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Gradation standard for multispectral data products of remote sensing satellite

遥感卫星多光谱数据产品分级

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Gradation standard for multispectral data products of remote sensing satellite

1 Scope

This Standard specifies the gradation standard for multispectral data products of solar reflective band of remote sensing satellite, as well as the specifications, naming, and identification of data products at all levels.

This Standard applies to the gradation for multispectral data products of solar reflective band of remote sensing satellite in production, management, and application services, as well as the specification description and use of data products at all levels.

2 Normative references

The following documents are indispensable for the application of this document. For the dated references, only the editions with the dates indicated are applicable to this document. For the undated references, the latest edition (including all the amendments) are applicable to this document.

GB/T 32453-2015 Rule for classification and gradation of earth observation satellite data product

3 Terms and definitions

The terms and definitions defined in GB/T 32453-2015 and the following ones apply to this document. For ease of use, the following lists some of the terms and definitions in GB/T 32453-2015.

3.1 Data product

A data, data set, or series of data sets which conforms to a data product specification.

3.2 Data product specification

The specification, a detailed description of a data, data set, or series of data sets with additional descriptions, which enables the data, data set, or series of data sets to be created, provided, and used by others.

parameters, and operating parameters of the remote sensor when acquiring remote sensing data.

4 Abbreviations

The following abbreviations apply to this document.

DN - Digital number;

L - Level.

5 Gradation

5.1 Overview

According to the processing level of multispectral data products of remote sensing satellite (including radiometric correction, geometric correction and expression, image fusion, and parameter inversion), it is divided into level 0~6 products. Products at all levels can be further subdivided or expanded as needed. This Standard only specifies the levels and sub-levels of multispectral data products of remote sensing satellite. Expansion can be specified by the data product production or application department according to actual needs.

5.2 L0 product

The data product in units of scenes or bands which is formed after the multispectral data transferred from the satellites are subject to processing such as framing and auxiliary data separation.

The quality of L0 data product is related to the satellite remote sensor system. The data shall be complete.

5.3 L1 product

L1 data product is image data obtained by the systematically radiometric correction of L0 data product. According to the degree of radiometric correction processing, it can be divided into 2 sub-levels:

- L1-1: Multispectral data product of remote sensing satellite obtained by relative radiometric correction;

- L1-2: Multispectral data product of remote sensing satellite obtained by absolute radiometric correction.

L1 product shall meet the corresponding index requirements and can be

5.6 L4 product

The data product which uses ground control points and digital elevation model for terrain correction based on L0~L3 data. According to the degree of radiometric correction processing, it can be divided into 3 sub-levels:

- L4-1: Multispectral data product of remote sensing satellite which has undergone terrain correction and not undergone radiometric correction;

- L4-2: Multispectral data product of remote sensing satellite which has undergone terrain correction and relative radiometric correction;

- L4-3: Multispectral data product of remote sensing satellite which has undergone terrain correction and absolute radiometric correction.

L4 product shall meet the corresponding index requirements and can be expanded or adjusted according to specific conditions. Refer to Appendix A for each index. Refer to Appendix B for specific algorithms.

5.7 L5 product

The multispectral data product obtained by fusion and parameter inversion based on L0~L4 data. According to the processing degree, it can be divided into 6 sub-levels.

- L5-1: Multispectral data product of remote sensing satellite by pixel-level fusion;

- L5-2: Multispectral data product of remote sensing satellite by feature-level fusion;

- L5-3: Multispectral data product of remote sensing satellite by decision-level fusion;

- L5-4: Inversion product based entirely on the parameter itself;

- L5-5: Parametric inversion product which has undergone direct authenticity inspection;

- L5-6: Parametric inversion product which has undergone indirect authenticity inspection.

L5 product shall meet the corresponding index requirements and can be expanded or adjusted according to specific conditions. Refer to Appendix A for each index. Refer to Appendix B for specific algorithms.

5.8 L6 product

product. It is used to construct the conversion model between the image point position and the corresponding ground object point position of the image.

6.4 Metadata file

Multispectral data product metadata of remote sensing satellite is a file about the content, quality, condition, and other relevant information of the data product. The metadata file shall contain the metadata items of product specified in this Standard. Other information extension items can be determined according to user needs. The basic content is as follows:

a) Data product identification information;

b) Data product coordinate reference system information;

c) Data product quality information;

d) Data product content information;

e) Data product access information;

f) Data product distribution information.

6.5 Thumbnail file

STORE low-resolution browse diagrams generated by resampling image files.

7 Naming and identification of data products at all levels

The naming of multispectral data products of remote sensing satellite shall be implemented in accordance with the provisions of GB/T 32453-2015.

Appendix B

(Informative)

Calculation methods for related indexes of multispectral data products of solar reflective band of remote sensing satellite

B.1 Test methods for uncertainty of radiometric correction

B.1.1 Uncertainty of relative radiometric correction

Generally, the products processed by relative radiometric correction are used to calculate the generalized noise, as an index to evaluate the uncertainty of relative radiometric correction. The test method and steps are as follows:

a) SELECT several level 1 product images which have undergone radiometric correction containing uniform ground objects;

b) For images of several brightness types, select uniform sub-images of m rows and n columns (m≥300, n≥300);

c) For the selected k^{th} image, first calculate the average (Avg_k) of the image; then calculate the absolute error (E_k) and relative error (RE_k) of the column pixel DN value;

d) Calculate the uncertainty (E) of relative radiometric correction of the pixel in which all sub-images are located.

The calculation of the average (Avg_k) of the image is shown in formula (B.1).

$$Avg_k = \frac{\sum_{j=1}^{n}\sum_{i=1}^{m} DN_{kij}}{m \times n} \qquad \cdots\cdots (B.1)$$

Where:

Avg_k - The average of image;

DN_{kij} - Image brightness value;

m - Number of rows;

n - Number of columns.

the same time phase and in the same area as the sensor to be evaluated as the standard radiance value. USE the multi-point linear fitting method to calculate the absolute radiometric correction accuracy (k_d) of the sensor to be evaluated. The calculation is shown in formula (B.5).

$$k_d = \frac{|L - \tilde{L}|}{L} \times 100\% \quad \cdots\cdots (B.5)$$

Where:

k_d - Uncertainty of absolute radiometric correction;

L - Radiance value on satellite image;

$\tilde{L}$ - Reference radiance value.

B.2 Test methods for geometric correction accuracy

B.2.1 Geometric positioning accuracy

The geometric positioning accuracy of a multispectral remote sensing satellite image is characterized by a mean square error between the geographic position of a given point on its image and its real location or the homonymy point on the geographic-position accurate reference image. The test steps are as follows:

a) Uniformly select N control points on the level 2 image product which has undergone systematically geometric correction;

b) Calculate the error between each control point and its real position or a homonymy point on the reference image respectively;

c) Calculate the mean square error of the control points selected on the level 2 image product, i.e., the geometric positioning accuracy.

The calculation of the error (Δ_i) of the homonymy point is shown in formula (B.6).

$$\Delta_i = \sqrt{\Delta X^2 + \Delta Y^2} \quad \cdots\cdots (B.6)$$

Where:

Δ_i - Error of homonymy point;

ΔX - X image coordinate value minus X real coordinate value;

ΔY - Y image coordinate value minus Y real coordinate value.

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