SMAPVEX12 PALS Backscatter Data, Version 1

USER GUIDE

How to Cite These Data

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

Colliander, A. 2014. SMAPVEX12 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/KQC0KOL4DK1I. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SV12PLBK/

National Snow and Ice Data Center

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1 DATA DESCRIPTION

This data set contains backscatter data obtained by the Passive Active L- and S-band (PALS) microwave aircraft instrument. The data were collected as part of the Soil Moisture Active Passive Validation Experiment 2012 (SMAPVEX12).

1.1 Parameters

The parameter for this data set is normalized radar cross-section (dB). Valid parameter values range between -40 and 0 dB.

1.2 File Information

1.2.1 Format

Data are provided in 32 ASCII text files (two files for each day in which data were collected). Table 1 provides descriptions for each column in the data files:

Table 1. Contents of Data Fields

Column Number	Description
1	UTC time in seconds
2	Latitude of the boresight (footprint center) [°]
3	Longitude of the boresight [°]
4	UTM x-coordinate of the boresight [m]
5	UTM y-coordinate of the boresight [m]
6	VV normalized radar cross-section [dB]
7	HH normalized radar cross-section [dB]
8	HV normalized radar cross-section [dB]
9	VH normalized radar cross-section [dB]
10	Heading uncertainty flag [0/1]

1.2.2 Naming Convention

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

`SV12PLBK_PALS_S0_2012MMDD_[Hi/Lo]Alt_vXXX.txt`

Where:

Table 2. File Naming Convention

Variable	Description
SV12PLBK	Data Set Short Name
PALS	Passive Active L- and S-band (PALS) data
S0	Sigma Nought (dB)
2012	2012 (representing SMAPVEX12 campaign)
MM	2-Digit Month
DD	2-Digit Day
[Hi/Lo]Alt	Indicates whether this is a high- or low-altitude file
vXXX	Data version (v101 = version 1.01)
.txt	Indicates this is an ASCII text file

Example: `SV12PLBK_PALS_S0_20120629_LoAlt_v101.txt`

1.3 Spatial Information

1.3.1 Coverage

Southernmost Latitude: 49.44°N

Northernmost Latitude: 49.96°N

Westernmost Longitude: 98.51°W

Easternmost Longitude: 97.85°W

1.3.2 Resolution

The low-altitude radiometer footprint size is approximately 500 m, and the high-altitude radiometer footprint size is approximately 1500 m.

1.3.3 Projection

Data are provided in Universal Transverse Mercator (UTM), Zone 14 N, World Geodetic System 1984 (WGS84) coordinates.

1.4 Temporal Information

1.4.1 Coverage

Data were collected every 1 to 5 days from 07 June 2012 through 19 July 2012.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

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).

2.2 Quality, Errors, and Limitations

2.2.1 Error Sources

When the aircraft heading uncertainty flag is set to 1 the uncertainty of the boresight geolocation exceeds the nominal. The uncertainty in the heading of the aircraft was caused by drifting navigation unit. Except for the very first days of the campaign this drift was compensated for.

2.2.2 Quality Assessment

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

2.3 Instrumentation

2.3.1 Description

The campaign deployed by the Jet Propulsion Laboratory (JPL), with NASA support, designed, built and tested a precision Passive/Active L/S-band (PALS) 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, including 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). Table 3 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

The PALS instrument was flown in four major soil moisture experiments (SGP99, SMEX02, CLASIC and SMAPVEX08 [Colliander et al. 2012]) before deployment in SMAPVEX12. 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 a 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 33 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 (Yueh et al. 2008).

PALS was mounted at a 40° incidence angle looking to the rear of the aircraft. The 3dB spatial resolutions of the instrument at the minimum and maximum altitudes are 500 m (1000 m altitude, minimum for the radar operation) and 1500 m (3000 m altitude, maximum for Twin Otter operation without oxygen supply). 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.

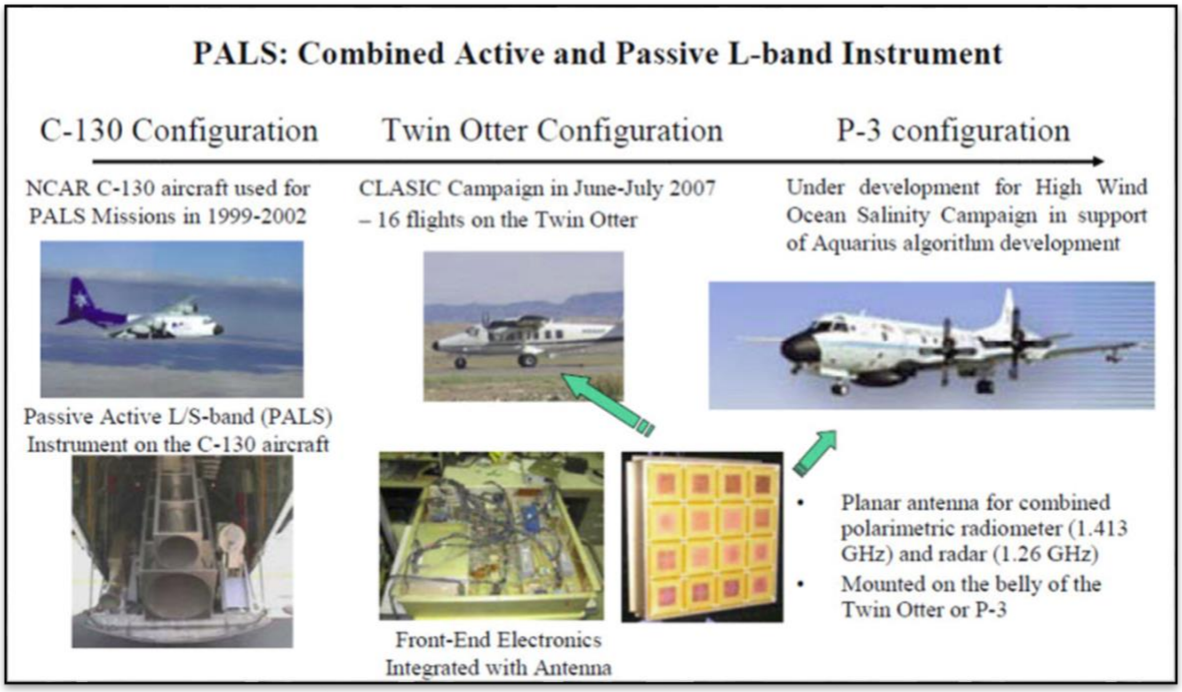

Figure 1. Images of Three Different Aircraft Installations of the PALS Combined Active and Passive L-band Instrument

3 SOFTWARE AND TOOLS

No special tools are required to view these data. Any word-processing program or Web browser will display the data.

4 CONTACTS AND ACKNOWLEDGMENTS

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5 REFERENCES

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6 DOCUMENT INFORMATION

6.1 Publication Date

October 2013

6.2 Date Last Updated

28 October 2020