CLASIC07 PALS Backscatter Data, Version 1

USER GUIDE

How to Cite These Data

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

Yueh, S. 2015. *CLASIC07 PALS Backscatter Data, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/75ZB400QV98N. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/CL07PLBK

National Snow and Ice Data Center

TABLE OF CONTENTS

1 DETAILED DATA DESCRIPTION

This data set contains backscatter data obtained by the Passive Active L-band System (PALS) microwave aircraft radar instrument as part of the Cloud and Land Surface Interaction Campaign 2007 (CLASIC07).

1.1 Format

The following table provides descriptions for each column in the ASCII data files. An associated Extensible Markup Language (XML) metadata file is also provided for each data file.

Table 1. Data Column Descriptions

Column Number	Description
1	Time (hour after local midnight)
2	Latitude [°]
3	Longitude [°]
4	Incidence angle [°]
5	VV normalized radar cross-section [dB]
6	HH normalized radar cross-section [dB]
7	HV normalized radar cross-section [dB]
8	VH normalized radar cross-section [dB]

1.2 File and Directory Structure

Data files are available at:

https://n5eil01u.ecs.nsidc.org/SMAP_VAL/CL07PLBK.001/

1.3 File Naming Convention

Files are named according to the following convention, and as described in Table 2.

`CL07PLBK_MMDDADrdr.txt`

Where:

Table 2. File Naming Convention

Variable	Description
CL07PLBK	Data Set ID
MM	2-Digit Month
DD	2-Digit Day
AD	2-Character Area Designation (LW: Little Washita, FC: Fort Cobb)
rdr	radar
.txt	Indicates this is a text file

Example: `CL07PLBK_0611LWrdr.txt`

1.4 File Size

Files range in size from approximately 80 to 400 KB.

1.5 Volume

The total volume for this data set is approximately 4.14 MB.

1.6 Spatial Coverage

Southernmost Latitude: 34.91°N

Northernmost Latitude: 35.21°N

Westernmost Longitude: 98.70°W

Easternmost Longitude: 97.75°W

1.7 Spatial Resolution

The 3dB spatial resolutions of the instruments at two potential altitudes are 350 m (1000 m altitude, minimum for the radar operation) and 1100 m (3000 m, maximum).

1.8 Projection

Longitude and latitude are in World Geodetic System 1984 (WGS84) coordinates.

1.9 Temporal Coverage and Resolution

Data were collected every one to seven days from 11 June 2007 through 07 July 2007.

1.10 Parameter or Variable

Parameters include normalized radar cross-section (dB) and incidence angle (°)

1.10.1 Parameter Range

Valid parameter values are as follows:

Normalized radar cross-section: -40 – 0 dB
Incidence angle: 30° – 50°
Fill value for missing data: ****** or -inf

2 SOFTWARE AND TOOLS

Any word-processing program or Web browser is sufficient for viewing the ASCII text files.

3 DATA ACQUISITION AND PROCESSING

3.1 Theory of Measurements

Current microwave models and retrieval algorithms have significant limitations in their treatment of different vegetation types and heterogeneous scenes (mixtures of grass, crops, trees, streams, lakes) and quantitative treatment of algorithm scaling and error analysis for such heterogeneous scenes. Measurements over wide varieties of terrain are needed, with joint active and passive sensors, to develop algorithms and parameterizations that can work across all terrain types, and extract optimum information from the combined data. This will have direct impact on the design of dedicated soil moisture missions and development of methods to assimilate such data into land surface models.

Microwave radiometry and radar are well-established techniques for surface remote sensing. Combining passive and active sensors provides complementary information contained in the surface emissivity and backscatter signatures, which can improve the accuracy of retrieval of geophysical parameters. Over land, it has been demonstrated that the radiometer and the radar both provide information for estimating soil moisture and vegetation water content (Bolten et al. 2003, Njoku et al. 2002, Narayan et al. 2004).

3.2 Sensor or Instrument Description

The campaign deployed the Jet Propulsion Laboratory (JPL), with NASA support, designed, built and tested precision Passive Active L-band System (PALS) microwave aircraft instrument for measurements of soil moisture and ocean salinity (Wilson et al. 2001). PALS provides radiometer products, vertically and horizontally polarized brightness temperatures, and radar products, normalized radar backscatter cross-section for V- transmit/V-receive, V-transmit/H-receive, H-transmit/H-receive, and H-transmit/V-receive. In addition, it can also provide the polarimetric third Stokes parameter measurement for the radiometer and the complex correlation between any two of the polarized radar echoes (VV, HH, HV and VH). The following table provides the key characteristics of PALS:

Table 3. Description of the PALS instrument

Passive	Frequency	1.413 GHz
	Polarization	V, H, +45, -45
	Calibration stability	1 K (bias); 0.2 K (stability)
Active	Frequency	1.26 GHz
	Polarization	VV, HH, VH, HV
	Calibration accuracy	<2 dB (bias); 0.2 dB (stability)
Antenna	Half Power Beamwidth	20° (passive); 23°(active)
	Beam Efficiency	94%
	Directivity	18.5 dB
	Polarization isolation	> 35 dB

PALS was flown in two major soil moisture experiments (SPG99, SMEX02) before deployment in CLASIC. Beginning with CLASIC, a new flat-panel antenna array was substituted for the large horns. The planar antenna consists of 16 stacked-patch microstrip elements arranged in four-by-four array configurations. Each stacked-patch element uses a honeycomb structure with extremely low dielectric loss at L-band to support the ground plane and radiating patches. The measured antenna pattern shows better than 35 dB polarization isolation, far exceeding the need for the polarimetric measurement capability. This compact, lightweight antenna has enabled PALS to transition to operating on small aircraft, such as the Twin Otter.

PALS was mounted at a 40° incidence angle looking to the rear of the aircraft. The 3dB spatial resolutions of the instruments at two potential altitudes are 350 m (1000 m altitude, minimum for the radar operation) and 1100 m (3000 m, maximum). It is important to note that PALS provides a single beam of data along a flight track and that any mapping must rely upon multiple flight lines at a spacing of the footprint width.

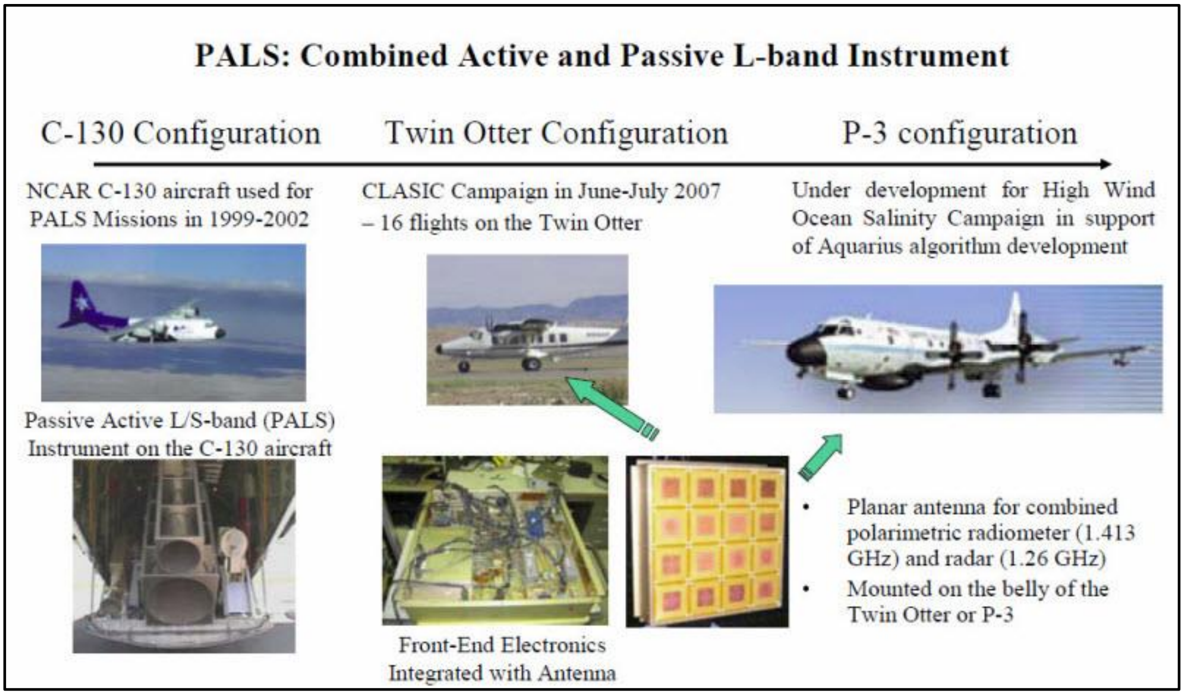

Figure 1. Images of Three Different Aircraft Installations of the PALS Combined Active and Passive L-band Instrument

3.3 Error Sources

There are no exceptional error sources for this data set.

3.4 Quality Assessment

The quality of the normalized radar cross-section relies on an internal calibration utilizing a calibration loop. The external calibration utilizes predetermined coefficients of the antenna and front-end. These references assure good quality of the data.

4 REFERENCES AND RELATED PUBLICATIONS

Bolten, J., V. Lakshmi, and E. Njoku. 2003. Soil Moisture Retrieval Using the Passive/Active L- and S-band Radar/Radiometer. *IEEE Trans. Geosci. Rem. Sens.,* 41:2792-2801.

Narayan, U., V. Lakshmi, and E. Njoku. 2004. Retrieval of Soil Moisture from Passive and Active L/S Band Sensor (PALS) Observations during the Soil Moisture Experiment in 2002 (SMEX02). *Rem. Sens. Environ.*, 92:483-496.

Njoku, E., W. Wilson, S. Yueh, S. Dinardo, F. Li, T. Jackson, V. Lakshmi, and J. Bolten. 2002. Observations of Soil Moisture Using a Passive and Active Low Frequency Microwave Airborne Sensor during SGP99. *IEEE Trans. Geosci. Rem. Sens.*, 40:2659-2673.

Wilson, W. J., S. H. Yueh, S. J. Dinardo, S. Chazanoff, F. K. Li, and Y. Rahmat-Samii. 2001. Passive Active L- and S-band (PALS) Microwave Sensor for Ocean Salinity and Soil Moisture Measurements. *IEEE Trans. Geosci. Rem. Sens*. 39, 1039-1048.

5 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Publication Date

June 2015

6.2 Date Last Updated

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