SMAPVEX15 PALS Brightness Temperature Data, Version 1

USER GUIDE

How to Cite These Data

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

Colliander, A. and S. Misra. 2017. *SMAPVEX15 PALS Brightness Temperature Data, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/50DIUMRHN5E1. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SV15PLTB

National Snow and Ice Data Center

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1 DATA DESCRIPTION

This data set contains brightness temperatures obtained by the Passive Active L-band System (PALS) microwave aircraft instrument. The data were collected as part of the Soil Moisture Active Passive Validation Experiment 2015 (SMAPVEX15).

1.1 Parameters

Parameters include vertically and horizontally polarized brightness temperature [K] and infrared surface temperature [°C].

Valid parameter values are the following:

Vertically polarized brightness temperature (TAV): 50.0 - 350.0 K
Horizontally polarized brightness temperature (TAH): 50.0 - 350.0 K
Infrared surface temperature (TIR): 0.0 - 50.0° C
Fill value for missing data: -9999

1.2 File Information

1.2.1 Format

Table 1 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 Description

Column Heading	Description
Date	4-digit year, 2-digit month, 2-digit day (YYYYMMDD)
LAT	Latitude of the boresight (footprint center) [°]
LON	Longitude of the boresight (footprint center) [°]
TAV	Vertically polarized brightness temperature [K]
TAH	Horizontally polarized brightness temperature [K]
TIR	Infrared surface temperature [°C]
sec	Seconds since the start of the day [Coordinated Universal Time (UTC)]

1.2.2 Directory Structure

Data files are available on the HTTPS site at: https://n5eil01u.ecs.nsidc.org/SMAP_VAL/SV15PLTB.001/

Within this directory files are organized in subdirectories by date, such as 2015.08.02. Dates are given in four-digit year, two-digit month, and two-digit day format.

1.2.3 Naming Convention

Files are named according to the following convention, and as described in the table below:

`PALS_TA_WG_M500_vXXX_YYYYMMDD_[scan].txt`

Where:

Table 2. Contents of Data Fields

Variable	Description
PALS	Passive Active L-band System (PALS) data
TA	Antenna Temperature
WG	Walnut Gulch
M500	500 m (grid resolution)
vXXX	Data Version (v040: Version 0.40)
YYYYMMDD	4-digit year, 2-digit month, 2-digit day
[scan]	Indicates the part of the conical scan included in the processing (fore, aft, both)
.txt	Indicates this is an ASCII text file

Example: `PALS_TA_WG_M500_v040_20150813_both.txt`

1.3 Spatial Information

1.3.1 Coverage

Southernmost Latitude: 31.51°N

Northernmost Latitude: 31.87°N

Westernmost Longitude: 110.96°W

Easternmost Longitude: 109.84°W

1.3.2 Resolution

The flight altitude of 2300 m results in a footprint size of approximately 1200 m.

1.3.3 Geolocation

1.3.3.1 Projection

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

1.3.3.2 Grid Description

The data map to a 500 m grid that represents the geometry and geolocation information of EASE-Grid 2.0.

1.4 Temporal Information

1.4.1 Coverage and Resolution

Data were collected every two to three days from 02 August 2015 through 16 August 2015.

2 DATA ACQUISITION AND PROCESSING

2.1 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).

2.2 Quality, Errors, and Limitations

The quality of the brightness temperature data relies on internal calibration utilizing matched loads and external calibration exploiting lake surface close to the experiment area. PALS brightness temperature measurements were calibrated as documented in Misra et al. (2017). Overall the correlation with SMAP brightness temperature measurements is very high as shown in Colliander et al. (2017) adding to the reliability of the measurement. The error in the measurement is estimated to be approzimately 2 K.

2.3 Instrumentation

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). 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	0.5 K
Active	Frequency	1.26 GHz
	Polarization	VV, HH, VH, HV
	Calibration stability	0.2 dB
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, CLASIC07 and SMAPVEX08 [Colliander et al. 2012, McNairn et al. 2015]) before deployment in SMAPVEX15. Beginning with CLASIC07, 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 configuration. The measured antenna pattern shows better than 33 dB polarization isolation, far exceeding the need for the polarimetric measurement capability. This compact, lightweight antenna enabled PALS to transition to operating on small aircraft, such as the Twin Otter (Yueh et al. 2008), but also enabled the conical scan operation implemented for the SMAPVEX15 (Colliander et al. 2017).

PALS was mounted at a 40° incidence angle. The 3 dB spatial resolution of the instrument at the flight altitude of 2300 m was approximately 1200 m. 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.

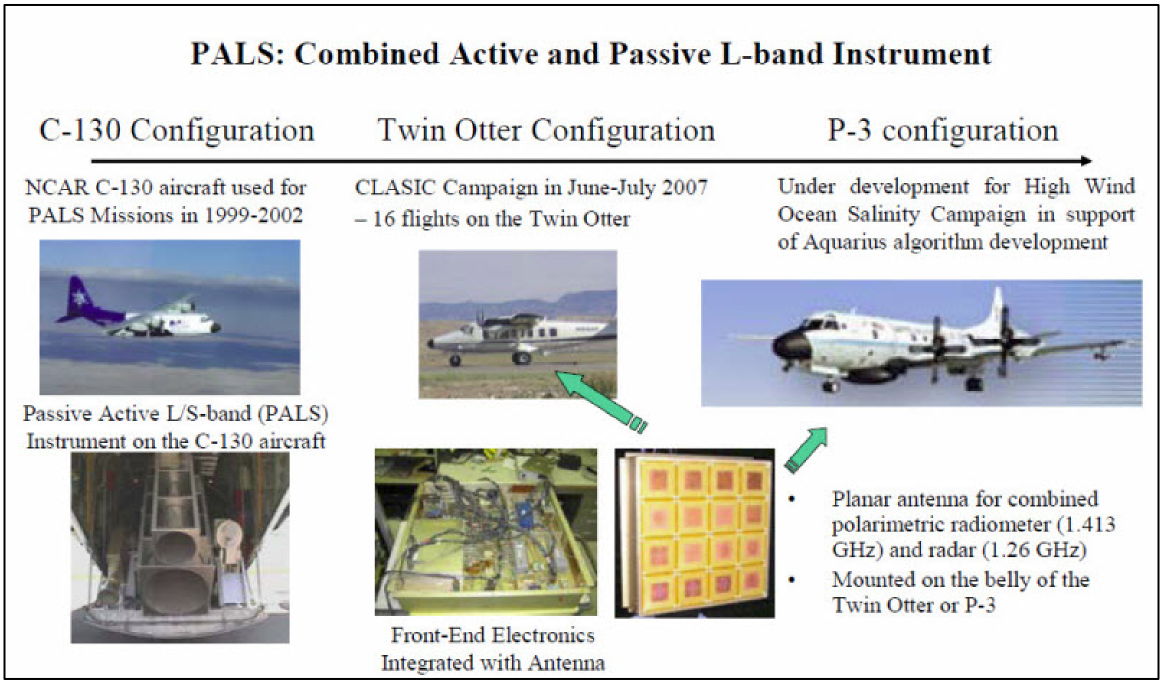

Figure 1. Images of Three Different Aircraft Installations of the
PALS Combined Active and Passive L-band Instrument

For more information, refer to the official PALS* sensor page at the Jet Propulsion Laboratory (JPL).

* The sensor name has been changed from the Passive Active L- and S-band Sensor to the Passive Active L-band System.

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

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5 REFERENCES

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6 DOCUMENT INFORMATION

6.1 Publication Date

August 2017

6.2 Date Last Updated

November 2020