



**Global 25 m Resolution PALSAR Mosaic
and Forest/Non-Forest Map (FNF)
Dataset Description**

**Japan Aerospace Exploration Agency (JAXA)
Earth Observation Research Center (EORC)**

Revision history

Version	Release Date	Revised Content
Initial release	Jan. 18, 2016	-
A	Apr. 28, 2016	Added descriptions about 0.25 deg/1 km resolution datasets to Table 3.1 and Table 5.4
B	Oct. 31, 2016	Added descriptions about JERS-1 SAR global mosaic.
C	Jan. 10, 2017	Added descriptions about JERS-1 SAR yearly mosaic.
D	Apr. 25, 2017	Revised Table 3.1 (Number of tiles, DEM) due to the update of the 2015 and 2016 datasets. Added the lack of the image at the path boundary to Section 6.2.
E	Oct. 2, 2017	Changed some items in Section 7.
F	Apr. 11, 2018	Revised Table 3.1 (Number of tiles) due to added 2017 datasets. Added forest classification in Japan to Section 6.4.
G	Apr. 27, 2018	Modified a description of “2 Overview of the dataset”
H	May 7, 2018	Revised Table 3.1 (Number of tiles) due to added 2017 datasets.
I	Dec. 27, 2019	Revised Table 3.1 (Number of tiles) due to added 2018 datasets.
J	Mar. 31, 2021	Revised Table 3.1 (Number of tiles, DEM) with the addition of the 2019 datasets. Added about CARD4L to Section 4. Added about no observation to Section 6.2. Added about absolute geometric accuracy to Section 6.3.
K	Apr. 9, 2021	Revised Table 3.1 (Number of tiles) with the addition of the 2020 datasets.
L	Feb. 28, 2022	Revised Table 3.1 (Number of tiles) with the update of the 2019 and 2020 datasets.

Version	Release Date	Revised Content
M	Mar. 22, 2022	Revised Table 3.1 (Number of tiles) with the update of the 2017 and 2018 datasets.
N	Apr. 11, 2022	Divided the dataset description to PALSAR and PALSAR-2 and updated the overall content in accordance with the renewal of the processing method of Global 25 m resolution PALSAR-2 mosaic and Forest/Non-Forest Map.
O	Jun. 20, 2022	Revised a description of each section.

1 Overview of the dataset (Ver.1)

The global 25 m resolution PALSAR mosaics (hereinafter referred to as “PALSAR global mosaics”) and forest/non-forest map (hereinafter referred to as “PALSAR FNF”) are free and open dataset generated by JAXA using the L-band Synthetic Aperture Radar (PALSAR) on Advanced Land Observing Satellite (ALOS). The datasets (Ver.1) were released by JAXA in January 2016.

The mosaics were created by assembling long paths of SAR backscatter images observed through JAXA’s global Basic Observation Scenario for PALSAR. Correction of geometric distortions specific to SAR (ortho-rectification) and topographic effects on image intensity (radiometric slope correction) was applied. The mosaics are provided as Gamma-0 backscatter, in geographical (lat/long) coordinates with a pixel spacing of 0.8 arc seconds (approximately 25 meters at the Equator). The temporal interval of the mosaics is annual, with PALSAR mosaics available for the 2007-2010 time period.

The global 25 m resolution JERS-1 (Japanese Earth Resources Satellite-1) SAR mosaic dataset was published on Oct. 31, 2016. This dataset was generated by the same method (Ver.1) as the PALSAR mosaic, using data mainly acquired in 1996.

The PALSAR global forest/non-forest maps (PALSAR FNF) were generated by thresholding the PALSAR global mosaic images (HV polarization backscattering coefficient) so that high and low backscatter pixels were assigned as “forest” (colored in green) and “non-forest” (colored in yellow), respectively. Here, “forest” was defined as the tree covered land with the area larger than 0.5 ha and canopy cover over 10 %, in accordance with the forest FAO definition. Since the radar backscatter from the forest depends on the region (climate zone), the classification of forest/non-forest was conducted by using a region dependent backscatter threshold. The classification accuracy was assessed by using in-situ photographs and high-resolution optical satellite images. Detailed information is described in the documents listed in Section 8, References.

2 Dataset specification

Table 2.1 Dataset Specification (PALSAR)

	25m resolution dataset	100m resolution dataset	0.25deg resolution dataset	1km resolution dataset
Map projection	Geographic coordinates (Latitude/Longitude)			
Datum	ITRF97 + GRS80			
Data unit (one file)	1 deg. grid in latitude-longitude	10 deg. grid in latitude-longitude	1 global image	
Number of pixels for one tile	4500 pixels x 4500 lines	1125 pixels x 1125 lines	1440 pixels x 580 lines (180W/85N - 180E/60S)	43200 pixels x 17400 lines (180W/85N - 180E/60S)
Size of one pixel	0.8 arcsec (approx. 25 m)	3.2 arcsec (approx. 100 m)	0.25 deg (0.25 deg grid)	30 arcsec (approx. 1 km)
Data size	40.5 MB/tile	2.5 MB/tile	816 KB/year	717 MB/year
Content	<ol style="list-style-type: none"> 1. Normalized Radar Backscattering coefficient (Gamma-0) for HH and HV polarizations 2. Observation date image 3. Local incidence angle image 4. Processing mask information image 5. Forest/non-forest classification 	<ol style="list-style-type: none"> 1. Forest/non-forest classification 	<ol style="list-style-type: none"> 1. Forest/non-forest classification 	
Number of tiles	Year 2007: 27,062 Year 2008: 27,163 Year 2009: 27,703 Year 2010: 27,923	Year 2007: 367 Year 2008: 369 Year 2009: 376 Year 2010: 370	Year 2007-2010, 2015-2017: 1 tile/year	
Original SAR data	PALSAR: Fine Beam Dual mode (off-nadir angle 34.3 deg.; HH+HV)			
DEM for processing	SRTM3			
SAR algorithm	Sigma-SAR (IMAGE&MOSAIC), 2015			

Table 2.2 Dataset Specification (JERS-1 SAR)

	25m resolution dataset Global Mosaic	25m resolution dataset Yearly Mosaic (only tropical regions)
Map projection	Geographic coordinates (Latitude/Longitude)	
Datum	ITRF97 + GRS80	
Data unit (one file)	1 deg. grid in latitude-longitude	
Number of pixels for one tile	4500 pixels x 4500 lines	
Size of one pixel	0.8 arcsec (approx. 25 m)	
Data size	40.5 MB/tile	
Content	<ol style="list-style-type: none"> 1. Normalized Radar Backscattering coefficient (HH polarization) 2. Observation date image 3. Local incidence angle image 4. Processing mask information image 	
Number of tiles	Year 1996: 24,540	Year 1993: 2,253 Year 1994: 2,430 Year 1995: 2,660 Year 1996: 3,291 Year 1997: 1,858 Year 1998: 976
Original SAR data	JERS-1 SAR: off-nadir angle 35 deg., resolution 18 m x 24 m, HH polarization	
DEM for processing	SRTM3	
SAR algorism	Sigma-SAR (IMAGE&MOSAIC), 2015	

3 Data list and naming convention

The data list and its file naming conversion are as follows.

- LLLLLLL: latitude/longitude e.g., North latitude 0 degree, East longitude 100 degrees: LLLLLLL = "N00E100"
- YY: year e.g., year 2010: YY = "10"; year 1996: YY = "96"

Table 3.1 Data list, naming convention and format (PALSAR)

Data list	File name	Data type
Backscattering coefficient (HH pol.)	LLLLLLL_YY_sl_HH	16-bit unsigned integer
Backscattering coefficient (HV pol.)	LLLLLLL_YY_sl_HV	16-bit unsigned integer
Observation date	LLLLLLL_YY_date	16-bit unsigned integer
Local incidence angle	LLLLLLL_YY_linci	8-bit unsigned integer
Processing mask information	LLLLLLL_YY_mask	8-bit unsigned integer
Forest/non-forest classification	LLLLLLL_YY_C	8-bit unsigned integer

Table 3.2 Data list, naming convention and format (JERS-1)

Data list	File name (Upper: JERS-1 Global Mosaic, Lower: JERS-1 Yearly Mosaic)	Data type
Backscattering coefficient (HH pol.)	LLLLLLL_YY_sl_HH LLLLLLL_JYY_sl_HH	16-bit unsigned integer
Observation date	LLLLLLL_YY_date LLLLLLL_JYY_date	16-bit unsigned integer
Local incidence angle	LLLLLLL_YY_linci LLLLLLL_JYY_linci	8-bit unsigned integer
Processing mask information	LLLLLLL_YY_mask LLLLLLL_JYY_mask	8-bit unsigned integer

Further descriptions of each data are provided in Section 4.

4 Content of data

4.1 Backscattering coefficient

Data provided as linear amplitude backscatter, and are stored as digital number (DN) in 16-bit unsigned integer format. The DN values can be converted to gamma nought values in decibel unit (dB) using the following equation:

$$\gamma^0 = 10 \log_{10} \langle DN^2 \rangle + CF$$

where, CF is the calibration factor, and the expression within <> is the ensemble square (power) average value (calculated over several pixels to reduce the impact of speckle). The CF values are -83.0 (dB) for the PALSAR mosaic and -84.66 (dB) for the JERS-1 SAR mosaic.

4.2 Observation date image

The pixel digital numbers (DN) in the observation date image represent the number of days after the satellite launch. The launch dates of ALOS and JERS-1 are Jan. 24, 2006 and Feb. 11, 1992, respectively. Observation dates are provided in Universal Coordinated Time (UTC).

PALSAR mosaic example: A DN value of 1760 corresponds to the UTC observation date of November 19, 2010 (24/01/2006 + 1760 days = 19/11/2010).

JERS-1 mosaic example: DN = 1623 → July 22, 1996 (11/01/1992 + 1623 = 22/07/1996).

4.3 Local incidence angle image

The pixel digital numbers (DN) in the local incidence angle image represent the angle, expressed in integer degrees which round the number down after the decimal point, between the ground normal at the pixel location and the SAR antenna. DN values are stored as 8-bit unsigned integer (BYTE).

4.4 Processing mask information image

Table 4.1 shows how to translate values in the mask information image.

Table 4.1 Content of the processing mask information

Value	Category
0	No data
50	Ocean and water
100	Lay over
150	Shadowing
255	Land

4.5 Forest/non-forest classification

The contents of the 25m resolution dataset and the low resolution datasets are shown in Table 4.2, 4.3 and 4.4, respectively. The low resolution datasets were generated from the 25m resolution dataset, and the stored values are the ratio of forest pixels at 25m resolution.

Table 4.2 Content of the 25m resolution forest/non-forest dataset

Value	Category
0	No data
1	Forest
2	Non-forest
3	Water

Table 4.3 Content of the 100m resolution forest/non-forest dataset

Value	Category
1	Water
3	Non-forest (0-9%)
4	Forest (10-25%)
5	Forest (26-50%)
6	Forest (51-75%)
7	Forest (76-100%)

Table 4.4 Content of the 0.25deg / 1km resolution forest/non-forest datasets

Value	Category
0-100	Forest Coverage (0-100%) ^{*1}
200	Water
255	NoData

*1: coverage = (forest pixels) / (all pixels)

5 Other information

5.1 Data generation method and accuracy assessment

In the case of datasets before 2016, detailed information is described in Shimada et al. (2014) listed in Section 8.

5.2 Lack of data

In case of lack of data, "No data" (=0) is stored in the processing mask information. Lack of data may be caused by that data are excluded in the mosaic generation process due to strong ionospheric distortion effects, especially common in tropical regions.

5.3 Backscatter variations over high latitude regions

Differences in mosaic image brightness from path to path may sometimes be observed, in particular over high latitude areas due to variations in backscattering intensity caused by winter observations during frozen/un-frozen conditions. Please note that such backscatter differences may affect the classification of forest/non-forest.

6 Note for data use

- JAXA retains ownership of the dataset. JAXA cannot guarantee any problem caused by or possibly caused by using the datasets.
- Anyone wishing to publish any results using the datasets should clearly acknowledge the ownership of the data in the publication.
- For details on JAXA's site policy and terms of use, please check the following URL:
<https://earth.jaxa.jp/en/data/policy/>

7 FAQ and Contact

If you have any questions regarding the dataset, please refer to the online “Frequently Asked Questions” (FAQ) on https://www.eorc.jaxa.jp/ALOS/en/inquiry/faq_e.htm

For further questions, please contact the Secretariat of the ALOS series Research Group, Earth Observation Research Center (EORC), Japan Aerospace Exploration Agency (JAXA)
E-mail: aproject@jaxa.jp

8 References

- Masanobu Shimada, Takuya Itoh, Takeshi Motooka, Manabu Watanabe, Shiraishi Tomohiro, Rajesh Thapa, and Richard Lucas, "New Global Forest/Non-forest Maps from ALOS PALSAR Data (2007-2010)," Remote Sensing of Environment, 155, pp. 13-31, December 2014. doi.org/10.1016/j.rse.2014.04.014.
- Generation of Global Forest / Non-forest map Using ALOS/PALSAR: (Oct. 21, 2010)
https://www.eorc.jaxa.jp/ALOS/en/dataset/fnf/forestmap_oct2010_e.htm
- PALSAR 10 m mosaic: (Nov. 4, 2010)
https://www.eorc.jaxa.jp/ALOS/en/dataset/fnf/pal_10m_mosaic_e.htm
- Rosenqvist A., Killough B. (2018), “A Layman’s Interpretation Guide to Synthetic Aperture Radar Data.” Committee on Earth Observation Satellites, CEOS.
https://ceos.org/ard/files/Laymans_SAR_Interpretation_Guide_2.0.pdf