMSR-E sea ice algorithms from the presence of melting ponds on the pack ice surface. Melt ponds were currently the largest source of error in determining arctic sea ice concentrations using satellite passive microwave sensors. A secondary objective of Meltpond2000 was to develop a microwave capability to discriminate between melt ponds and open sea water. Dr. Donald J. Cavalieri was the Chief Scientist for the campaign, and it was funded by multiple agencies.

3 CLPX

The NASA Cold Land Processes Field Experiment (CLPX) was conducted in the central Rocky Mountains of the western United States and focused on developing quantitative understanding, models, and measurements necessary to extend our local-scale understanding of water fluxes, storage, and transformations to regional and global scales. The experiment emphasized the development of a strong synergism between process-oriented understanding, land surface models, and microwave remote sensing by using a multi-sensor, multi-scale approach. During the CLPX campaigns, intensive ground, airborne, and spaceborne observations were collected. Data collection occurred during two seasons: mid-winter, when conditions are generally frozen and dry, and early spring, a transitional period when both frozen and thawed, and dry and wet conditions are widespread. CLPX was conducted in the central Rocky Mountains of the western United States where large physiographic gradients provided a rich array of different terrain, snow, soil, and ecological characteristics. For more information, see the [CLPX website](#).

4 AMSRICE03

AMSRIce03 was an additional sea ice campaign with the objective to compare field, airborne, and other satellite data to validate and improve existing sea ice retrieval algorithms for the AMSR-E instrument. The campaign, headed by Don Cavalieri, was conducted over a three-week period in March 2003. Both ground and aircraft measurements were taken in the Chukchi and Beaufort Seas of the Arctic Ocean, and in Elson Lagoon off the northern coast of Alaska, USA.

5 AMSRICE06

The AMSRice06 campaign, headed by Don Cavalieri, was conducted over a one-week period in March 2006. Joint ground and aircraft measurements of snow and sea ice were taken over the Chukchi and Beaufort Seas of the Arctic Ocean. The objectives of the experiment were to compare field, airborne, and other satellite data to validate and improve existing snow depth on sea ice retrieval algorithms for the AMSR-E instrument. For more information and campaign maps, visit the Goddard Space Flight Center (GSFC) [Sea Ice Remote Sensing: Arctic 2006](#) web page

6 WEST ANTARCTIC SEA ICE CAMPAIGN

The West Antarctic Sea Ice Campaign included passive microwave measurements of sea ice concentration from the ship Laurence M. Gold as well as aircraft-based measurements. The campaign began in Punta Arenas, Chile, and progressed to the Bellinghausen and Weddell Seas.

Dr. Konrad Steffen led the ship campaign, which monitored sea ice surface at various passive microwave frequencies to obtain brightness temperatures. Figure 3 shows graduate students Russell Huff and Nicolas Cullen from the University of Colorado as they make ice thickness validation measurements on small ice floes using an EM31 (electromagnetic induction) sensor. The photograph was taken by Dr. Steffen from a small boat that launched from the research ship shown in the background.



Figure 3. Researchers measuring the sea ice thickness of small ice floes during the West Antarctic Sea Ice Campaign. The research ship Lawrence M. Gold is shown in the background. Image courtesy of Dr. Konrad Steffen. All rights reserved.

The West Antarctic Sea Ice Campaign was carried out from 14 August through 4 September 2003. The map in Figure 4 indicates the area that the ship study covered. Note the brown tip of South America on the left side of the map.

The aircraft-based campaign was headed by Dr. Joey Comiso from 14 August through 15 September 2003. The aircraft study was to have encompassed a larger area than the ship campaign, as shown in Figure 5; however, mechanical problems forced cancellation of this part of the mission.

For more information, see Dr. Comiso's [AMSR-E Sea Ice Parameters and Validation Studies](#).

Note: NSIDC does not archive any West Antarctic Sea Ice Campaign data.

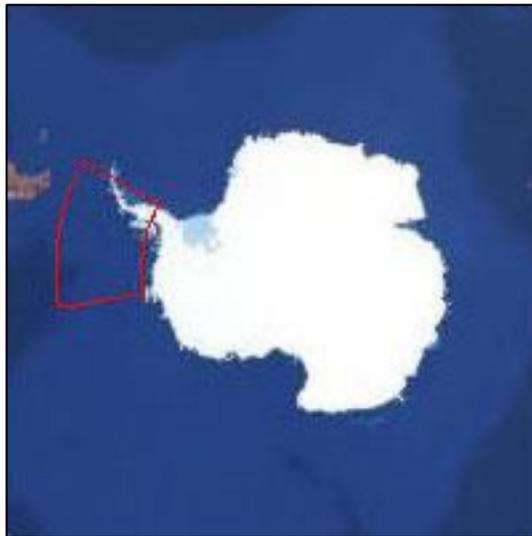


Figure 4. Study Area by Ship Red line indicates the ship-based study area of the West Antarctic Sea Ice Campaign. Image courtesy of NSIDC.

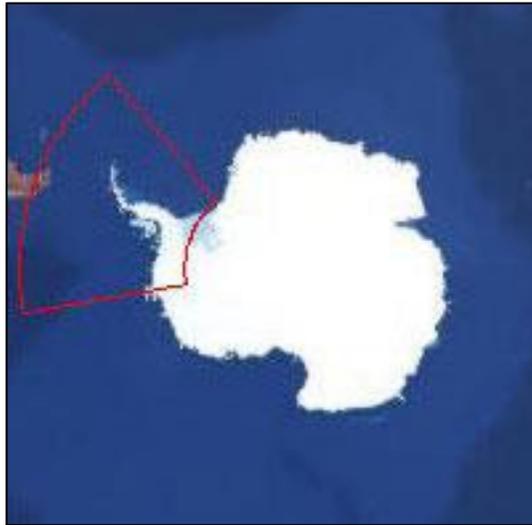


Figure 5. Study Area by Air Red line indicates the aircraft-based study area of the West Antarctic Sea Ice Campaign. Image courtesy of NSIDC.

7 EAST ANTARCTIC SEA ICE CAMPAIGN

The East Antarctic Sea Ice Campaign was a collaborative project focused on using surface, near-surface, and various satellite data in order to assess the accuracy of AMSR-E satellite data and AMSR-E derived sea ice products, namely sea ice concentration, snow cover thickness and ice-surface temperature products. It incorporated the use of aerial cameras and thermal infrared radiometers in the assessment of sea ice concentration. The experiment was also designed to inform modeling and sensitivity studies.

The project's Principal Investigator, Dr. Rob Massom, of the Antarctic Climate and Ecosystems (ACE) Cooperative Research Centre at the University of Tasmania, led the ship campaign onboard

the Australian icebreaker Research Vessel (R/V) Aurora Australis. The campaign was conducted from 11 September 2003 to 30 October 2003, with much of October 2003 dedicated solely to AMSR-E sea ice validation. Field experiments involved in situ data collection and helicopters equipped with aerial cameras, thermal infrared (IR) radiometers, and electromagnetic induction systems. The project also incorporated radiative transfer modeling and sensitivity studies.

The data collection strategy for the sea ice component of the campaign was to obtain measurements within a 75 by 100 km sampling grid in order to approximate the locations of AMSR-E 12.5 km and 25 km data product pixels, the locations of which were tracked by buoys for the entire experiment to account for ice drift. In addition, thermistor strings attached to several buoys provided additional data on the temporal variability of air, ice, and snow temperature.

Figure 6 shows the approximate area covered by the sea ice component of the campaign. For more details regarding this voyage of the R/V Aurora Australis, refer to the "2003/04 V1 - ARISE" page on the [Australian Antarctic Data Centre \(AADC\)](#) web site.

Note: NSIDC does not archive the East Antarctic Sea Ice Campaign data. See the [AADC web site](#) for access to these data.



Figure 6. Map is SSMI EASE-GRID South 12.5 KM resolution, 1:2 scale. The map was created using NSIDC's former JazPanel tool.

8 REFERENCES AND RELATED PUBLICATIONS

- [AMSR-E at NSIDC](#)
- [NOAA's PSR Instrument Description](#)
- [NOAA's Earth System Research Laboratory \(ESRL\)](#)
- [The Australian Antarctic Program](#)

- [The Antarctic Climate & Ecosystems \(ACE\) Cooperative Research Centre \(CRC\)](#)
- Cavalieri, D., M. Thorsten, J. Maslanik, M. Sturm, and L. Elena. (2006). March 2003 EOS Aqua AMSR-E Arctic Sea ice field campaign. *Geoscience and Remote Sensing, IEEE Transactions on Remote Sensing*, 44. 3003 - 3008. DOI: 10.1109/TGRS.2006.883133.

9 DOCUMENT INFORMATION

9.1 Publication Date

09 January 2015

9.2 Date Last Updated

02 March 2021