
Geografske informacije - Kalibracija in validacija podatkov daljinskega zaznavanja in izpeljanih proizvodov - 2. del: Radar z umetno odprtino (SAR) (ISO/TS 19124-2:2025)

Geographic information - Calibration and validation of remote sensing data and derived products - Part 2: Synthetic aperture radar (SAR) (ISO/TS 19124-2:2025)

Geoinformation - Kalibrierung und Validierung von Fernmessdaten und abgeleitete Daten - Teil 2: SAR (ISO/TS 19124-2:2025)

Information géographique - Calibration et validation des données de télédétection et produits dérivés - Partie 2: Radar à synthèse d'ouverture (SAR) (ISO/TS 19124-2:2025)

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**Geographic information - Calibration and validation of
remote sensing data and derived products - Part 2:
Synthetic aperture radar (SAR) (ISO/TS 19124-2:2025)**

Information géographique - Calibration et validation
des données de télédétection et produits dérivés -
Partie 2: Radar à synthèse d'ouverture (SAR) (ISO/TS
19124-2:2025)

Geoinformation - Kalibrierung und Validierung von
Fernerkundungsdaten und abgeleiteten Produkten -
Teil 2: SAR (ISO/TS 19124-2:2025)

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European foreword

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Technical Specification

ISO/TS 19124-2

Geographic information — Calibration and validation of remote sensing data and derived products —

Part 2: Synthetic aperture radar (SAR)

*Information géographique — Calibration et validation des
données de télédétection et produits dérivés —*

Partie 2: Radar à synthèse d'ouverture (SAR)

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Foreword

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Introduction

Remote sensing is one of the major data sources for geographic information. As a kind of active imaging radar sensor, SAR has the ability to observe the earth in both day and night, and for almost all weather conditions. As a result, SAR data and their derived products have been widely used in various fields such as disaster monitoring, geological mapping, environmental protection, etc.

Such applications can integrate SAR data from different suppliers and different sensors. The quality of those data and products is essential for the success of such applications. Calibration and validation are the fundamental processes to assess and improve the data quality and ensure the Earth observing (EO) data and derived products from different sources are comparable and interoperable.

The calibration and validation include the SAR sensors themselves, SAR data collected by sensors, and products derived from SAR data. ISO/TC 211 has developed the ISO 19159 series of Technical Specifications to cover the calibration of sensor hardware and validation of the calibration results. ISO/TS 19159-3 is about calibration and validation of SAR/InSAR sensors. The ISO 19124 series standardizes calibration and validation of remote sensing data and products:

- ISO/TS 19124-1 addresses the overall framework and common calibration and validation processes related to EO data and derived products from different types of remote sensors.
- This document (ISO/TS 19124-2) standardizes the calibration and validation of SAR data and their derived products.

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Geographic information — Calibration and validation of remote sensing data and derived products —

Part 2: Synthetic aperture radar (SAR)

1 Scope

This document defines the calibration and validation of Earth observing (EO) data acquired by synthetic aperture radar (SAR) sensors and products derived from SAR data. The specified SAR sensors include general working modes and advanced working modes.

In this document, calibration addresses the process to correct the data, not only geometrically and radiometrically, but also characteristically for qualitative and quantitative applications. Validation addresses an evaluation of the quality and accuracy of the calibrated data and derived products.

This document also addresses the associated metadata related to calibration and validation that has not been defined in other geographic information International Standards.

This document does not apply to the calibration of SAR sensors and validation of SAR sensor calibration, which are covered by ISO/TS 19159-3. However, the calibration and validation procedure can be also applied and referenced among others.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TS 19124-1, *Geographic information — Calibration and validation of remote sensing data and derived products — Part 1: Fundamentals*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TS 19124-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

azimuth ambiguity

<SAR> azimuth quality degradation of SAR images as a result of the azimuth spectrum aliasing of the side lobes of the antenna pattern

Note 1 to entry: Azimuth ambiguity is mainly caused by under-sampling of Doppler frequency, when the pulse repetition frequency is too low during SAR satellite scanning detection.

Note 2 to entry: In severe cases, azimuth ambiguity can even produce false targets, known as “ghost shadows”.

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3.2

azimuth resolution

<SAR> resolution in the cross-range direction

Note 1 to entry: This is usually measured in terms of the impulse response of the SAR sensor and processing system. It is a function of the size of the synthetic aperture, or alternatively the dwell time (i.e. a larger aperture results in a longer dwell time results in better resolution).

Note 2 to entry: 3dB width of the impulse response is the normal value of measurements.

Note 3 to entry: Cross-range direction is also the same as along-track direction.

[SOURCE: ISO 19130-1:2018, 3.7, modified — Notes 2 and 3 to entry added.]

3.3

backscattering coefficient

average *radar cross section* (3.9) per unit area

Note 1 to entry: If the radar return from the illuminated area is contributed by a number of independent scattering elements, it is described by the backscattering coefficient instead of radar cross section used for the point target. It is calculated as:

$$\sigma^0 = \frac{\sigma}{A}$$

where

σ is the total radar cross section of an area A ;

σ^0 is a dimensionless parameter and is usually expressed in decibels (dB) as $\sigma^0_{\text{dB}} = 10 \log_{10} \sigma^0$.

Note 2 to entry: “Backscattering coefficient” is sometimes called “normalized radar cross section”.

[SOURCE: ISO/TS 19159-3:2018, 3.6]

3.4

cross-talk

any signal or circuit unintentionally affecting another signal or circuit

Note 1 to entry: For PolSAR sensor, if the transmitting channel is horizontally (H) polarized, the cross-talk on transmitting defines the ratio of V polarization transmitting power to H polarization transmitting power, expressed in decibels (dB). The cross-talk on receiving is similar to that on transmitting.

[SOURCE: ISO/TS 19159-3:2018, 3.10]

3.5

integrated side lobe ratio

ISLR

ratio between the side lobe power and the main lobe power of the impulse response of point targets in the radar imaging scene

Note 1 to entry: The ISLR can be obtained by integrating the power of the impulse response over suitable regions. The ISLR is expressed as:

$$\text{ISLR} = 10 \log_{10} \left\{ \frac{P_{\text{total}} - P_{\text{main}}}{P_{\text{main}}} \right\}$$

where

P_{total} is the total power;

P_{main} is the main lobe power.

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Note 2 to entry: The main lobe width can be taken as α times the impulse response width (IRW), centred around the peak, where α is a predefined constant, usually between 2 and 2,5.

[SOURCE: ISO/TS 19159-3:2018, 3.15]

3.6 multi-dimensional synthetic aperture radar multi-dimensional SAR

method of obtaining multi-dimensional joint observation data of the target in polarization, frequency, angle, time and other dimensions based on the basic observation method of SAR

Note 1 to entry: Multi-dimensional SAR can be used to obtain the microwave scattering characteristics of the target with the changes of these dimensions, and then extract the target's geometric structure, bio-physical and other parameters. In contrast, single-dimensional SAR refers to the SAR observation method when the parameters such as polarization, frequency, angle, time, etc. are fixed, and obtains the microwave scattering characteristics of the target under fixed observation conditions.

3.7 multi-dimensional product

<earth observation, SAR> product that involves multiple dimensions or variables, which provides the geometrical, bio-physical and backscattering parameter information from the multi-dimensional data, except for conventional image products

3.8 peak side lobe ratio PSLR

ratio between the peak power of the largest side lobe and the peak power of the main lobe of the impulse response of point targets in the SAR image

Note 1 to entry: The PSLR is usually expressed in decibels (dB) and computed as follows:

$$\text{PSLR} = 10 \log_{10} \left\{ \frac{P_{\text{sidepeak}}}{P_{\text{mainpeak}}} \right\}$$

where

P_{sidepeak} is the peak power of the main lobe;

P_{mainpeak} is the peak power of the largest side lobe.

[SOURCE: ISO/TS 19159-3:2018, 3.19]

3.9 radar cross section

measure of the capability of the object to scatter the transmitted radar power

Note 1 to entry: Radar cross section is calculated as:

$$\sigma = \lim_{R \rightarrow \infty} 4\pi R^2 \frac{|E_s|^2}{|E_i|^2}$$

where

σ is the radar cross section;

E_i is the electric-field strength of the incident wave;

E_s is the electric-field strength of the scattered wave at the radar with a distance away from the target.

Note 2 to entry: Radar cross section has the dimensions of area, with the unit of square metres. Usually, it is expressed in the form of logarithm with the unit of dBsm as follows: