

EORC global mosaic and FNF map update & PALSAR-2 processing and data provision

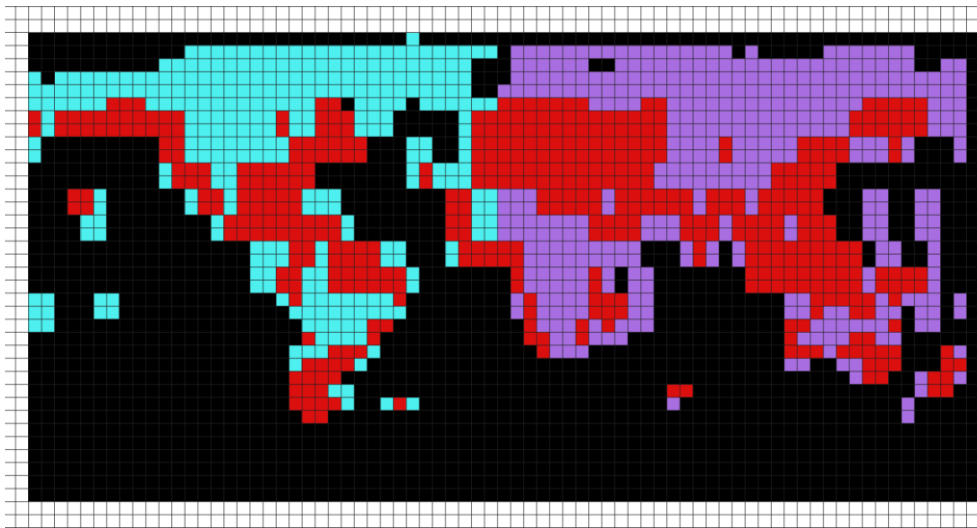
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Takeo Tadono, Masato Hayashi (JAXA)
Masanobu Shimada (TDU)
Ake Rosenqvist (soloEO)*

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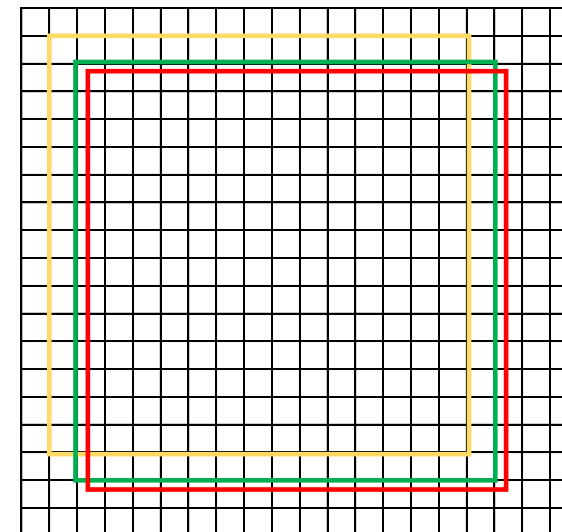
- ✓ Global Mosaic Processing / Re-processing
- ✓ Description of Products for KC
- ✓ Path Image Data Products
- ✓ ScanSAR mosaic Products

Global Mosaic Processing status

- JAXA released the 2018 PALSAR-2 Global Mosaic Map in Dec. 2019.
- Geometric accuracy was enhanced:
 - Revise SAR processing software (Presentation #6 by Dr. Shimada)
 - Fixed bug of RESTEC tile subset tool



Affected Tile by Previous Sigma-SAR



- Original Image
- 1 deg tile range
- True subset range
- Wrong subset range

Tile Subset Error

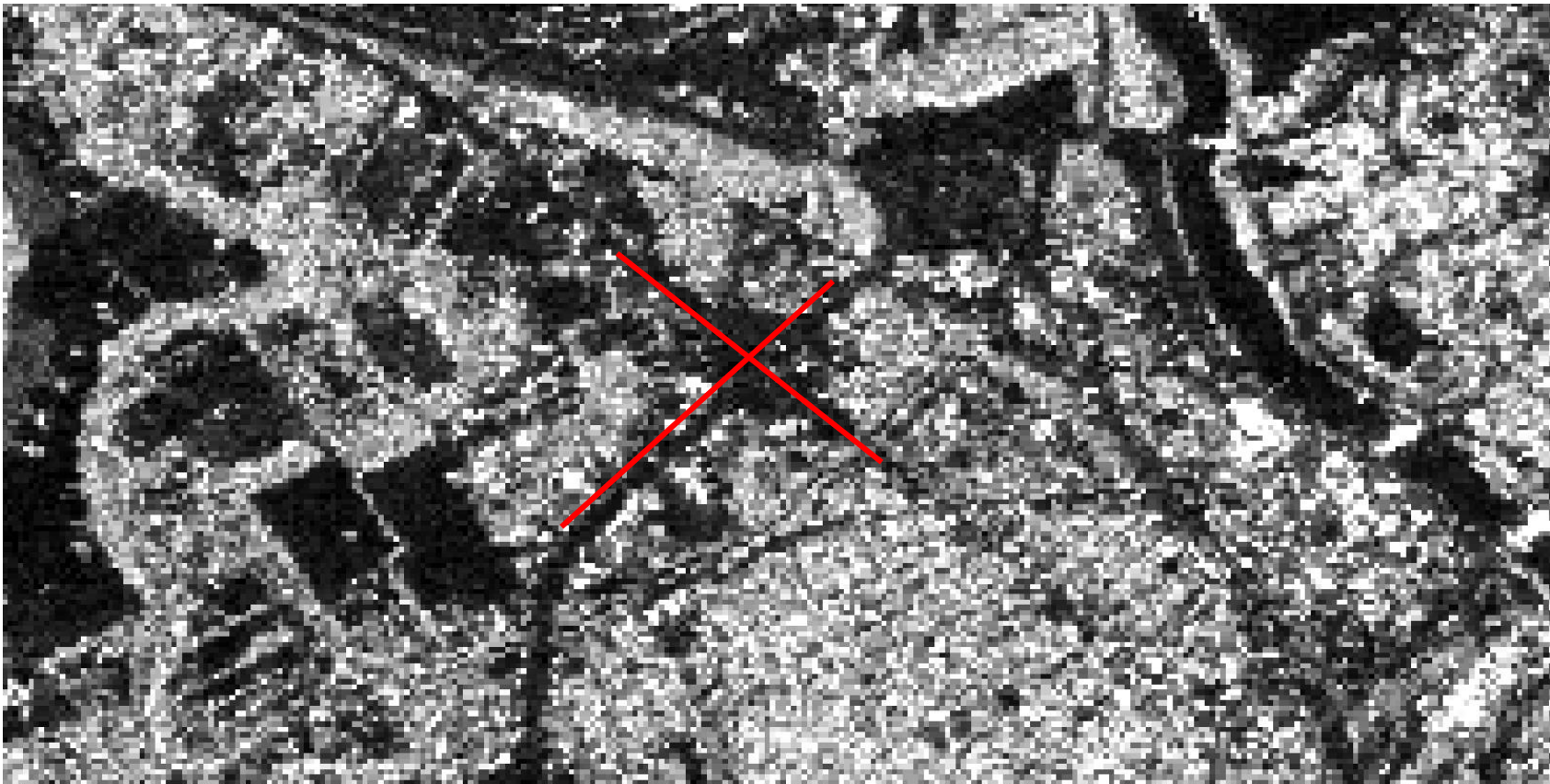
Google Earth Image (Alexandria, Louisiana)



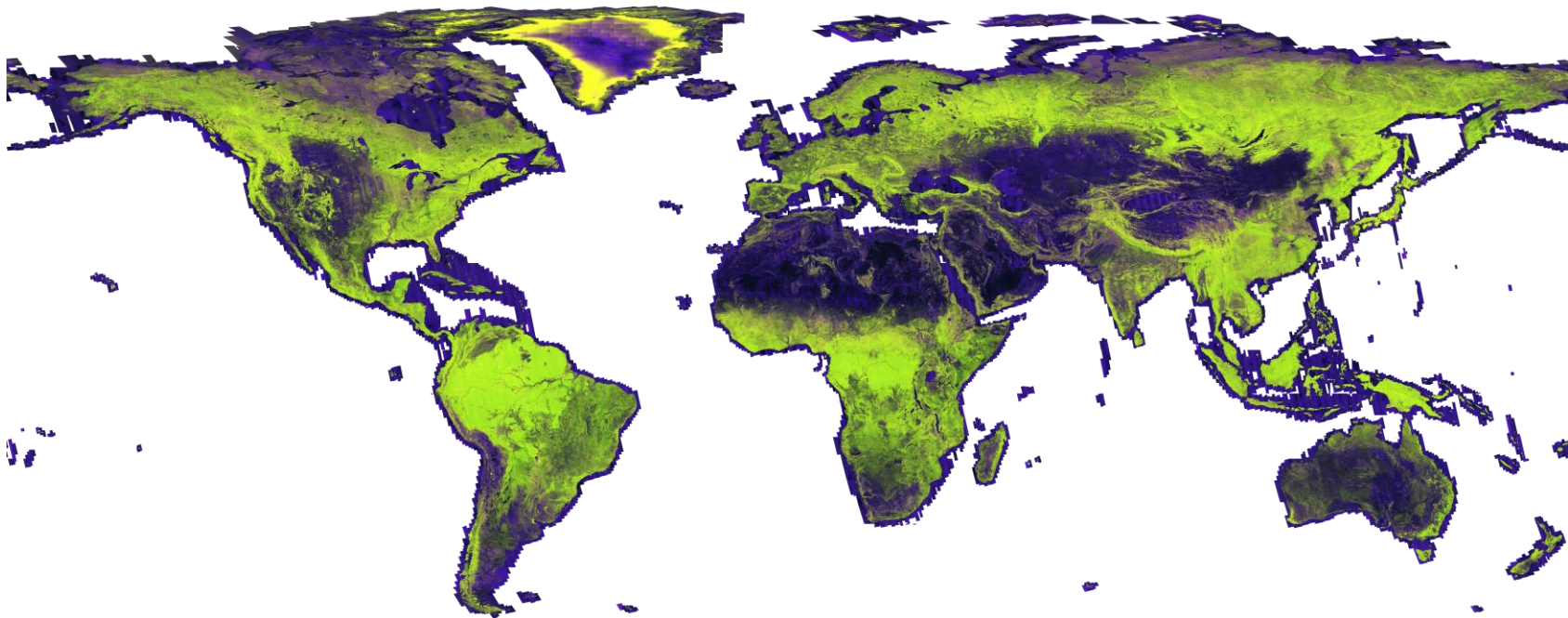
N32W093 (2018 mosaic)



N32W093 (2017 mosaic)

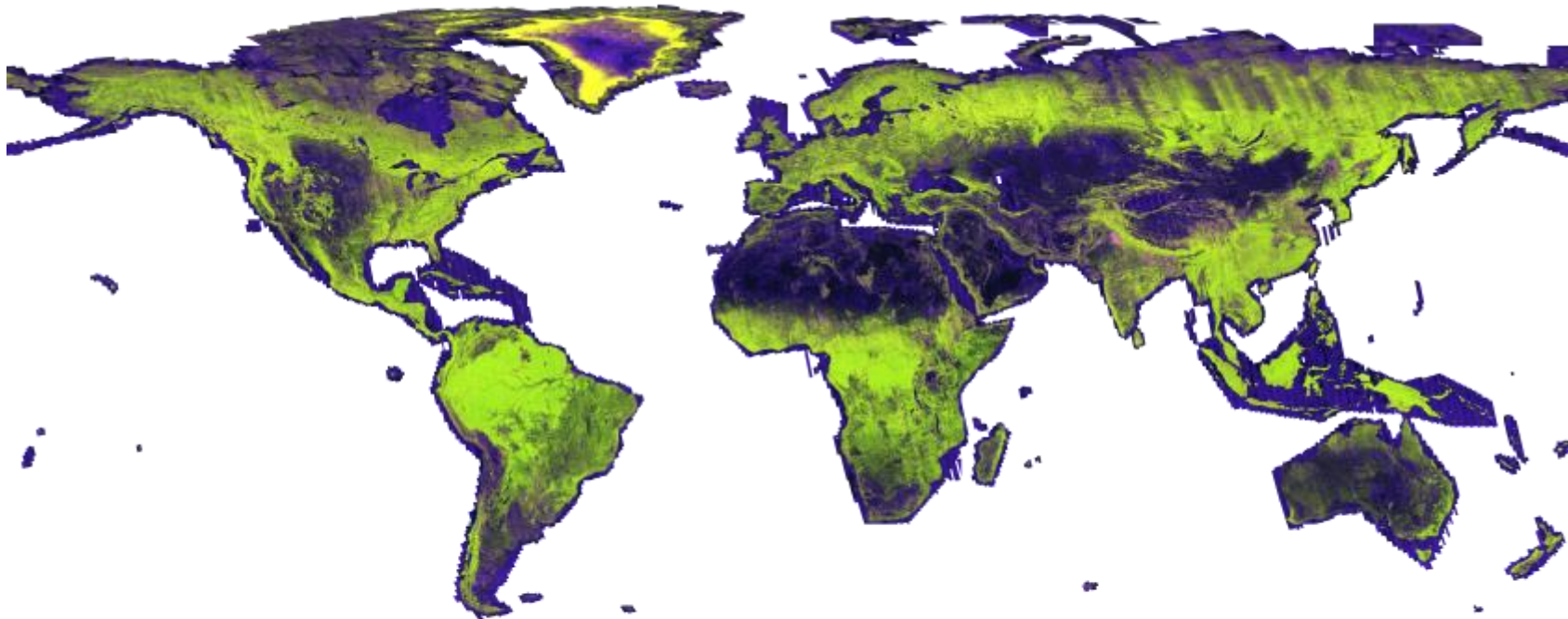


2018 Global mosaic

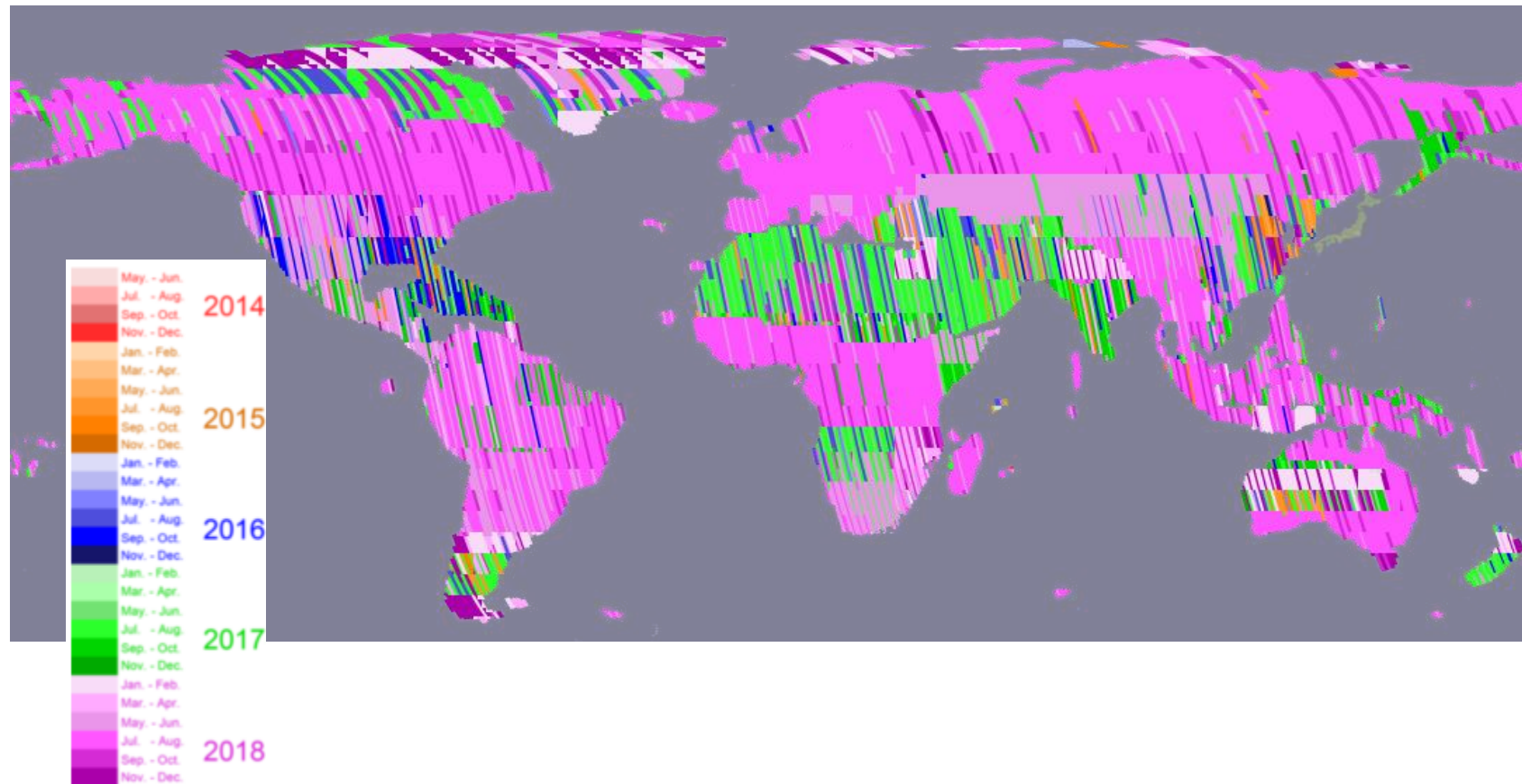


Discontinuity of mosaic image was reduced by using data of summer season in the Northern Hemisphere (May to Sep) preferentially.

2017 Global mosaic

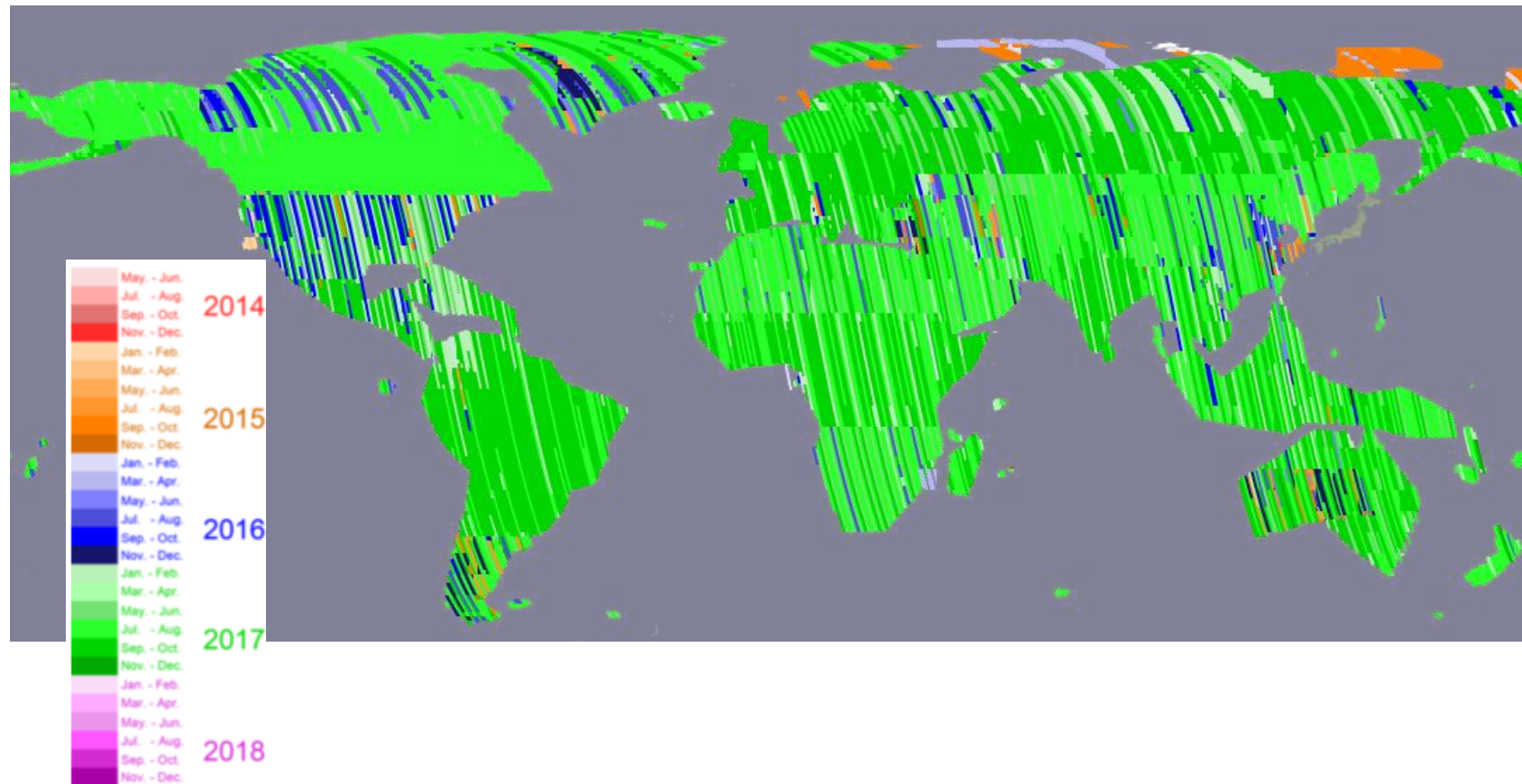


2018 Global mosaic observation date



#Light Color in the date image indicates the early phase of the year.

2017 Global mosaic observation date



#Light Color in the date image indicates the early phase of the year.

PALSAR-2/PALSAR Global Mosaic for CARD4L certification

- *CEOS Analysis Ready Data for Land (CARD4L) are satellite data that have been processed to a minimum set of requirements and organized into a form that allows immediate analysis with a minimum of additional user effort and interoperability both through time and with other datasets.✧*
- PALSAR-2/PALSAR Global Mosaic is candidate for CARD4L Normalised Radar Backscatter (NRB).
- JAXA made self-assessment using Product Family Specification (PFS).
- CARD4L specifications define a minimum (Threshold) and a more stringent (Target) requirement for each parameter, which considered sufficient to render the product ready for analysis or further improves the product quality/usefulness.

1 – General Metadata

CARD4L specs:

The CARD4L NRB specification for general metadata are records describing a distributed collection of pixels that must be contiguous in space and time.

The general metadata should allow the user to assess the overall suitability of the dataset.

JAXA product compliance as of Nov. 2019:

The SAR mosaics meet

- **THRESHOLD** requirements in seven instances
- **TARGET** in nine instances
- **Unknown, not applicable or non-compliance** in three instances

1. Traceability
2. Metadata machine readability
3. Data collection time
4. Geographical area
5. Coordinate reference system
6. Map projection
7. Geometric correction
8. Geometric accuracy
9. Instrument
10. Acquisition parameters
11. Processing parameters
12. Sensor calibration
13. Radiometric accuracy
14. Algorithms
15. Ancillary data
16. Processing chain provenance
17. Data access
18. Overall data quality
19. Performance Indicators

2 – Per-pixel Metadata

CARD4L specs:

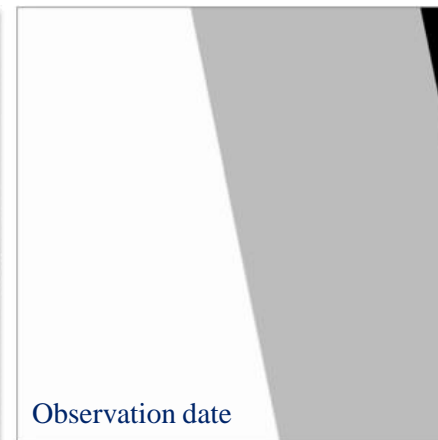
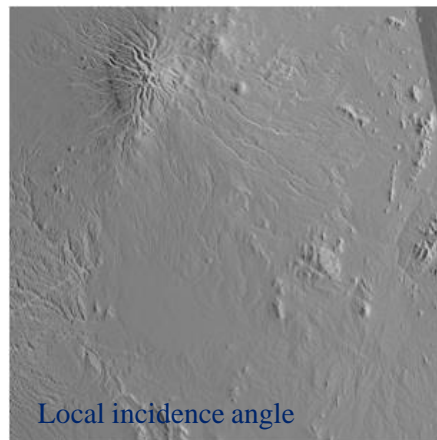
The per-pixel metadata specifications apply to each pixel, provided in a single record relevant to all pixels, or separately for each pixel.

JAXA product compliance as of Nov. 2019:

Per-pixel metadata are provided as image data, with pixel-to-pixel correspondence with the backscatter image data. These include local incidence angle, observation date and data masks for layover, shadowing and no-data.

The SAR mosaics meet

- **THRESHOLD** requirements in one instance
- **TARGET** in four instances
- **unknown, not applicable or non-compliance** in four instances.



Mask (shadow, layover, no-data)

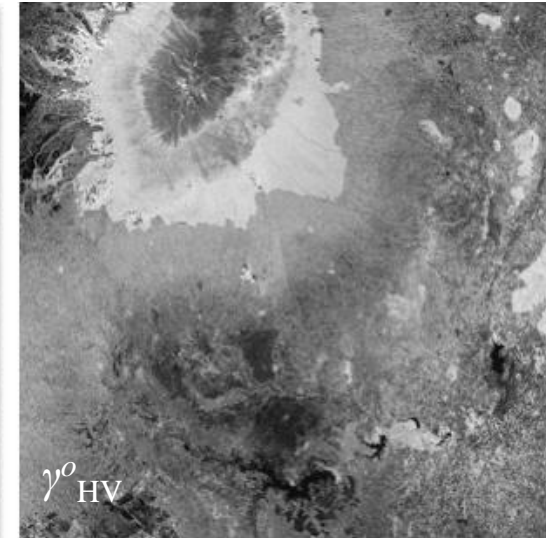


1. Metadata machine readability
2. No data
3. Layover
4. Shadow
5. Local Incidence Angle
6. Global Incidence Angle
7. Digital Elevation Model
8. Noise Equivalent Sigma-0
9. Number of Looks

3 – Radiometric corrections

CARD4L specs:

The requirements for radiometric corrections must be met for all pixels and must lead to normalised measurement(s) of backscatter intensity.



JAXA product compliance as of Nov. 2019 :

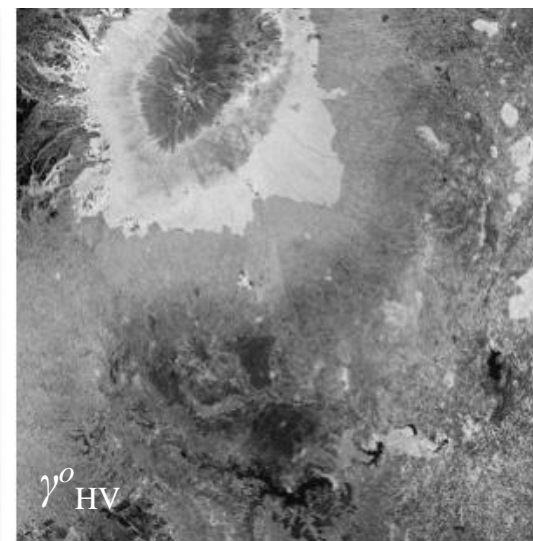
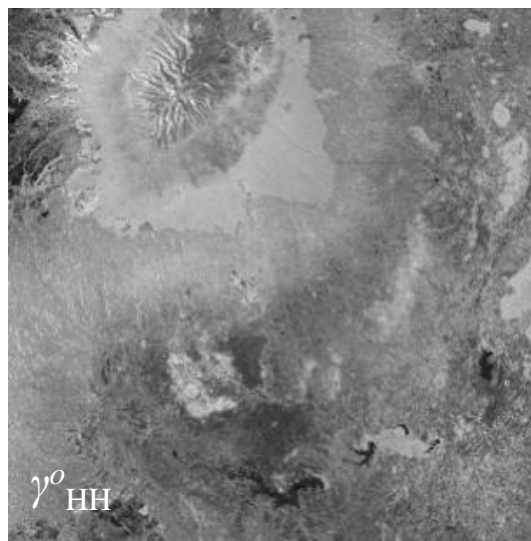
- **Radiometric Terrain Correction** (RTC) has been undertaken to eliminate incidence angle and topographic effects on the backscatter measurements to render γ° using a peer-reviewed algorithm. The backscatter values are given as (2 byte UINT) linear amplitude.
- All three sensors (JERS-1 SAR, PALSAR and PALSAR-2) have been subject to absolute calibration (using corner reflectors and radar transponders) and γ° can be calculated with the standard formula for amplitude data: $\gamma^{\circ} = 10 * \log_{10}(DN^2) + K$
- The global SAR mosaics conform with the CARD4L **TARGET** requirements for radiometric corrections.

4 – Geometric corrections

CARD4L specs:

Relevant metadata relating to geometric accuracy and geometric correction must be provided,

Absolute geolocation at sub-pixel accuracy is required.



JAXA product compliance as of Nov. 2019 :

- The global SAR mosaics are ortho-rectified using a peer-reviewed algorithm, utilizing SRTM Digital Elevation Model. (JERS-1 & ALOS-1: SRTM-90, ALOS-2: SRTM-30) in high-latitude regions ($>60^\circ$ N and S), a public open 3-arcsec global DEM is used.
- The global SAR mosaics are **NOT** compliant with parameter a) (≤ 0.2 pix RMSE pub-pixel accuracy), and meets the **THRESHOLD** requirements for parameters b) and c) (DEM quality and consistency; Gridding/sampling frame consistency)

JAXA product compliance as of Nov. 2019 (1/2)

	Threshold	Target
1. General Metadata		
1.1 Traceability	YES	
1.2 Metadata Machine Readability	YES	
1.3 Data Collection Time	NO	
1.4 Geographical Area		YES
1.5 Coordinate Reference System		YES
1.6 Map Projection		YES
1.7 Geometric Correction		YES
1.8 Geometric Accuracy	NO	
1.9 Instrument	YES	
1.10 Acquisition Parameters		YES
1.11 Processing Parameters		YES
1.12 Sensor Calibration		YES
1.13 Radiometric Accuracy	NO	
1.14 Algorithms		YES
1.15 Ancillary Data		YES
1.16 Processing Chain Provenance	YES	
1.17 Data Access	YES	
1.18 Overall Data Quality	YES	
1.19 Performance Indicators	YES	
1.20 Ionosphere Indicator	NO	

JAXA product compliance as of Nov. 2019 (2/2)

	Threshold	Target
2. Per-Pixel Metadata		
2.1 Metadata Machine Readability	YES	
2.2 No Data		YES
2.3 Layover		YES
2.4 Shadow		YES
2.5 Local Incidence Angle		YES
2.6 Global Incidence Angle	NO	
2.7 Digital Elevation Model	NO (N/A)	
2.8 Noise Equivalent Sigma0	NO	
2.9 Number of Looks	NO	
3. Radiometric Corrections		
3.1 Measurements		YES
3.2 Noise Removal		N/A
3.3 Terrain Corrections		YES
3.4 Accuracy		YES
4. Geometric Corrections		
4.1 Accuracy	NO	

Standardised representation of Metadata

JAXA Global mosaic metadata to be modified to conform with the (suggested) CARD4L metadata file format.

Also modify data format from binary image file + header file to GeoTiff.

```
ENVI
description = {
  File Imported into ENVI.}
samples = 4500
lines = 4500
bands = 1
header offset = 0
file type = ENVI Standard
data type = 12
interleave = bsq
sensor type = Unknown
byte order = 0
map info = {Geographic Lat/Lon, 1.0000, 1.0000, 540000.00000000,
-93600.00000000, 8.0000000000e-01, 8.0000000000e-01, WGS-84, units=Seconds}
wavelength units = Unknown
```



Current

```
<?xml version="1.0" encoding="utf-8"?>
<product Type="Normalized Radar Backscatter">
  <documentIdentifier>CARD4L-NRB v4.0</documentIdentifier>
  <generalMetadata item="1.0">
    <traceability item="1.1"></traceability>
    <metadataMachineReadability item="1.2"></metadataMachineReadability>
    <dataCollectionTime item="1.3">
      <startTime>2017-07-17T00:00:00.000000Z</startTime>
      <stopTime>2017-10-07T00:00:00.000000Z</stopTime>
    </dataCollectionTime>
    <geographicalArea item="1.4">
      <geodeticCoordinate corner="UpperLeft">
        <latitude units="deg">1.00</latitude>
        <longitude units="deg">102.00</longitude>
        <height units="m"></height>
      </geodeticCoordinate>
      <geodeticCoordinate corner="UpperRight">
        <latitude units="deg">1.00</latitude>
        <longitude units="deg">103.00</longitude>
        <height units="m"></height>
      </geodeticCoordinate>
      <geodeticCoordinate corner="LowerLeft">
        <latitude units="deg">0.00</latitude>
        <longitude units="deg">102.00</longitude>
        <height units="m"></height>
      </geodeticCoordinate>
      <geodeticCoordinate corner="LowerRight">
        <latitude units="deg">0.00</latitude>
        <longitude units="deg">103.00</longitude>
        <height units="m"></height>
      </geodeticCoordinate>
    </geographicalArea>
    <coordinateReferenceSystem item="1.5">
      <numLines>4500</numLines>
      <numSamplePerLines>4500</numSamplePerLines>
      <cornerNorth units="m">367200.000</cornerNorth>
      <cornerWest units="m">3600.000</cornerWest>
      <postNorth units="arcsec">8.0000000000e-01</postNorth>
      <postEast units="arcsec">8.0000000000e-01</postEast>
      <ellipsoidName>GRS80</ellipsoidName>
      <ellipsoidRadius units="m">6378137.000</ellipsoidRadius>
      <ellipsoidRecFlattening>298.2572221</ellipsoidRecFlattening>
      <datumName>WGS-84</datumName>
    </coordinateReferenceSystem>
    <mapProjection item="1.6">
      <projectionName>Geographic Lat/Lon</projectionName>
    </mapProjection>
    <geometricCorrection item="1.7">
      <method type="DOI">10.1109/JSTARS.2010.2072984</method>
    </geometricCorrection>
    <geometricAccuracy item="1.8">See item 4.1</geometricAccuracy>
    <Instrument item="1.9">ALOS-2</Instrument>
  </generalMetadata>
</product>
```

Proposed new

Global Mosaic re-processing plan

- Global mosaic metadata to be complemented and/or modified to conform with the (new) CARD4L file formats being developed by the CARD4L SAR group.
- Aim to release 2018 Global Mosaic map fully compliant with the latest CARD4L NRB FPS within this fiscal year.
- Experimentally generate Daily Mosaic map of 2018 for boreal forest area.
 - No observation overlap, user can select which data to use for their research analysis.
- Planning to re-process historical PALSAR-2 Global Mosaic (2015-2017) map until summer in 2020, and PALSAR Global Mosaic (2007-2010) map in the second half of fiscal year 2020.

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Description of Products for KC

	Satellite /sensor	Mode	Area	Pixel Spacing
Path Images	ALOS-2 /PALSAR-2	FBD	As requested	50m
	ALOS /PALSAR	ScanSAR	As requested	100m

	Satellite /sensor	Mode	Area	Pixel Spacing
Mosaic Products	ALOS-2 /PALSAR-2	ScanSAR	SE-Asia Africa Amazon	50m
	ALOS /PALSAR	ScanSAR	SE-Asia Africa Amazon	100m

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Path Images

	FBD	ScanSAR	Total	Remarks
Requests	1,457	1,235	2,692	1,000 path prioritized by K&C members will be processed.
Provision	143	0	143	

Status:

- Received the request in Nov. 2019.
- Number of K&C members who have requested path products:
→ 4 members
- Announce the FTP site soon.

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ScanSAR Mosaic

Status:

- Processing 2019 ScanSAR mosaic data are not started.
 - Geolocation error was found in SAR processing software.
 - Currently under investigation.

Question:

- Which is better to generate ScanSAR mosaic after revise the software, or generate with current version and re-process in the next physical year.

- Please send the requests for mosaic or path products to
Z-ALOS-KC@ml.jaxa.jp
(please check your agreement with JAXA if you can request mosaic or path products)
- For questions regarding standard product data (AUIG-2), please contact the EORC Order Desk
Z-orderdesk@ml.jaxa.jp

Thank you for your attention

Questions?