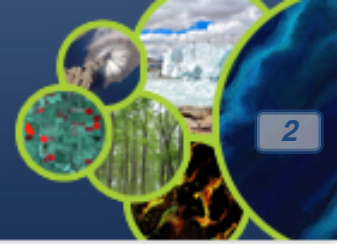# CEOS

Committee on Earth Observation Satellites

CARD4L Product Assessment Process
&
JAXA self-assessment for PALSAR and PALSAR-2 products

Takeo Tadono (JAXA)
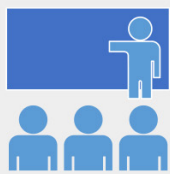Ake Rosenqvist (soloEO) *for* JAXA

WGCV SAR ws @ESA/ERSIN 18-22 Nov 2019

Data Provider

Data provider wants a dataset to be considered as CARD4L

1

LSI-VC

LSI-VC SEC monitors the process and keeps a registry of proposals

LSI-VC SEC adds the dataset/access instructions to the CARD4L webpage

6

CEOS www

Www.ceos.org/ard

LSI-VC SEC connects data provider with a product-specific LSI POC

2

LSI POC approves the review and confirms the CARD4L level

5
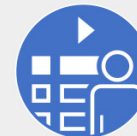
Data Provider

Data provider self-assesses their product using PFS document

3

LSI-VC POC

The LSI POC interacts with data provider and WGCV
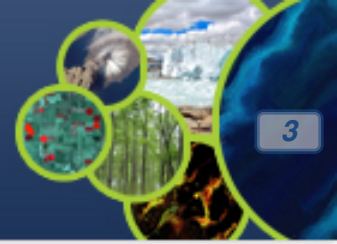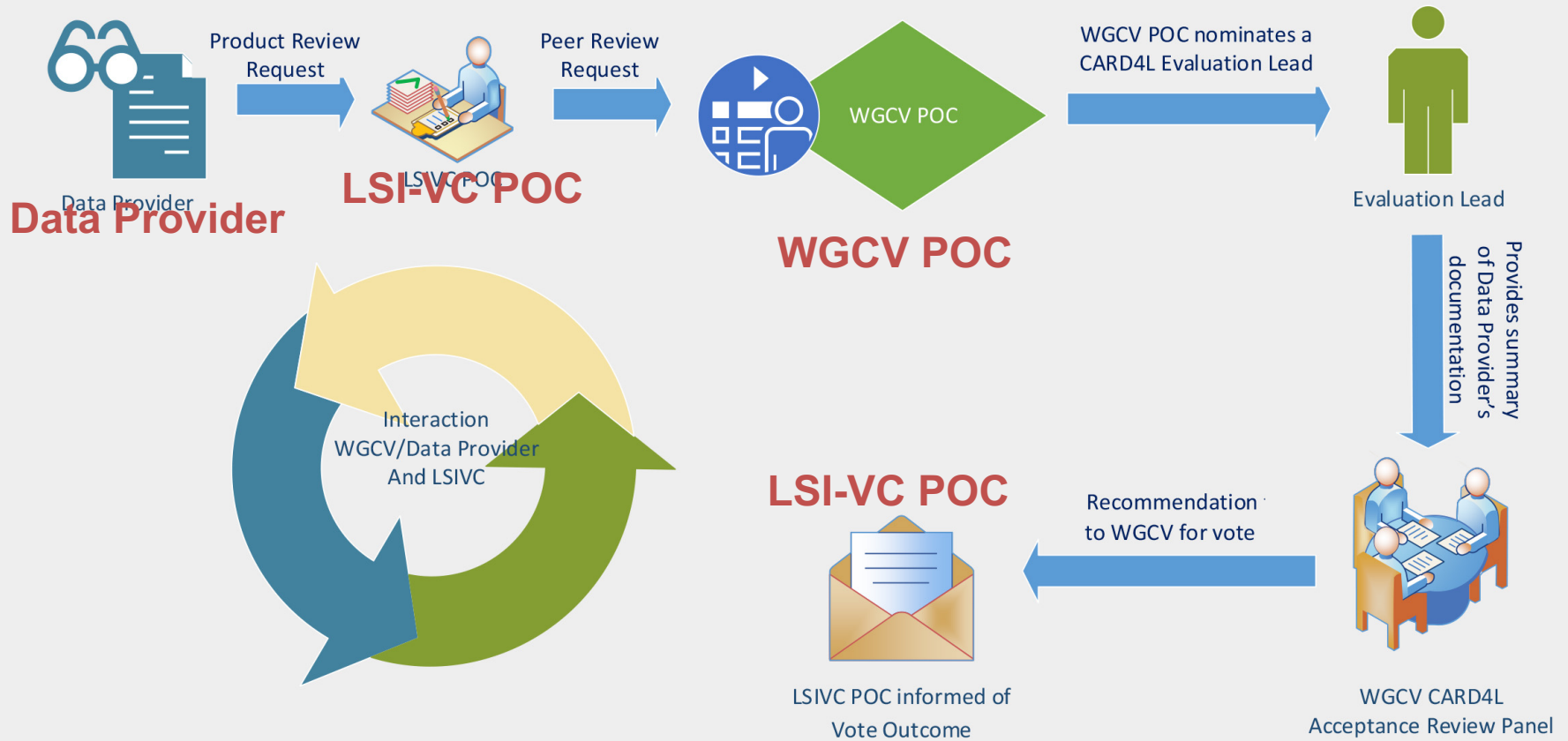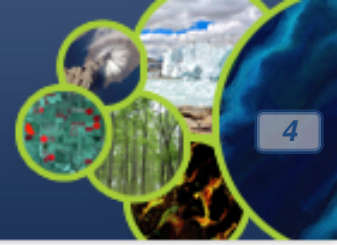
4

WGCV

WGCV provides a peer review

## CARD4L Product Alignment – The Role of WGCV

- Normalised Radar Backscatter (NRB)
  - ***25m ALOS PALSAR/ALOS-2 PALSAR-2 mosaics***
    - *Global coverage (2007-2010; 2015-2018+)*
    - *Derived from 10m/20m Fine Beam data*
    - *Self-assessment ongoing*

  - ***50m ALOS-2 PALSAR-2 ScanSAR***
    - *Regional coverage (pan-tropical + selected global regions)*
    - *1x1 deg tiles (non-mosaicked)*

  - ***ALOS PALSAR (FBS, FBD, POL, ScanSAR)***
    - *Scene-based, Full resolution*
    - *Full archive (2006-2011)*
    - *JAXA to release CARD4L format conversion software*

JAXA CARD4L Self-assessment example:

- CARD4L PSF: Normalised Radar Backscatter (NRB)
- JAXA product:v**25m ALOS PALSAR/ALOS-2 PALSAR-2 mosaics**

JAXA Global SAR Mosaics –
Candidate for CARD4L Normalised Radar Backscatter


©JAXA, METI Analyzed by JAXA
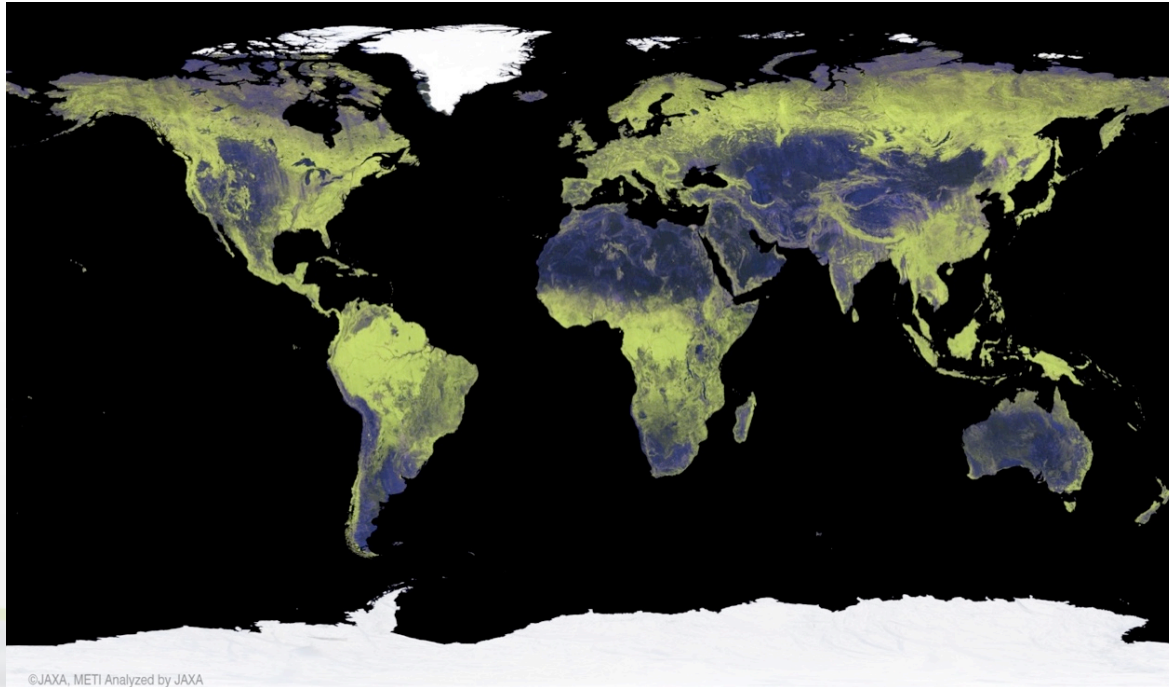
- **ALOS-2 PALSAR-2:** 2015, 2016, 2017 (2018)

- **ALOS PALSAR:** 2007, 2008, 2009, 2010

- **JERS-1 SAR:** 1996

- Global coverage at 25 m pixel spacing, provided in 1°x1° tiles

- Publicly available free of charge at

  https://www.eorc.jaxa.jp/ALOS/en/palsar_fnf/fnf_index.htm

JAXA Global SAR Mosaics – Image and Meta data
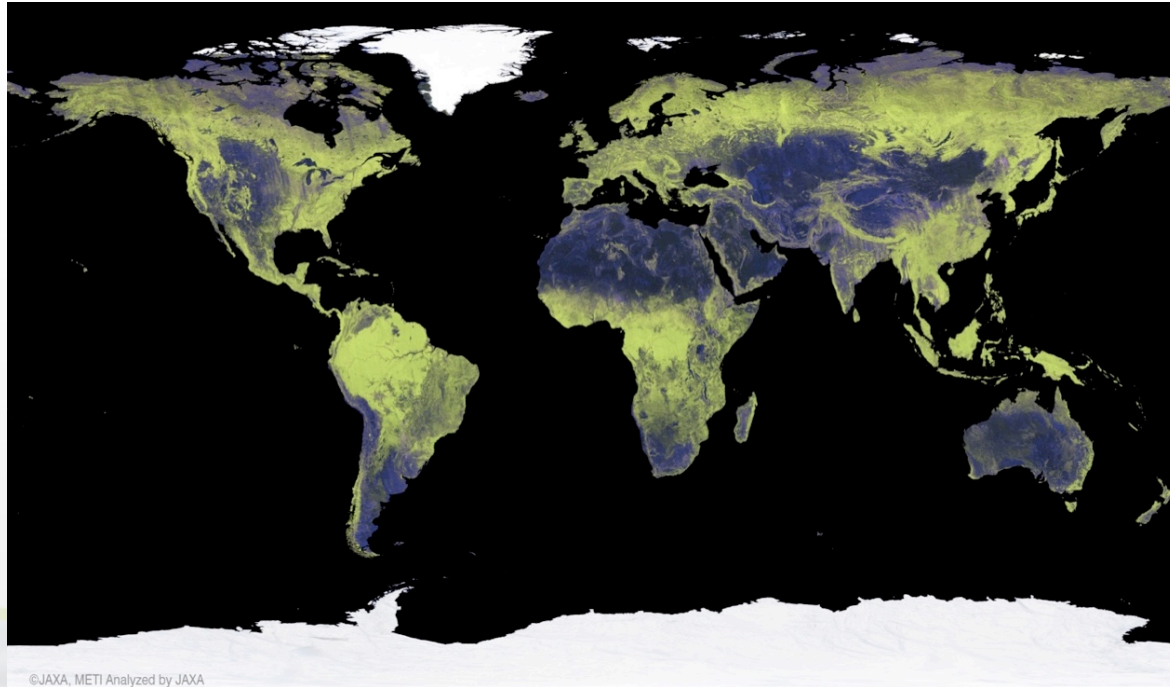
©JAXA, METI Analyzed by JAXA

Global SAR mosaic datasets image/data layers:

- Radar backscatter (γ^o) – HH polarisation

- Radar backscatter (γ^o) – HV polarisation

- Local incidence angle

- Observation date image

- Mask image (layover, shadowing, no-data, water)
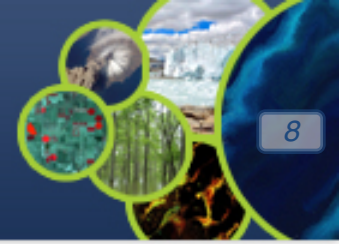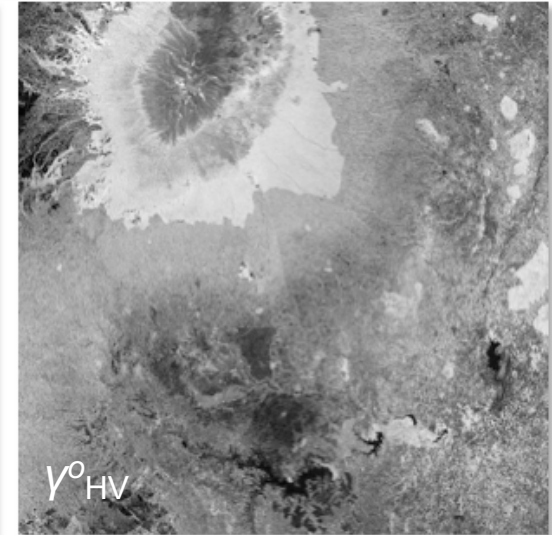
1 – Radiometric corrections

CARD4L specs:

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


γ^o_{HH} γ^o_{HV}

JAXA product compliance:

Radiometric Terrain Correction (RTC) has been undertaken to eliminate incidence angle and topographic effects on the backscatter measurements to render γ^o 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^o can be calculated with the standard formula for amplitude data: $\gamma^o = 10 * \log_{10}(DN^2) + K$

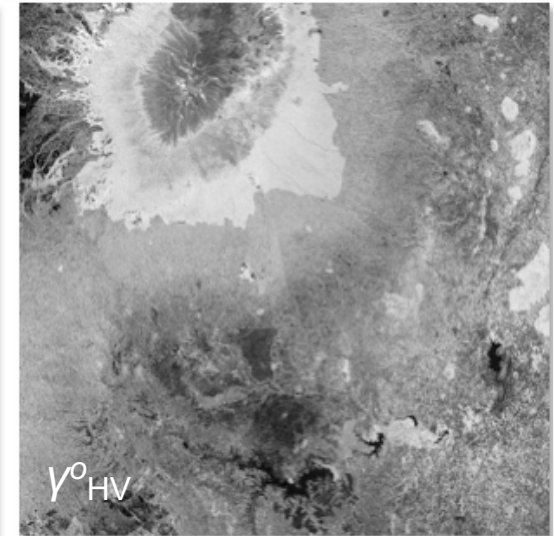The global SAR mosaics conform with the CARD4L **TARGET** requirements for radiometric corrections.
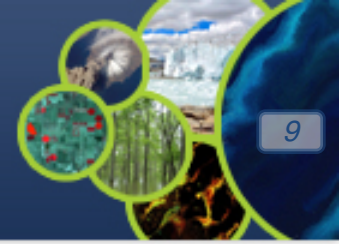
2 – Geometric corrections

CARD4L specs*:*

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

Absolute geolocation at sub-pixel accuracy is required.

$\gamma^o{}_{HH}$ $\gamma^o{}_{HV}$

JAXA product compliance:

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°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*)

3 – 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:

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

4 – 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:

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.

Local incidence angle

Observation date

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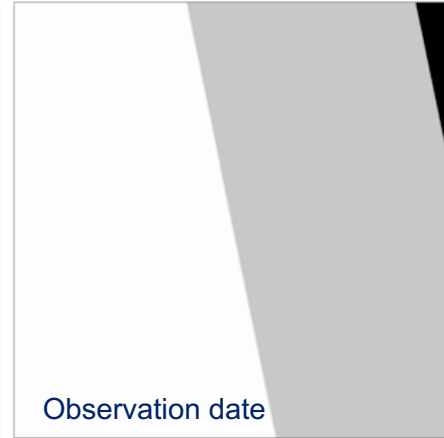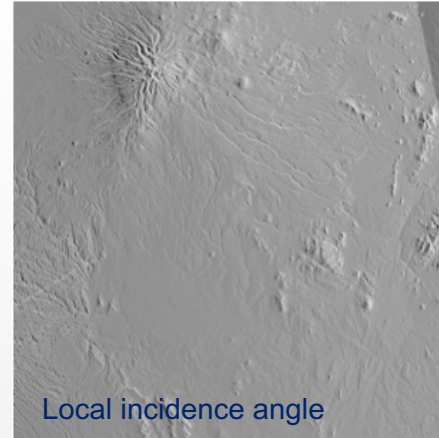
1. Metadata machine readability
2. No data
3. Layover
4. Shadow
5. Local Incidence Angle
6. Global Incidence Angle
7. Digital Elevation Model
8. Noise Equivalent Sigma-0
9. Number of Looks

Standardised representation of Metadata

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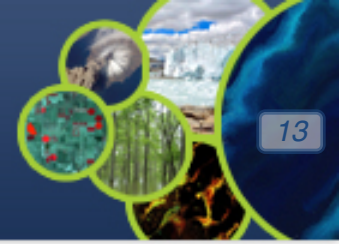

Current

Proposed new

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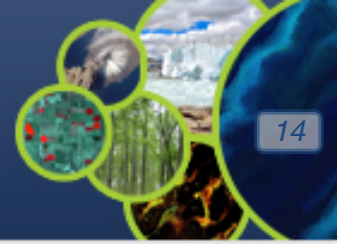
	Threshold	Target
2. Per-Pixel Metadata		
2.1 Metadata Machine Readability	YES	
2.2 No Data		YES
2.3 Layover		YES
2.4 Shadow		YES
2.5 Local Incidence Angle		YES
2.6 Global Incidence Angle	NO	
2.7 Digital Elevation Model	NO (N/A)	
2.8 Noise Equivalent Sigma0	NO	
2.9 Number of Looks	NO	
3. Radiometric Corrections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

Summary

JAXA's Global SAR Mosaic products currently NOT FULLY COMPLIANT with CARD4L NRB (v1.0) specs

Actions:

- Processing of 2018 Global Mosaic with revised SAR processing software underway to address errors affecting the **Geometric Accuracy**

- Re-processing of historical (2007-2017) Global Mosaic products

- 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 have *at least* 2018 Global Mosaic product fully compliant with CARD4L NRB (v2.0←) by LSI-VC-9.