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Terminology for ground processing system of land observation satellites

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Terminology for ground processing system of land observation satellites

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FOREWORD

This standard is proposed by China National Space Administration.

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In case of any doubt about the contents of English version, the Chinese original shall be considered authoritative.

Terminology for ground processing system of land observation satellites

1 Scope

This standard specifies the terminology used in the construction and operation management of ground processing system of land observation satellites.

This standard is applicable to definition in the files and/or technical documents of ground processing system of land observation satellites. Abbreviations and definitions in other files or technical documents concerning ground processing system of remote sensing satellites may also be referred.

2 Abbreviations

The following abbreviations are applicable to this document.

DN——Digital Number, digital number obtained by analogue-to-digital conversion device with quantization of analog signal at the specified quantization rate.

MTFC——Modulation Transfer Function Compensation.

SAR——Synthetic Aperture Radar.

3 Terms and definitions

3.1 Fundamental terms

3.1.1

cluster

a group of several integrated planned and constructed computer systems in which they can share each other information and be organized together based on certain subordinate relationship and may either be managed uniformly or form as independent systems separately.

Note: It generally includes the software and hardware.

3.1.2

cluster deployment

command line and the operation modes on Web interface for the operation system and application software in the cluster to make the unified installation, backup and recovery.

3.1.3

cluster management

unified parallel processing of progress, service, file, network configuration, common command and on-off controller in the cluster by means of command line and web interface operation and implementation of single management for the whole system.

3.1.4

resource allocation

automatic and optimizing configuration process for the calculation, storage and communication resources during the cluster operation. It generally consists of resource pool and configuration strategy, job scheduler and resource manager.

3.1.5

memory management

waterline adjustment of working storage section, and deletion of historical data and junk data as well as other management work required for data processing of the disk space on the computer nodes and shared disk array.

3.1.6

system monitoring

monitoring of hardware environment, facility status and system topological structure of ground system, including the monitoring of the equipment status, environment, network, memory, operational system, applications, playback of monitoried information, database, and alerting parameter setup, etc.

3.2 Data processing

3.2.1

data processing system

system of the processing, classification, archiving and output distribution of the data get at the receiving station of the remote sensing satellite.

3.2.2

worldwide grid reference system

worldwide earth surface reference system divided by generally uniform grids whose size is close to the size of a standard satellite scene.

3.2.3

cataloging

the process to generate scene and metadata through the scene-dividing processing of the original tape data on the basis of the worldwide grid reference system.

3.2.4

data extracting

the process required for the data product to extract level 0 data of standard scene or not, calibration data, satellite parameters and auxiliary data.

3.2.5

auxiliary data

quantitative data at the time of obtaining the remote sensing data with respect to the time, orbit, attitude parameters and other relevant engineering parameters of satellite sensor.

3.2.6

relative radiometric correction

the process for uniformizing the measured DNs of the uniform scene images in the channels, in order to correct the unconformity of the responsiveness of the various detection unit channels in the sensor.

3.2.7

absolute radiometric correction

the process for converting DN measured with sensors to the incident radiation quantity.

3.2.8

systematical geometric correction

the process, using the systematical offset matrix obtained from on-orbit testing for eliminating the system geometric deviation caused by the factors such as orbit and attitude error, etc. in the sensors' imaging process, and to generate the geographic coded image.

3.2.9

geometric precise correction

the process for implementing more precise geometric correction over image by manual or automatic selection of ground control points on the basis of the the systematical geometric correction, and building accordingly the conversion model between actual product and standard map.

3.2.10

ortho-geometric correction

the process for compensating the geometric distortion caused by land surface irregularity using the digital elevation model (DEM) to meet the orthographic projection requirements.

3.2.11

MTFC Modulation Transfer Function Compensation

the process to compensate the image, using the actually measured declining curve of the modulation transfer function based on the image quality degradation theory of modulation transfer fuction.

3.2.12

band-to-band registration

registration between pixels with the same name but different spectrum bands on the image.

3.3 Data archiving and information management

3.3.1

online storage

a kind of storage state in which the storage equipment and stored data remain readable and revisable by users on the data network.

3.3.2

near-line storage

a kind of storage state in which the data with small access volume are stored on the storage equipment that has relatively lower performance characters but ability of quick addressing and with high transmission rate.

3.3.3

off-line storage

a kind of storage state in which data are stored in the storage medium independent of the system applications.

3.3.4

lifecycle

storage cycle of data in the system.

3.3.5

storage area network

high-speed network connecting the storage equipment into a group of computers through fiber channel and observing corresponding protocols for the communication.

3.3.6

network attached storage

storage equipment that is connected to the processing system network and may provide data and file service. It is generally comprised of storage hardwares, operating systems, file systems on it, etc.

3.3.7

two-line elements

See Annex A for its definition.

3.4 Data distribution

3.4.1

order

work order automatically generated by the data distribution system for facilitating users to obtain the image data.

3.4.2

product order

order in which the products ordered by the user have already been processed by the system properly, stored in the storage area of the system and can be provided to the users directly.

3.4.3

producing order

order in which the products ordered by users and not jet processed by the system, shall be produced, starting from level 0 data, and can be provided to users only if they reach the users the required level.

3.4.4

collect order

order, provided to the user when the satellite image where the data he/she expects to order was not yet available, and it is required to uplink the command to control the satellite imaging over the assigned area, and then, after the completion of imaging, generate the producing order to put into production.

3.4.5

intranet

core network, isolated inside internal environment by the NetGAP and used for system production and operation. This network zone needs the NetGAP to conduct communication with the internet.

3.4.6

internet

network zone, isolated in the outer environment by the NetGAP and used to provide users with services. This network zone needs the NetGAP to conduct communication with the intranet.

3.4.7

enterprise serving bus

an intermediary system, between the client device for calling services and the provides of the services, responsible for dealing with the connections between them.

3.5 Data simulation and evaluation

3.5.1

geometric imaginary simulating

the process for establishing the coordinate relationship between the image point and the corresponding ground point, based on the imaging equation derived from the satellite orbit parameters and the attitude parameters of remote sensors at the time of imaging.

3.5.2

data format simulating

the process for simulating the arrangement and organization of auxiliary payload data and image data in conformity with the data format defined by the satellite and ground system interface specifications or of the input from the ground system.

3.5.3

scene simulating

the process for simulating the generation of the photographic ground scene of the remote sensor. It includes the terrestrial and atmospheric radiative transfer model.

3.5.4

queue signal noise ratio

ratio of the average value of the image data signal of a uniform scene to the standard deviation of signal values.

3.5.5

generalized noise

average value of the ratio of the absolute value of the difference between the average value of uniform scene image on each line (in the flight direction) and the average value on the whole image to the average value on the whole image.

3.5.6

modulation transfer function (MTF)

the function, changing along with the space frequencies, of the ratio of image space modulation degree to object space modulation degree in the imaging system.

3.5.7

location accuracy

discrepancy between the geometrically corrected geographic location on the image and the true geographic location.

3.5.8

inner distortion

image torsion and distortion caused by the factors such as the attitude and orbit measurement error, the camera geometric model error, the space environment etc.

3.5.9

band registration accuracy

root mean square deviation of the registrations of the same-named pixel spaces to the image data of different bands.

3.5.10

ground resolution

ground distance corresponding to each line pair of the imaging resolution of the remote sensor.

ground distance corresponding to the effective instantaneous field of view of the optical sensor.

ground distance corresponding to the antenna beam width of the microwave sensor.

3.6 Application demonstration and training

3.6.1

supervised classification

the process for defining the classification criterion, based on the observed value of known sample types, and classifying the images.

3.6.2

unsupervised classification

the method to classify the overall objectives to be classified into several groups in the case with no priori class knowledge. It generally includes such as ISODATA, minimum distance, generalized distance, parallel hexahedron, KOHONEN neural network, artificial neural network, FUZZY ART, etc.

3.6.3

transmission rate

ratio, when solar radiation incoming, of irradiance pass through the atmosphere to the initial incoming irradiance, expressed in percentage.

3.6.4

apparent radiance

radiance on the unit area per unit solid angle at the top level of the atmosphere.

3.6.5

apparent reflectance

ratio of the irradiation energy reflected from the top level of atmosphere to that incident to the atmosphere.

3.6.6

entrance pupil equivalent radiance

equivalent radiation energy on the unit area per unit solid angle at the entrance pupil of the satellite sensor.

3.6.7

noise equivalent radiance

radiation energy on the unit area per unit solid angle, equivalent to the sensor noise.

3.6.8

single window algorithm

a kind of single-band temperature inversion algorithm specially aimed to a single thermal infrared band and following the radiative transfer equation.

3.6.9

heat radiation

heat transfer process on the object surface by means of continuous radiative emission and absorption.

3.6.10

density slicing

a method using the image grayscale threshold to distinguish the targets with different grayscales.

3.6.11

topographic map division

division operation that divides the earth's surface into trapezoidal slices by 6 (longitude) × 3(latitude) degrees.

3.6.12

sheet number

the number showing a specific area on the earth defined by such way as follows：

Starting from 180 degree meridian, take the area of every 6 degree longitude difference as one column from the Western Hemisphere to the Eastern Hemisphere, 60 columns totaled accordingly. Use the Arabic numerals 1, 2, 3 ... 60 to represent each of them successively (for China, its Hemisphere column number is greater than 30). Similarly, starting from the equator, take the area of every 4 degree latitude difference as one line and, accordingly, divide the Southern Hemisphere and Northern Hemisphere into 22 lines respectively. The line number is represented by A, B, C, etc., successively.

3.6.13

mosaic

remote sensing image processing algorithm that seamlessly pieces several images together to form a whole image in accordance with the unified spatial reference system. Common mosaic algorithms includes FIRST, LAST, MIN, MAX, BLEND, CUTLINE, etc.

3.6.14

feather

a seamless treatment of the multi-image interface edges during mosaic process.

3.6.15

resampling

process for re-interpolating the grayscale values of the image pixels into the image grayscale data after the geometric transformation.

3.6.16

color balance

correction process of the hues of whole image based on the histogram of the overlapping regions or reference image and the other statistical data. The corrected image after shall be of the hues similar to of the overlapping region or reference image.

3.6.17

change detecting

process for detecting the image information on the time zone change region and its changes by comparing the remote sensing images at multi-time-phases.

3.7 On-orbit calibration

3.7.1

radiometric calibration

the process for determining the quantitative relationship between the output of the remote sensor and the known objective radiance received by the remote sensor.

3.7.2

absolute calibration

the process for determining the quantitative relationship between DN and the actual radiance value or radiation luminance value of the surface feature in the pixel corresponding to each detector. Here the DN is of the output signal from each detection unit of the satellite remote sensor.

3.7.3

relative calibration

the process for determining the non-uniformity of the response to the uniform incident radiant quantity between the different detection units of the remote sensor.

3.7.4

geometric calibration

the process, based on the ground measurement data to determine the relevant parameters of the sensors effecting the geometric features of the remote sensing image.

3.7.5

calibration site

a remote sense experimental field selected and designed for the radiancy and geometric correction and calibration of remote sensors.

3.7.6

in-flight calibration

the process for calibrating the in-flight satellite sensors with onboard calibration devices.

3.7.7

field radiometric calibration

the process for calibrating the in-flight satellite sensors at the radiometric calibration site, or using the well calibrated reference sensors.

3.7.8

cross-calibration

the process, taking the calibrated on-orbit sensors as reference and under the adequate compatible conditions such as view field, optical spectrum, observation geometric condition and timing, to calibrate the remote sensors through comparison with the remote sensing image data.

3.7.9

spectral calibration

the process for calibrating the parameters such as the central wavelength and the spectral bandwidth of each spectral channel of the optical remote sensor using the standard light source and the precise spectral radiant luminance measuring equipment.

3.8 Standardized data products

3.8.1 Data standard products of optical remote sensor

3.8.1.1

optical raw product

scene-divided optical remote sensing data downloaded from the satellite. It is also referred to as level 0 data.

3.8.1.2

optical radiometric correction product

radiometric corrected but not geometric corrected optical product data. It is also referred to as level 1 product.

3.8.1.3

optical systematical geometric correction product

optical image product with the map projection, formed through the radiometric correction and systematical geometric correction. It is also referred to as level 2 product.

3.8.1.4

optical precise geometric correction product

optical data product, radiometric corrected and geometric corrected, while using the ground control point to improve the product geometric accuracy. It is also referred to as level 3 product.

3.8.1.5

optical ortho-rectification product

optical data product, radiometric corrected, geometric corrected and geometric precisely corrected, and using the digital elevation model (DEM) to have corrected the optical parallax caused by the terrain effect. It is also referred to as level 4 product.

3.8.1.6

optical mosaic image product

optical image product, mosaic ked of multi-scene images. It is also referred to as level 5 product.

3.8.2 Hyperspectral data standard products

3.8.2.1

hyperspectral raw product

scene-divided hyperspectral remote sensing data downloaded from satellite, i.e. level 0 data.

3.8.2.2

hyperspectral radiometric correction product

hyperspectral data product, spectral recovered and radiometric corrected but not geometric corrected. It is also referred to as level 1 product.

3.8.2.3

hyperspectral systematical geometric correction product

hyperspectral image product, processed through radiometric correction and systematical geometric correction, and formed with map projection. It is also referred to as level 2 product.

3.8.2.4

hyperspectral precise geometric correction product

hyperspectral data product, spectrum recovered, radiometric corrected and geometric corrected while using the ground control points (GCP) to improve the geometric accuracy. It is also referred to as level 3 product.

3.8.2.5

hyperspectral ortho-rectification product

hyperspectral data product, spectrum recovered, radiometric corrected, geometric corrected and geometric precisely corrected, and using the digital elevation model (DEM) to have corrected the optical parallax caused by the terrain effect. It is also referred to as level 4 product.

3.8.2.6

hyperspectral mosaic image product

hyperspectral image product mosaic ked of multi-scene images. It is also referred to as level 5 product.

3.8.3 SAR data standard products

3.8.3.1

SAR raw product

raw signal data downloaded by synthetic aperture radar (SAR) with the image unprocessed, stored in the form of complex number, and also referred to as level 0 data.

3.8.3.2

SAR single-look complex image product

SAR image product, processed through the imaging processing and radiometric correction, retaining the amplitude and phase information in the form of complex number, and also referred to as level 1A product.

3.8.3.3

SAR multi-look image product

SAR image product, processed through multi-look imaging processing, radiometric correction and distance processing, and retaining the amplitude, and also referred to as level 1B product.

3.8.3.4

SAR systematical geometric correction product

SAR image product, processed through the imaging processing, radiometric correction and systematical geometric correction, formed with map projection, and also referred to as level 2 product.

3.8.3.5

SAR precise geometric correction product

SAR data product, processed through the imaging processing, radiometric correction and geometric correction, while using the ground control point to improve the geometric accuracy of the SAR data products, and also referred to as level 3 product.

3.8.3.6

SAR ortho-rectification product

SAR data product, imaging processed, radiometric corrected, geometric corrected and geometric precisely corrected, while using the digital elevation model (DEM) to have rectified the influence caused by the rugged terrain, and also referred to as level 4 product.

3.8.3.7

SAR mosaic image product

SAR image product mosaic ked of multi-scene images, and also referred to as level 5 product.

3.9 Thematic products

3.9.1

radiance product

remote sensing image product resulted from the conversion of image DN value to absolute radiance.

3.9.2

vegetation index product

remote sensing image product established on the basis of the standard data products and radiance products, and, through analysis and calculation, able to estimate the vegetation cover and biomass quantitatively and qualitatively such as ratio vegetation index, normalized differential vegetation index, D-value vegetation index, vertical vegetation index, etc.

3.9.3

land surface reflectance product

remote sensing image product inverting the land surface reflectance rate with atmospheric correction based on the radiance product.

3.9.4

land surface temperature/land surface emissivity product

remote sensing image product reflecting the characteristics of the land surface temperature and emissivity.

3.9.5

geo-coded standard image product

remote sensing digital image map, corrected on the basis of the Digital Terrain Model (DTM), registrating the image with the map according to the international photo-framing rule, and generating the geo-code.

3.10 Rapid response product

3.10.1

rapid response product

product, in fast visual scanning, rapid data extracted on user’s clicked area, radiometric corrected and geometric corrected, including optical or hyperspectral or SAR response products.

Annex A

(Normative)

Definition of Two-line Elements

The expression form of the definition is shown in the following:

AAAAAAAAAAAAAAAAAAAAAAA

1 NNNNNU NNNNNAAA NNNNN.NNNNNNNN +. NNNNNNNN +NNNNN-N +NNNNN-N N NNNNN

2 NNNNN NNN.NNNN NNN.NNNN NNNNNNN NNN.NNNN NNN.NNNN NN.NNNNNNNNNN

NNN

It starts with a 24-character name. See Figure A.1 for the meaning of the latter two lines.

1st line	
Byte	Description
01	Line No.
03-07	Satellite No.
08	Confidentiality level (U=non-confidential)
10-11	International marker (the latter two figures of launching year)
12-14	International marker (launching number of the year)
15-17	International marker (number of the launching time)
19-20	TLE time (latter two figures of the year)
21-32	TLE time (which day of the year and decimal part of mid-day time represented by a decimal fraction)
34-43	First order time derivative of mean motion
45-52	Second order time derivative of mean motion (position of decimal point already determined)
54-61	BSTAR resistance coefficient (position of decimal point already determined)
63	Type of ephemeris
65-68	Ephemeris number
69	Checksum (use 10 as modulus) (For the non-numeric portion: letter, blank space, full point, positive sign=0; negative sign=1)

2nd line	
Byte	Description
01	Line No.
03-07	Satellite No.
09-16	Orbit inclination angle [degree]
18-25	Equator longitude of ascending node [degree]
27-33	Eccentricity (decimal)
35-42	Argument of perigee [degree]
44-51	Mean anomaly [degree]
53-63	Mean motion [number of cycles/day]
64-68	Number of on-orbit cycles
69	Checksum (use 10 as modulus) (For the non-numeric portion: letter, blank space, full point, positive sign=0; negative sign=1)

Note: This definition here comes from the expression created by the North American Aerospace Defense Command of America and used for describing the satellite position and velocity.

Figure A.1 Meaning of the latter two lines of two-line elements