



**Global 25m Resolution PALSAR-2/PALSAR Mosaic
and Forest/Non-Forest Map (FNF)
Dataset Description**

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1 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 products 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 products. Added the lack of the image at path boundary to Section 6.2.

2 Overview of the dataset

Global 25m resolution PALSAR-2/PALSAR mosaic and forest/non-forest map are free and open dataset generated by applying JAXA's sophisticated processing and analysis method/technique to a lot of images obtained with Japanese L-band Synthetic Aperture Radars (PALSAR and PALSAR-2) on Advanced Land Observing Satellite (ALOS) and Advanced Land Observing Satellite-2 (ALOS-2).

The global 25m resolution PALSAR/PALSAR-2 mosaic is a seamless global SAR image created by mosaicking SAR images of backscattering coefficient measured by PALSAR/PALSAR-2, where all the path within 10x10 degrees in latitude and longitude are path processed and mosaicked for the sake of processing efficiency. Correction of geometric distortion specific to SAR (ortho-rectification) and topographic effects on image intensity (slope correction) are applied to make forest classification easy. The size of one pixel is approximately 25 meter by 25 meter. The temporal interval of the mosaic is generally 1 year.

The global forest/non-forest map (FNF) is generated by classifying the SAR image (backscattering coefficient) in the global 25m resolution PALSAR-2/PALSAR mosaic so that strong and low backscatter pixels are assigned as "forest" (colored in green) and "non-forest" (colored in yellow), respectively. Here, the "forest" is defined as the natural forest with the area larger than 0.5ha and forest cover over 90%, as same to the FAO definition. Since the radar backscatter from the forest depends on the region (climate zone), the classification of

Forest/Non-forest is conducted by using the region dependent threshold of backscatter. The classification accuracy is checked by using in-situ photos and high-resolution optical satellite images. Detailed information is described in the documents listed in the Section 9, Reference.

Global 25m resolution JERS-1 (Japanese Earth Resources Satellite-1) SAR mosaic dataset is published on Oct. 31, 2016. This dataset is generated by the same method as the PALSAR-2/PALSAR mosaic.

3 Dataset specification

Table 3.1 Dataset Specification (PALSAR-2/PALSAR)

	25m resolution product	100m resolution product	0.25deg resolution product	1km resolution product
Map projection	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)	0.25deg (0.25deg grid)	30arcsec (approx. 1km)
Data size	40.5 MB/tile	2.5 MB/tile	816 KB/year	717 MB/year
Content	<ol style="list-style-type: none"> 1. backscattering coefficient for each polarization 2. Processing mask information 3. Local incidence angle 4. Observation date 5. Forest/non-forest information 	<ol style="list-style-type: none"> 1. Forest/non-forest information 	<ol style="list-style-type: none"> 1. Forest/non-forest information 	
Number of tiles	Year 2007: 27062 Year 2008: 27163 Year 2009: 27703 Year 2010: 27923 Year 2015: 23401 Year 2016: 23105	Year 2007: 367 Year 2008: 369 Year 2009: 376 Year 2010: 370	Year 2007-2010, 2015-: 1 tile/year	
Original SAR data	PALSAR: Fine Beam Dual mode (off-nadir angle 34.3 deg.; HH+HV) PALSAR-2 (for world) : Fine Beam Dual mode (off-nadir angle: F2-5, F2-6, F2-7; HH+HV) PALSAR-2 (for Japan) : Ultra-fine Beam Quad mode (off-nadir angle: FP6-3 to FP6-7, HH+HV+VH+VV)			
DEM for processing	SRTM3 (2007-2010) SRTM1 (2015-)			
SAR algorithm	Sigma-SAR (IMAGE & MOSAIC), 2015			

Table 3.2 Dataset Specification (JERS-1 SAR)

	25m resolution product Global Mosaic	25m resolution product Yearly Mosaic (only tropical regions)
Map projection	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. backscattering coefficient for each polarization 2. Processing mask information 3. Local incidence angle 4. Observation date 	
Number of tiles	Year 1996: 24540	Year 1993: 2253 Year 1994: 2430 Year 1995: 2660 Year 1996: 3291 Year 1997: 1858 Year 1998: 976
Original SAR data	JERS-1 SAR: off-nadir angle 35 deg., resolution 18 mx 24 m, HH polarization	
DEM for processing	SRTM3	
SAR algorism	Sigma-SAR (IMAGE&MOSAIC), 2015	

4 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 degree:
LLLLLLL = "N00E100"
- YY: year e.g., year 2010: YY = "10"
- M: mode ID e.g., Fine Beam: "F", Ultra-fine: "U"
- BB: beam number
- P: number of polarization e.g., Dual: "D", Quad: "Q"
- O: ascending orbit = "A", descending orbit = "D"
- D: right observation = "R", left observation = "L"

Table 4.1 Data list, naming convention and format (PALSAR, PALSAR-2)

Data list	File name (Upper: PALSAR, Lower: PALSAR-2)	Data type
Backscattering coefficient (HH pol.)	LLLLLLL_YY_sl_HH LLLLLLL_YY_sl_HH_MBBPOD	16bit-unsigned
Backscattering coefficient (HV pol.)	LLLLLLL_YY_sl_HV LLLLLLL_YY_sl_HV_MBBPOD	16bit-unsigned
Observation date	LLLLLLL_YY_date LLLLLLL_YY_date_MBBPOD	16bit-unsigned
Local incidence angle	LLLLLLL_YY_linci LLLLLLL_YY_linci_MBBPOD	8bit-unsigned
Processing mask information	LLLLLLL_YY_mask LLLLLLL_YY_mask_MBBPOD	8bit-unsigned
Forest/non-forest information	LLLLLLL_YY_C LLLLLLL_YY_C_MBBPOD	8bit-unsigned

Table 4.2 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	16bit-unsigned
Observation date	LLLLLLL_YY_date LLLLLLL_JYY_date	16bit-unsigned
Local incidence angle	LLLLLLL_YY_linci LLLLLLL_JYY_linci	8bit-unsigned
Processing mask information	LLLLLLL_YY_mask LLLLLLL_JYY_mask	8bit-unsigned

5 Content of data

5.1 Backscattering coefficient

Data are stored as digital number (DN) in unsigned 16 bit. The DN values can be converted to gamma naught values in decibel unit (dB) using the following equation:

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

where, CF is a calibration factor, and $\langle \rangle$ is the ensemble averaging. The CF values are “-83.0 dB” for the PALSAR-2/PALSAR mosaic and “-84.66 dB” for the JERS-1 SAR mosaic.

5.2 Processing mask information

Table 5.1 shows how to translate values in the mask information.

Table 5.1 Content of the processing mask information

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

5.3 Observation date

Observation date is expressed as the date after launching satellite. The launch date of PALSAR, PALSAR-2, and JERS-1 are Jan. 24, 2006, May. 24, 2014, and Feb. 11, 1992, respectively.

5.4 Forest/non-forest information

The contents of the 25m resolution product and low resolution product are shown in Table 5.2 and 5.3, respectively. The low resolution product is generated from the 25m resolution product, and the stored values is the ratio of forest pixels in 25m resolution.

Table 5.2 Content of the 25m resolution forest/non-forest product

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

Table 5.3 Content of the 100m resolution forest/non-forest product

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 5.4 Content of the 0.25deg / 1km resolution forest/non-forest products

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

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

6 Other information

6.1 Data generation method and accuracy assessment

Detailed information is described in Shimada et al. (2014) listed in the Section 9.

6.2 Lack of data

Due to the following reasons, there are “lack of data” in some areas. In this case, “No data” (=0) is stored in the processing mask information.

- Data are excluded in the mosaic generation process due to strong ionospheric

distortion effects, especially in tropical regions.

- The mosaic generation process sometimes generated small missing parts at path boundary. It occurs mainly in the Tian Shan mountain range and in some parts of Australia. We plan to improve the process and update the products in the future.

6.3 Uneven color of mosaic images over high latitude regions

The color of the mosaic image sometimes differs from path to path over high latitude forest areas, which is due to the change of backscattering intensity caused by freezing trees in winter. Please note that this color change may affect the classification of forest/non-forest.

7 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.
- The datasets are provided free of charge, but are available for research and educational purposes only. It is prohibited to use the datasets for commercial, profit-making purposes without JAXA's consent. If users wish to use the datasets for such purposes, please make contact to JAXA.

8 Contact

ALOS-2/ALOS Science Project

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9 Reference

- 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=10.1016/j.rse.2014.04.014.
- Generation of Global Forest / Non-forest map Using ALOS/PALSAR
http://www.eorc.jaxa.jp/ALOS/en/guide/forestmap_oct2010.htm
- PALSAR 10m mosaic
http://www.eorc.jaxa.jp/ALOS/en/guide/pal_10m_mosaic_dl.htm