Korea Aerospace Research Institute (KARI)

CEOS Analysis Ready Data

Normalised Radar Backscatter (NRB)

Product User Manual

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Contents

1. Introduction 5
1.1 Purpose and Scope 5
1.2 Intended Reader 5
1.3 Document Structure 5
1.4 Applicable and Reference Documents 5
1.5 Terms and Definitions 6
2. Mission and Sensor 7
2.1 KOMPSAT-5 Mission 7
2.2 COSI SAR Instrument 7
2.3 Observation Modes and Acquisition Geometry 7
3. NRB Product 8
3.1 Definition of Normalised Radar Backscatter 8
3.2 CEOS-ARD Compliance 8
3.3 Input Products and Generation 8
3.4 Spatial Coverage, Gridding and Tiling 9
3.5 Temporal Coverage and Latency 10
4. Product Structure and Format 11
4.1 Product Naming Convention 11
4.2 Package Directory Structure 11
4.3 Measurement Layer (Terrain-Flattened γ^o) 11
4.4 Per-Pixel Metadata Layers 12
4.5 Coordinate Reference System and Map Projection 12
4.6 File Format, Data Types and Scaling 14
4.7 Metadata Files 14
4.8 Quicklook and Browse Imagery 14
5. Data Mask 15
6. Using the Data 16
6.1 Reading the Product 16
6.2 Converting γ^o to Decibels 16

6.3 Converting γ^0 to σ^0 17
6.4 Applying the Data Mask 17
6.5 Multi-Temporal and Multi-Track Analysis 18
7. Data Access and References 19
7.1 Landing Page, DOI and Licensing 19
7.2 Citation and User Support 19
8. Acronyms and Abbreviations 20
Appendix A. Metadata Field Dictionary 21
Appendix B. Sample Product Listing 21
Appendix C. CEOS-ARD PFS Requirement Cross-Reference 21

Document Change Record

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1. Introduction

1.1 Purpose and Scope

This Product User Manual (PUM) describes the Normalised Radar Backscatter (NRB) product generated by the Korea Aerospace Research Institute (KARI) as a CEOS Analysis Ready Data (CEOS-ARD) dataset. It explains what the product contains, how it is structured and formatted, how it should be read and interpreted, and the quality that users can expect. Throughout this manual, a specific NRB reference dataset is used only to illustrate the product with concrete examples; the descriptions themselves apply to the NRB product family in general.

The NRB product is a radiometrically terrain-corrected (RTC), map-projected SAR backscatter product expressed as terrain-flattened gamma-nought (γ^0). It is derived from KOMPSAT-5 Level-1A Single-look Complex (SCS) imagery and is intended to be directly usable in analysis without further radiometric or geometric correction by the user.

1.2 Intended Reader

The manual is intended for scientific and operational users of SAR data — e.g. researchers in land, water and disaster applications, value-adding service providers, and data-portal integrators — who need to read, mask, convert and combine the NRB layers correctly. Familiarity with basic SAR concepts (backscatter, incidence angle, geometric distortion) is assumed; SAR imaging geometry and terrain-induced distortions are illustrated in Section 5.

1.3 Document Structure

Section 2 summarizes the mission and sensor. Section 3 defines the NRB product and its CEOS-ARD compliance. Section 4 describes the product structure and file format. Section 5 defines the data mask. Section 6 gives practical guidance for reading, converting and combining the data. Section 7 covers data access, licensing and references, and Section 8 lists the acronyms and abbreviations used.

1.4 Applicable and Reference Documents

Ref.	Title	Reference / Source
AD-1	CEOS-ARD Product Family Specification — Synthetic Aperture Radar, v1.3.1	https://ceos.org/ard/
RD-1	D. Small, “Flattening Gamma: Radiometric Terrain Correction for SAR Imagery”, IEEE TGRS, 2011	DOI:10.1109/TGRS.2011.2120616
RD-2	KOMPSAT-5 NRB Algorithm Theoretical Basis Document (ATBD)	KARD-ATBD-NRB-001
RD-3	KOMPSAT-5 Standard Product Specifications	KARI
RD-4	Layman’s SAR Interpretation Guide, v3.0	ESA
RD-5	Copernicus GLO-30 DEM	https://portal.opentopography.org

1.5 Terms and Definitions

- **Beta-nought (β^o):** radar brightness, backscatter per unit area in slant range.
- **Sigma-nought (σ^o):** backscatter coefficient normalised to the ground area projected on the ellipsoid.
- **Gamma-nought (γ^o):** backscatter coefficient normalised to the area in the plane perpendicular to the line of sight.
- **Terrain-flattened γ^o (γ^o_T):** γ^o normalised using the true, DEM-derived illuminated area (RTC).
- **Local incidence angle (LIA):** angle between the radar line of sight and the terrain-surface normal.
- **RTC:** Radiometric Terrain Correction.

2. Mission and Sensor

2.1 KOMPSAT-5 Mission

KOMPSAT-5 (Korea Multi-Purpose Satellite 5) is a KARI Earth-observation mission carrying an X-band Synthetic Aperture Radar. It operates in a Sun-synchronous dawn–dusk orbit and provides all-weather, day-and-night imaging in support of land management, disaster monitoring and environmental applications.

2.2 COSI SAR Instrument

The payload is COSI (COrea SAR Instrument), an X-band SAR. The radar center frequency is 9.66 GHz (X-band) supporting for single polarization channel operations (HH or HV or VH or VV).



Figure 1. KOMPSAT-5 model

2.3 Observation Modes and Acquisition Geometry

KOMPSAT-5 operates in several beam modes that trade spatial resolution against swath width.

Observation mode	Resolution	Swath Width	Beams
Ultra High Resolution (UH)	0.85m	2.7x2.7 Km (5x5 Km)	27~31
High Resolution (HR)	1m	5x5 Km	1~31
Enhanced High Resolution (EH)	1m	3x3 Km (5x5 Km)	17~31
Standard (ST)	3m	30x30 Km	1~19
Enhanced Standard (ES)	2.5m	30x30 Km	5~19
Wide Swath (WD)	20m	100x100 Km	1~5

Enhanced Wide Swath (EW)	5m (single look) 20m (4 looks)	100x100 Km	1~5

3. NRB Product

3.1 Definition of Normalised Radar Backscatter

Normalised Radar Backscatter (NRB) is a CEOS-ARD product in which the SAR backscatter has been radiometrically terrain corrected and geocoded to a map grid. The measurement quantity is terrain-flattened gamma-nought (γ^o_T): the backscattered power is normalised by the true illuminated ground area derived from a Digital Elevation Model, rather than by the ellipsoidal area. This removes the radiometric brightness variations caused by topography and yields values that are comparable across acquisition geometries and terrain.

3.2 CEOS-ARD Compliance

The product is assessed against the CEOS-ARD Product Family Specification for SAR (AD-1) as a Normalised Radar Backscatter product. Based on the accompanying self-assessment, the product meets the CEOS-ARD Threshold requirements for the NRB family. General metadata, per-pixel metadata, radiometric terrain correction and geocoding requirements are addressed by the layers and metadata described in Sections 4 and 5. No speckle filtering is applied (FilterApplied = FALSE) and no additional noise removal is applied (NoiseRemovalApplied = FALSE).

3.3 Input Products and Generation

NRB generation starts from KOMPSAT-5 Level-1A SCS_B (Single-look Complex, slant-range) HDF5 products. The processor ingests the HDF5 image together with its auxiliary XML metadata (orbit, timing, calibration and geometry) to drive the radiometric and geometric processing chain.

The NRB processor is implemented on top of GAMMA remote-sensing software. The main processing stages are:

- Multi-look to form the detected multi-look intensity image (β^o).
- Geocode the DEM and compute the terrain geometry: local incidence angle, layover/shadow map and the DEM-derived normalisation area.
- Apply radiometric terrain flattening (Small, 2011; RD-1) to obtain terrain-flattened γ^o.
- Terrain-correct and geocode all layers to the output UTM map grid, mosaic sub-swaths, and export GeoTIFF layers plus JSON/XML metadata and quicklook images.

Auxiliary data: Copernicus GLO-30 surface DEM (RD-5) for terrain geometry; EGM geoid model for

the geoid layer; Nominal orbit data/POED precise orbit data if available for geolocation.

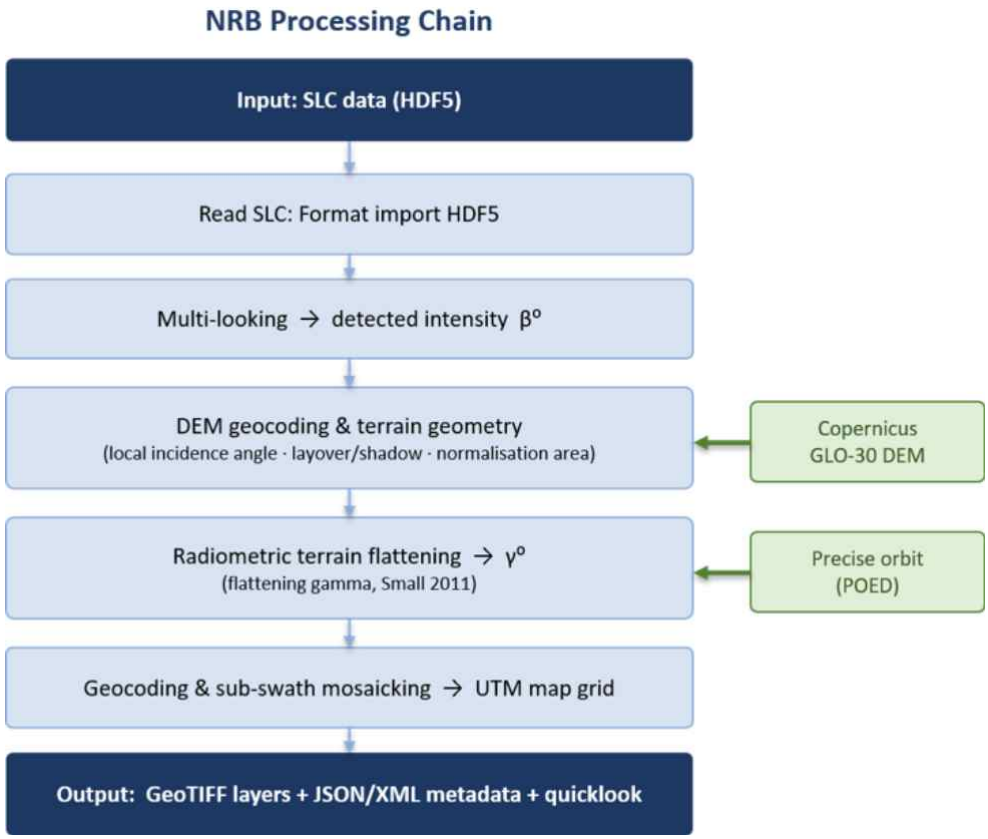


Figure 2. NRB processing chain and auxiliary data inputs.

3.4 Spatial Coverage, Gridding and Tiling

Tiling divides a large, geocoded scene into regularly sized units so that the same ground area is always referenced consistently and can be stored, processed, and analyzed efficiently. For interoperability with other ARD products, the KARD grid is based on the Military Grid Reference System (MGRS), with tiles snapped to the MGRS grid in the appropriate UTM zone.

From the 100 km MGRS cells, smaller KARD tiles are defined as a quad-tree in which each level halves the cell edge: Level 1 = 50 km, Level 2 = 25 km, Level 3 = 12.5 km, Level 4 = 6.25 km, and Level 5 = 3.125 km. Each tile is identified by an MGRS-based code that combines the grid-zone designator, the 100 km square identifier, and the quad-tree index (for example, 52SCG01). Each tile is delivered in the UTM projection of its MGRS zone; where a scene spans two zones, it is cut at the zone boundary and each part is delivered in its own UTM zone, with areas of no image data set to no-data. The output grid is aligned so that the tile upper-left corner coordinates are integer multiples of the product sample spacing, and the layers are stored as (Cloud-Optimized) GeoTIFF.

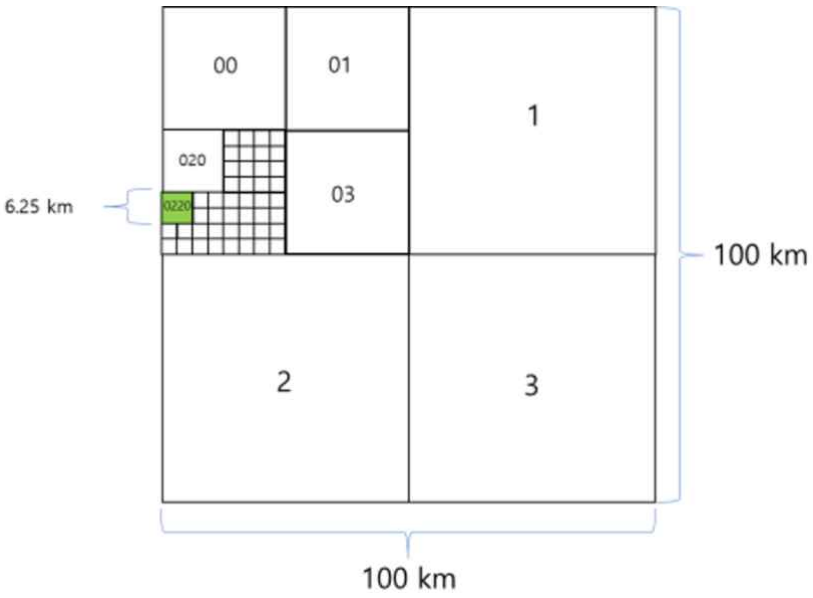


Figure 3. KARD MGRS quad-tree tiling: the 100 km MGRS cell is subdivided by a quad-tree (indices 0 = UL, 1 = UR, 2 = LL, 3 = LR).

The NRB output sample spacing follows the source observation mode:

Observation mode	Typical use	NRB sample spacing	MGRS quad-tree Level
High Resolution (HR/EH/UH)	Detailed mapping	2.5 m	Level 4 (6.25 km)
Standard (ST/ES)	General-purpose imaging	5 m	Level 2 (25 km)
Wide Swath (WD/EW)	Broad-area coverage	25 m	Level 2 (25 km)

The tile size in pixels therefore depends on the sample spacing: a 25 km SAR tile corresponds to 1000 × 1000 pixels at 25 m (Wide Swath), 5000 × 5000 pixels at 5 m (Standard), or 10000 × 10000 pixels at 2.5 m (High Resolution). File volume scales with these dimensions, the number of layers, and each layer's data type.

3.5 Temporal Coverage and Latency

NRB products are generated on demand from archived or newly acquired KOMPSAT-5 Standard-mode acquisitions. Each product corresponds to a single acquisition; the acquisition start and stop times are recorded in the metadata. Production latency depends on the availability of the L1A source product and whether or not to apply a precise orbit data.

4. Product Structure and Format

4.1 Product Naming Convention

Each product is delivered as a directory named:

<TILE>_<YYYYMMDDhhmmss>_K5_<BEAM>_NRB

where <TILE> is the MGRS-style tile code, <YYYYMMDDhhmmss> is the acquisition start time (UTC), K5 denotes KOMPSAT-5, and <BEAM> is the beam/mode identifier (e.g. ES02). Example: 12SUC33_20240225013539_K5_ES02_NRB. Individual layer files repeat this prefix and append a layer suffix (e.g. …_NRB_HH.tif).

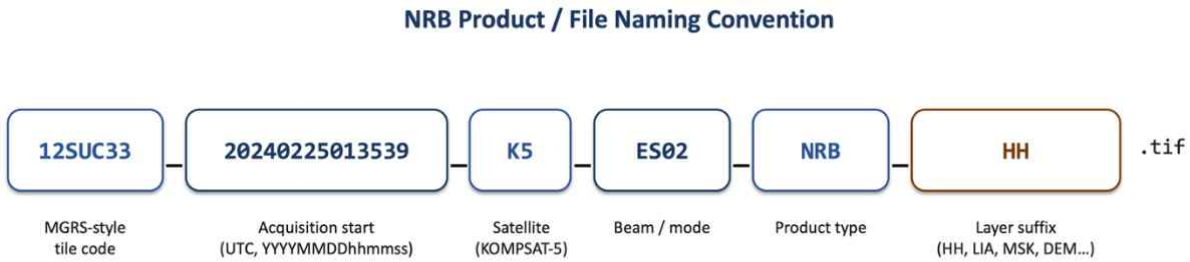


Figure 4. NRB product / file naming convention.

4.2 Package Directory Structure

A product package contains the measurement layer, the per-pixel metadata layers, the metadata files and the quicklook imagery, all sharing the product prefix:

File suffix	Content
_HH.tif	Terrain-flattened γ^0 backscatter (measurement layer)
_LIA.tif	Local incidence angle
_MSK.tif	Data mask (NoData / Water / Land / Layover / Shadow / Foreshortening)
_DEM.tif	Resampled DEM used for processing
_gamma2sigmaRatio.tif	Per-pixel γ^0-to-σ^0 conversion ratio
_AcquisitionID.tif	Acquisition / beam-mode identifier
_metadata.json	Product metadata (JSON)
_metadata.xml	Product metadata (XML)
_br.jpg (+ _br.jgw)	Browse image (geo-referenced quicklook)
_th.jpg	Thumbnail image

4.3 Measurement Layer (Terrain-Flattened γ^0)

The measurement layer is the terrain-flattened gamma-nought backscatter. It is stored as 32-bit floating point in linear power (natural units, not decibels). No-data is encoded as 0. Backscatter in decibels is obtained as γ^0[dB] = 10·log10(γ^0[power]). See Section 6.2 for conversion details.

4.4 Per-Pixel Metadata Layers

The following per-pixel layers are on the measurement layer. Data types and units below reflect the delivered files:

Layer	Quantity	Data type	Units / encoding	No-data
_HH	Terrain-flattened γ^0	Float32	linear power	0
_LIA	Local incidence angle	Float32	radians	0
_MSK	Data mask	UInt8	class code (see §5)	0
_DEM	Resampled DEM height	Float32	meters	0
_gamma2sigmaRatio	$\gamma^0 \rightarrow \sigma^0$ ratio	Float32	ratio (dimensionless)	0
_AcquisitionID	Acquisition/beam-mode ID	UInt32	integer code	0

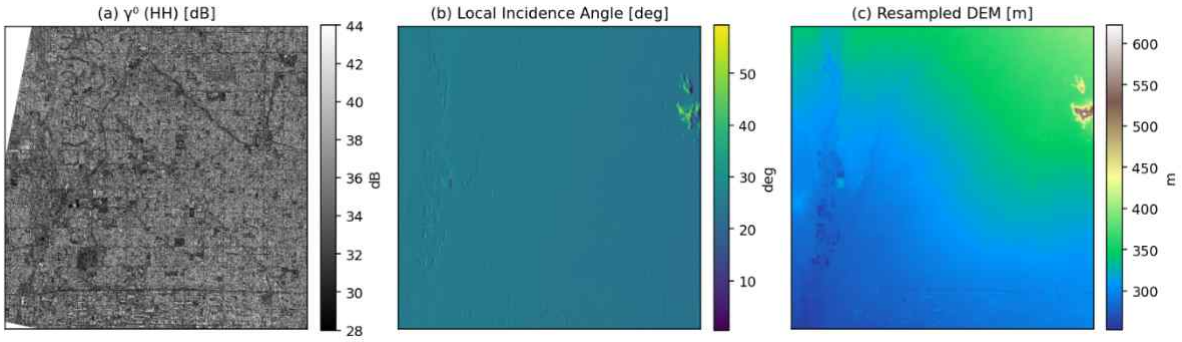


Figure 5. Example NRB product layers for tile 12SUC33_20240225013539_K5_ES02: (a) terrain-flattened γ^0 (HH), (b) local incidence angle, (c) resampled DEM.

The AcquisitionID layer records, for every pixel, an integer code that identifies the source acquisition. This lets the originating acquisition be traced per pixel, which is useful where a product mosaics more than one acquisition. The layer is stored as a UINT32 GeoTIFF, with 0 reserved for no-data.

The code is a fixed 10-digit number (UINT32, range 0 – 4 294 967 295) built as follows :

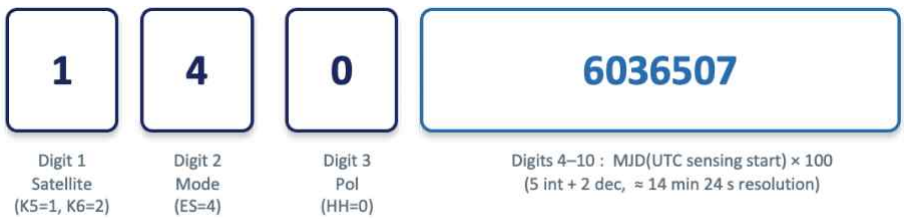


Figure 6. AcquisitionID structure — 10-digit UINT32 encoding.

Digit 1 - Satellite

Code	Satellite
1	KOMPSAT-5 (K5)

2	KOMPSAT-6 (K6)

Digit 2 – Observation mode

Code	Quantity
0	Ultra High Resolution (UH)
1	High Resolution (HR)
2	Enhanced High Resolution (EH)
3	Standard (ST)
4	Enhanced Standard (ES)
5	Wide Swath (WD)
6	Enhanced Wide Swath (EW)

Digit 3 - Polarization

Code	Pol
0	HH
1	HV
2	VV
3	VH

- Digit 1 — Satellite: K5 = 1, K6 = 2.
- Digit 2 — Observation mode: UH = 0, HR = 1, EH = 2, ST = 3, ES = 4, WD = 5, EW = 6.
- Digit 3 — Polarization: HH = 0, HV = 1, VH = 2, VV = 3.
- Digits 4–10 — Sensing-start time: the Modified Julian Date (MJD) of the acquisition start (UTC), kept to two decimals and multiplied by 100 (five integer + two decimal digits → seven digits). The time resolution is 0.01 MJD ≈ 14 min 24 s, and the five-digit MJD is valid through 31 August 2132.

The observation mode, polarization and sensing time are identified; the beam number is not encoded. K6 is reserved (satellite digit = 2), and its mode indices will be defined when K6 processing is developed.

For example, the reference product 12SUC33_20240225013539_K5_ES02 (HH) has satellite K5 = 1, mode ES = 4, polarization HH = 0, and MJD(2024-02-25 01:35:39) = 60365.06 → × 100 = 6036506, giving AcquisitionID = 1406036506.

4.5 Coordinate Reference System and Map Projection

All layers of a product share the same UTM projection, grid and dimensions. The CRS is recorded in the GeoTIFF and in the metadata as both an EPSG code and a WKT string (reference dataset: EPSG:32612). The pixel coordinate convention is pixel upper-left corner (pixel ULC). The grid is

aligned to integer multiples of the sample spacing.

4.6 File Format, Data Types and Scaling

Layers are delivered as GeoTIFF (Deflate-compressed). The measurement and most per-pixel layers are floating point and require no scaling or offset; the data mask and AcquisitionID layers are integer class/identifier codes. No-data is 0 for the measurement, LIA and ratio layers, and class 0 for the mask.

4.7 Metadata Files

Two machine-readable metadata files accompany every product: a JSON file (_metadata.json) and an XML file (_metadata.xml). Both encode the CEOS-ARD metadata: product identification, source-data attributes, acquisition parameters, orbit information, processing parameters, radiometric and geometric correction descriptions, per-pixel layer descriptions and product geometry (bounding box, geographic extent, image size, CRS). The metadata field dictionary is given in Appendix A.

4.8 Quicklook and Browse Imagery

A geo-referenced browse image (_br.jpg with a _br.jgw world file) and a thumbnail (_th.jpg) are provided for quick visual inspection and catalogue display. These are 8-bit visual renderings of the backscatter layer and are not intended for quantitative use.

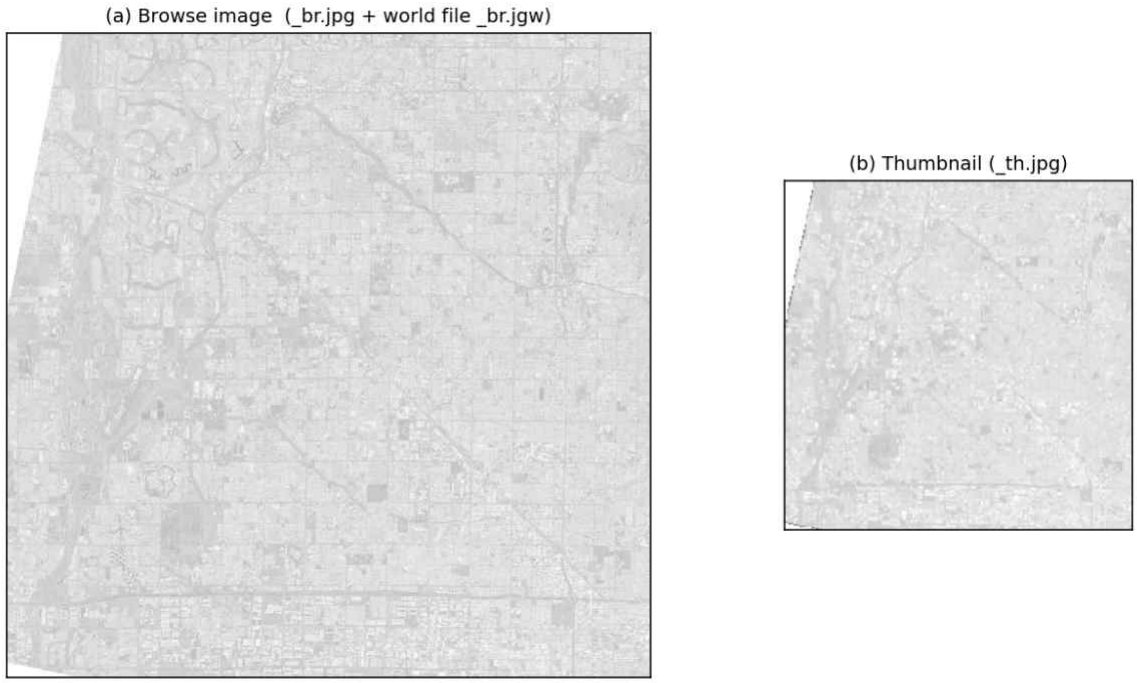


Figure 6. Quicklook imagery delivered with each product: (a) geo-referenced browse image (_br.jpg with _br.jgw world file) and (b) thumbnail (_th.jpg).

5. Data Mask

The data mask (_MSK.tif) is an 8-bit per-pixel classification layer. It labels each pixel as open water or valid land, and flags radar geometric distortions (layover, shadow, foreshortening) and no-data areas. Users should apply this mask before quantitative analysis. The look-up table is:

Value	Class	Meaning / recommended use
0	No-data	Outside the valid image footprint — exclude.
1	Water	Open water (ocean, lakes, rivers); characteristically low, smooth backscatter.
2	Land	Valid land surface, free of geometric distortion — suitable for analysis.
3	Layover	Radar layover — backscatter unreliable; exclude for quantitative use.
4	Shadow	Radar shadow — no valid signal; exclude.
5	Foreshortening	Foreshortened terrain — use with caution.

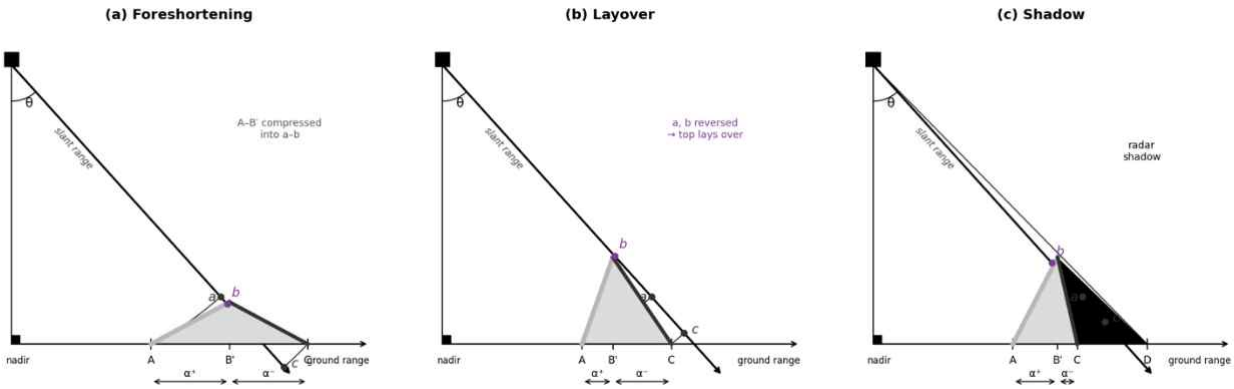


Figure 7. SAR geometric distortions due to terrain relief: (a) foreshortening — a radar-facing slope gentler than the incidence angle ϑ is compressed in range (the ground interval A–B′ maps to the short slant-range interval a–b); (b) layover — a slope steeper than ϑ is reversed, so the summit b is imaged before the base a and lays over the foreground; (c) shadow — a steep slope facing away from the radar leaves the region C–D unilluminated, appearing black in the image.

6. Using the Data

6.1 Reading the Product

All layers are standard GeoTIFFs and can be opened directly in GDAL-based tools (gdalinfo, QGIS), ESA SNAP, or Python (rasterio / GDAL). Because the layers share an identical grid, they can be stacked pixel-by-pixel without resampling. Example (Python / rasterio): The examples in this section are shown on the reference dataset 12SUC33_20240225013539_K5_ES02_NRB; the same steps apply to any NRB product.

```
import rasterio, numpy as np
base = '12SUC33_20240225013539_K5_ES02_NRB_'    # example data
g0  = rasterio.open(base+'HH.tif').read(1)      # linear γ⁰
msk = rasterio.open(base+'MSK.tif').read(1)     # data mask
g0  = np.where((g0 > 0) & ~np.isin(msk,[0,3,4]), g0, np.nan)
```

6.2 Converting γ^0 to Decibels

The measurement layer is linear-power terrain-flattened γ^0. To obtain backscatter in decibels:

$$\gamma^0[\text{dB}] = 10 \cdot \log10(\gamma^0)$$

```
import numpy as np, rasterio
base  = '12SUC33_20240225013539_K5_ES02_NRB_'
g0    = rasterio.open(base+'HH.tif').read(1)
g0    = np.where(g0 > 0, g0, np.nan)     # exclude no-data (0)
g0_dB = 10*np.log10(g0)                   # γ⁰ in decibels
```

No calibration constant or offset needs to be applied — the calibration is already embedded in the product. No-data (0) pixels must be excluded before taking the logarithm.

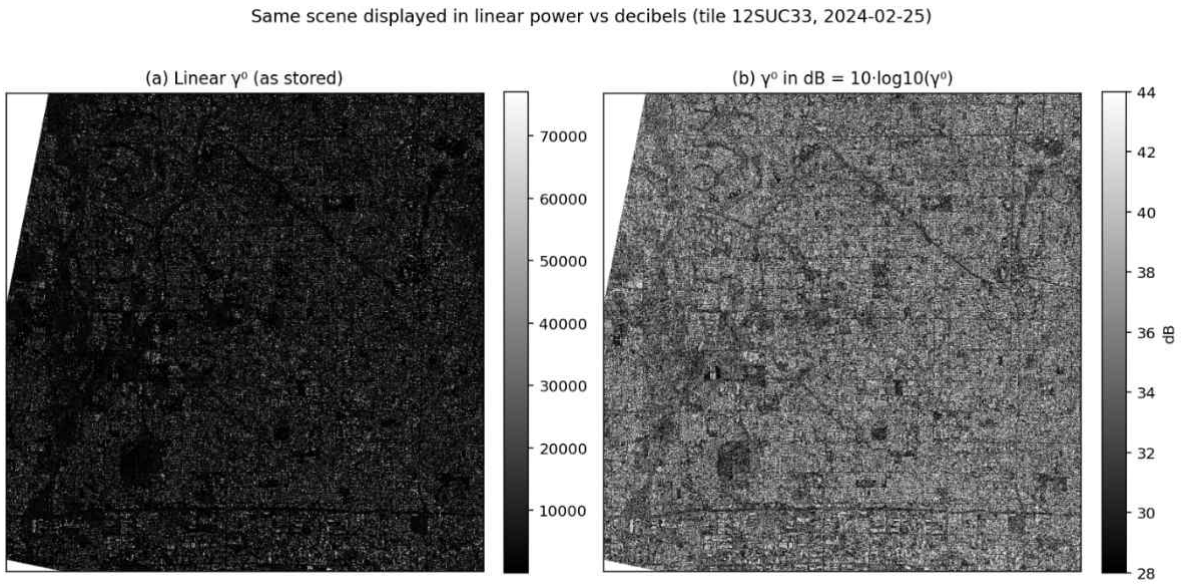


Figure 8. The same γ^0 scene displayed in (a) linear power and (b) decibels (10·log10 γ^0); the logarithmic scale reveals structure that is compressed and barely visible in the linear display.

6.3 Converting γ^0 to σ^0

Where sigma-nought is required (e.g. for comparison with σ^0 datasets), the product provides a per-pixel conversion layer, _gamma2sigmaRatio.tif. Terrain-flattened σ^0 is obtained by applying this ratio to the γ^0 measurement:

$$\sigma^0_T = \gamma^0_T \times \text{gamma2sigmaRatio}$$

```
import numpy as np, rasterio
base  = '12SUC33_20240225013539_K5_ES02_NRB_'
g0    = rasterio.open(base+'HH.tif').read(1).astype('float64')
ratio = rasterio.open(base+'gamma2sigmaRatio.tif').read(1).astype('float64')
valid = (g0 > 0) & (ratio > 0)
s0    = np.where(valid, g0*ratio, np.nan)   # terrain-flattened σ⁰
              s0_dB = 10*np.log10(s0, where=valid)        # σ⁰ in decibels
```

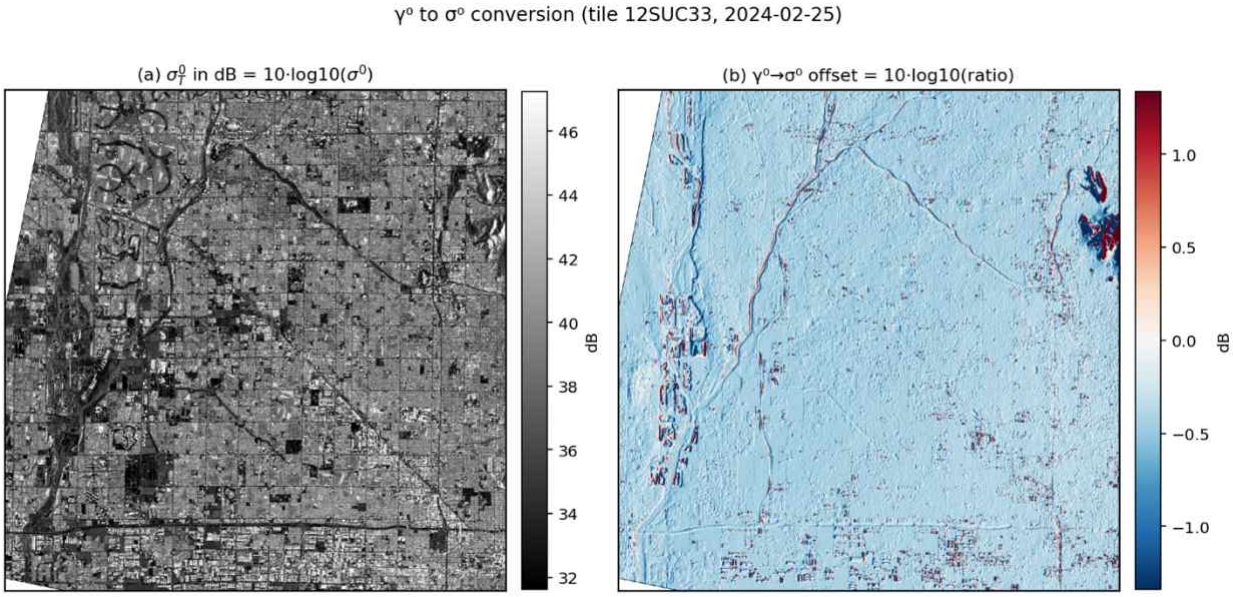


Figure 9. $\gamma^0 \rightarrow \sigma^0$ conversion on the reference dataset (tile 12SUC33, 2024-02-25): (a) terrain-flattened σ^0 in dB; (b) the per-pixel conversion offset 10·log10(gamma2sigmaRatio) in dB, largest over sloped terrain and small over flat, urban areas.

Using the provided per-pixel ratio preserves the terrain normalisation that would otherwise be lost with a simple cos(θ) approximation, particularly in steep terrain.

6.4 Applying the Data Mask

For quantitative analysis, exclude pixels flagged as no-data (0), layover (3) and shadow (4). Foreshortening (5) pixels are geometrically valid but radiometrically compressed and should be used with caution. Combine the mask with the no-data test on the measurement layer ($\gamma^0 > 0$).

```
import numpy as np, rasterio
base = '12SUC33_20240225013539_K5_ES02_NRB_'
g0   = rasterio.open(base+'HH.tif').read(1)
```

```
msk  = rasterio.open(base+'MSK.tif').read(1)   # 0 nodata,1 water,2 land,3 layover,4
shadow,5 foreshortening
# keep valid land/water; drop no-data(0), layover(3), shadow(4)
g0_clean = np.where((g0 > 0) & ~np.isin(msk,[0,3,4]), g0, np.nan)
```

6.5 Multi-Temporal and Multi-Track Analysis

Because all NRB products are radiometrically terrain corrected and delivered on a consistent UTM grid, products of the same tile from different dates can be stacked directly for change detection or time-series analysis. When combining acquisitions from different tracks or look directions, note that layover/shadow patterns and the local incidence angle differ; the LIA and mask layers should be used to reconcile or exclude affected pixels. Terrain flattening removes most topographic radiometric bias but does not correct for residual angular backscatter dependence, which can be assessed using the LIA layer.

```
import glob, numpy as np, rasterio
# stack same-tile γ⁰ (dB) acquisitions from different dates
files = sorted(glob.glob('12SUC33_*_K5_ES02_NRB_HH.tif'))   # one file per acquisition
stack = []
for f in files:
    g0 = rasterio.open(f).read(1)
    stack.append(10*np.log10(np.where(g0 > 0, g0, np.nan)))
cube   = np.stack(stack)        # (n_dates, rows, cols)
change = cube[-1] - cube[0]     # simple two-date change in dB
```

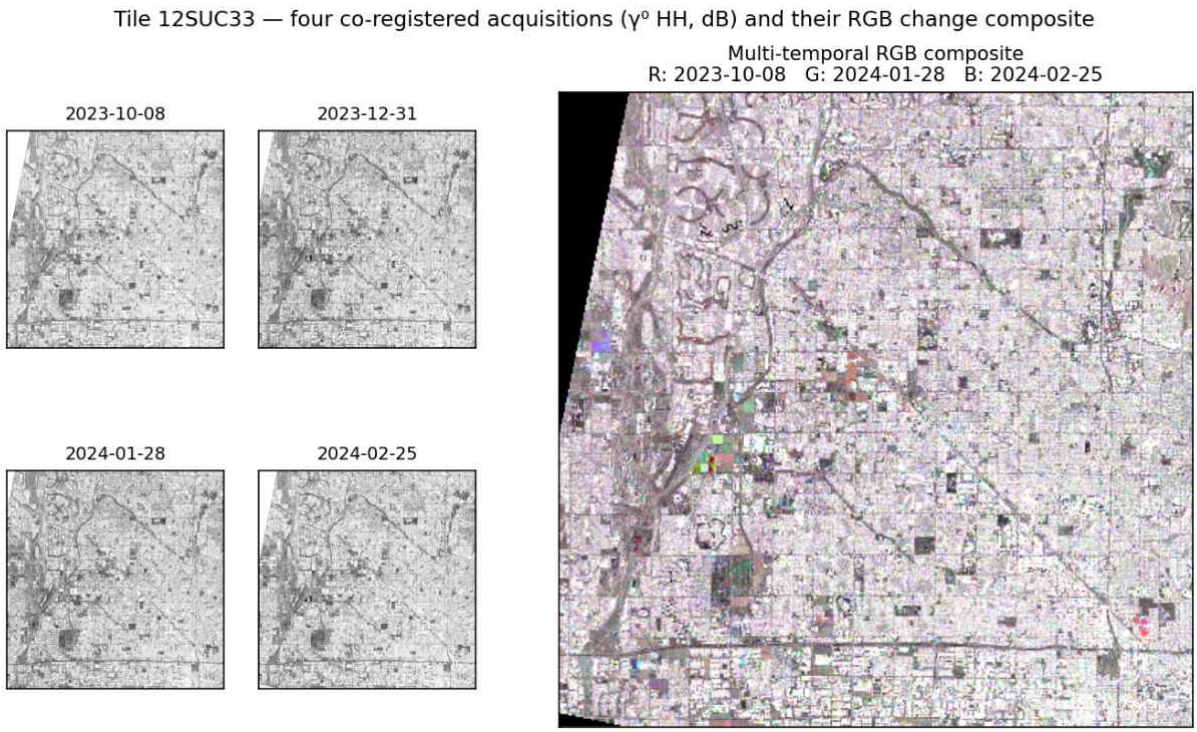


Figure 10. Multi-temporal use of NRB: four co-registered 12SUC33 acquisitions (γ^0 HH, dB) and an RGB change composite (R: 2023-10-08, G: 2024-01-28, B: 2024-02-25). Grey areas are stable between dates; coloured areas indicate temporal change.

7. Data Access and References

7.1 Landing Page, DOI and Licensing

The product is accessed by landing page. Source KOMPSAT-5 imagery can be discovered through the KARI Arirang catalogue search site (https://ksatdb.kari.re.kr/arirang/map/map.jsp). Use of the data is subject to the KARI data policy, and copyright of the product is held by KARI.

7.2 Citation and User Support

Users should cite the product using the DOI on the landing page and acknowledge KARI as the data provider and the ARD processor developers. Questions and feedback may be directed to KARI through the landing-page contact.

8. Acronyms and Abbreviations

Acronym	Definition
ARD	Analysis Ready Data
ATBD	Algorithm Theoretical Basis Document
CEOS	Committee on Earth Observation Satellites
COSI	COrea SAR Instrument
CRS	Coordinate Reference System
DEM	Digital Elevation Model
DOI	Digital Object Identifier
EGM	Earth Gravitational Model
EIA	Ellipsoidal Incidence Angle
GeoTIFF	Geographic Tagged Image File Format
HH	Horizontal transmit / Horizontal receive polarization
KARI	Korea Aerospace Research Institute
LIA	Local Incidence Angle
MGRS	Military Grid Reference System
NESZ	Noise-Equivalent Sigma-Zero
NRB	Normalised Radar Backscatter
PFS	Product Family Specification
PUM	Product User Manual
RTC	Radiometric Terrain Correction
SAR	Synthetic Aperture Radar
SCS	Single-look Complex Slant-range
UTM	Universal Transverse Mercator
γ^o / σ^o / β^o	Gamma- / Sigma- / Beta-nought backscatter

Appendix A. Metadata Field Dictionary

Selected fields from the product metadata (JSON/XML). Values shown are from the reference dataset.

Metadata field	Description	Example value
Product/ProductType	Product family	Normalised Radar Backscatter
DocumentIdentifier	CEOS-ARD PFS reference	CEOS-ARD for SAR, v1.3
SourceAttributes/Satellite	Source satellite	KOMPSAT-5
SourceAttributes/Instrument	Source instrument	COSI
…/RadarCenterFrequency	Radar center frequency	9.66 GHz
…/Polarizations	Acquired polarization(s)	HH
…/ObservationMode / BeamID	Beam mode / beam id	STANDARD / ES-02
OrbitInformation/PassDirection	Ascending / Descending	Descending
ProductSampleSpacing	Output pixel spacing	5 m
CoordinateReferenceSystem	EPSG / WKT of the grid	EPSG:32612
…/BackscatterMeasurement	Measurement quantity	Gamma-0
…/RTCAlgorithm	RTC algorithm (DOI)	10.1109/TGRS.2011.2120616
…/DigitalElevationModel	DEM used	Copernicus GLO-30 (surface)
…/NoiseEquivalentIntensity	NESZ	−17 dB (Sigma0, min)

Appendix B. Sample Product Listing

Reference product 12SUC33_20240225013539_K5_ES02_NRB (Standard mode, EPSG:32612, 5000 × 5000, 5 m):

File	Type	Size (approx.)
…_NRB_HH.tif	Float32 γ^0	115 MB
…_NRB_LIA.tif	Float32 LIA (rad)	110 MB
…_NRB_DEM.tif	Float32 DEM	96 MB
…_NRB_gamma2sigmaRatio.tif	Float32 ratio	109 MB
…_NRB_AcquisitionID.tif	UInt16 ID	128 KB
…_NRB_MSK.tif	UInt32 mask	~100 MB
…_NRB_metadata.json / .xml	Metadata	~10 KB each
…_NRB_br.jpg / _br.jgw / _th.jpg	Quicklook	~0.5 MB / 0.1 KB / 28 KB

Appendix C. CEOS-ARD PFS Requirement Cross-Reference

The item-by-item mapping of this product to the CEOS-ARD SAR PFS requirements is maintained in the CEOS-ARD SAR Self-Assessment document (AD-1) and is not duplicated here.