SLOVENSKI STANDARD
SIST-TS ISO/TS 19130:2010

01-oktober-2010

Geografske informacije - Modeli zaznavanja podob za geopozicioniranje

Geographic information - Imagery sensor models for geopositioning

Information géographique - Modèles de capteurs d'images de géopositionnement

Ta slovenski standard je istoveten z: **ISO/TS 19130:2010**

<u>**ICS:**</u>

07.040	Astronomija. Geodezija. Geografija	Astronomy. Geodesy. Geography
35.240.70	Uporabniške rešitve IT v znanosti	IT applications in science

SIST-TS ISO/TS 19130:2010 **en**

iTeh STANDARD PREVIEW
(standards.iteh.ai)

TECHNICAL SPECIFICATION

ISO/TS 19130

Geographic information — Imagery sensor models for geopositioning

Information géographique — Modèles de capteurs d'images de géopositionnement

ISO/TS 19130:2010(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

---

iTeh STANDARD PREVIEW
(standards.iteh.ai)

COPYRIGHT PROTECTED DOCUMENT

ISO/TS 19130:2010(E)

Contents

Page

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST-TS ISO/TS 19130:2010
https://standards.iteh.ai/catalog/standards/sist/9c040cdc-b96c-49da-9d81-
4f1fef3c801/sist-ts-iso-ts-19130-2010

ISO/TS 19130:2010(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 19130 was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

Introduction

The purpose of this Technical Specification is to specify the geolocation information that an imagery data provider shall supply in order for the user to be able to find the earth location of the data using a Physical Sensor Model, a True Replacement Model or a Correspondence Model. Detailed Physical Sensor Models are defined for passive electro-optical visible/infrared (IR) sensors (frame, pushbroom and whiskbroom) and for an active microwave sensing system (Synthetic Aperture Radar). A set of components from which models for other sensors can be constructed is also provided. Metadata required for geopositioning using a True Replacement Model, a Correspondence Model, or ground control points are also specified. The intent is to standardize sensor descriptions and specify the minimum geolocation metadata requirements for data providers and geopositioning imagery systems.

Vast amounts of data from imaging systems are collected, processed and distributed by government mapping and remote sensing agencies and commercial data vendors. In order for this data to be useful in extraction of geographic information, it requires further processing. Geopositioning, which determines the ground coordinates of an object from image coordinates, is a fundamental processing step. Because of the diversity of sensor types and the lack of a common sensor model standard, data from different producers can contain different parametric information, lack parameters required to describe the sensor that produces the data, or lack ancillary information necessary for geopositioning and analysing the data. Consequently, a separate software package often has to be developed to deal with data from each individual sensor or data producer. Standard sensor models and geolocation metadata allow agencies or vendors to develop generalized software products that are applicable to data from multiple data producers or from multiple sensors. With such a standard, different producers can describe the geolocation information of their data in the same way, thus promoting interoperability of data between application systems and facilitating data exchange.

This Technical Specification defines the set of metadata elements specified for providing sensor model and other geopositioning data to users. For the case where a Physical Sensor Model is provided, it includes a location model and metadata relevant to all sensors; it also includes metadata specific to whiskbroom, pushbroom, frame, and SAR sensors. It also includes metadata for functional fit geopositioning, where the function is part of a Correspondence Model or a True Replacement Model. This Technical Specification also provides a schema for all of these metadata elements.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

TECHNICAL SPECIFICATION   ISO/TS 19130:2010(E)

Geographic information — Imagery sensor models for geopositioning

1 Scope

This Technical Specification identifies the information required to determine the relationship between the position of a remotely sensed pixel in image coordinates and its geoposition. It supports exploitation of remotely sensed images. It defines the metadata to be distributed with the image to enable user determination of geographic position from the observations.

This Technical Specification specifies several ways in which information in support of geopositioning may be provided.

a) It may be provided as a sensor description with the associated physical and geometric information necessary to rigorously construct a Physical Sensor Model. For the case where precise geoposition information is needed, this Technical Specification identifies the mathematical formulae for rigorously constructing Physical Sensor Models that relate two-dimensional image space to three-dimensional ground space and the calculation of the associated propagated errors. This Technical Specification provides detailed information for three types of passive electro-optical/infrared (IR) sensors (frame, pushbroom and whiskbroom) and for an active microwave sensing system [Synthetic Aperture Radar (SAR)]. It provides a framework by which these sensor models can be extended to other sensor types.

b) It may be provided as a True Replacement Model, using functions whose coefficients are based on a Physical Sensor Model so that they provide information for precise geopositioning, including the calculation of errors, as precisely as the Physical Sensor Model they replace.

c) It may be provided as a Correspondence Model that provides a functional fitting based on observed relationships between the geopositions of a set of ground control points and their image coordinates.

d) It may be provided as a set of ground control points that can be used to develop a Correspondence Model or to refine a Physical Sensor Model or True Replacement Model.

This Technical Specification does not specify either how users derive geoposition data or the format or content of the data the users generate.

2 Conformance

This Technical Specification specifies four conformance classes. There is one conformance class for each of the methods specified for providing geopositioning information. Any set of geopositioning information claiming conformance to this Technical Specification shall satisfy the requirements for at least one conformance class as specified in Table 1. The requirements for each class are shown by the presence of an X in the boxes for all clauses in the application test suite (ATS) required for that class. If the requirement is conditional, the box contains a C.

1

ISO/TS 19130:2010(E)

Table 1 — Conformance classes

			A.1	A.2.1	A.2.2	A.3.1	A.3.2	A.3.3	A.3.4	A.3.5	A.4	A.5	A.6
			Subclause										
Conformance Class	Correspondence Model		X	X	X						X		X
	Physical Sensor Model	SAR	X			X	X	X		X			
		electro-optical	X			X	X	X	X				
	True Replacement Model		X								X	X	
	GCP Collection		X	X	X	C	C	C	C	C	C	C	C

3 Normative references

The following referenced documents are indispensable for the application 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 19103:2005, *Geographic information — Conceptual schema language*

ISO 19107, *Geographic information — Spatial schema*

ISO 19108, *Geographic information — Temporal schema*

ISO 19111:2007, *Geographic information — Spatial referencing by coordinates*

ISO 19115:2003, *Geographic information — Metadata*

ISO 19115-2:2009, *Geographic information — Metadata — Part 2: Extensions for imagery and gridded data*

ISO 19123, *Geographic information — Schema for coverage geometry and functions*

ISO/TS 19138:2006 *Geographic information — Data quality measures*

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1
active sensing system
sensing system that emits energy that the **sensor** uses to perform sensing

4.2
adjustable model parameters
model parameters that can be refined using available additional information, such as **ground control points**, to improve or enhance modelling corrections

4.3
along-track
direction in which the **sensor** platform moves

4.4
ARP
aperture reference point
3D location of the centre of the synthetic aperture

NOTE   It is usually expressed in ECEF **coordinates** in metres.

4.5
attitude
orientation of a body, described by the angles between the axes of that body's **coordinate system** and the axes of an external coordinate system

[ISO 19116:2004, definition 4.2]

4.6
attribute
named property of an entity

[ISO/IEC 2382-17:1999, definition 17.02.12]

NOTE   In this Technical Specification, the property relates to a geometrical, topological, thematic, or other characteristic of an entity.

4.7
azimuth resolution
⟨SAR⟩ resolution in the cross-range direction

NOTE   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).

4.8
beam width
⟨SAR⟩ useful angular width of the beam of electromagnetic energy

NOTE   Beam width is usually measured in radians and as the angular width between two points that have 50 % of the power (3 dB below) of the centre of the beam. It is a property of the antenna. Power emitted outside of this angle is too little to provide a usable return.

4.9
broadside
⟨SAR⟩ direction orthogonal to the velocity vector and parallel to the plane tangent to the Earth's **ellipsoid** at the nadir point of the **ARP**

4.10
calibrated focal length
distance between the **perspective centre** and the **image plane** that is the result of balancing positive and negative radial lens distortions during **sensor** calibration

4.11
coordinate
one of a sequence of n numbers designating the position of a point in n-dimensional space

[ISO 19111:2007, definition 4.5]

NOTE   In a **coordinate reference system**, the coordinate numbers are qualified by units.

4.12
coordinate reference system
coordinate system that is related to an object by a **datum**

ISO/TS 19130:2010(E)

[ISO 19111:2007, definition 4.8]

NOTE   For geodetic and vertical datums, the object will be the Earth.

4.13
coordinate system
set of mathematical rules for specifying how **coordinates** are to be assigned to points

[ISO 19111:2007, definition 4.10]

4.14
Correspondence Model
functional relationship between ground and **image coordinates** based on the correlation between a set of **ground control points** and their corresponding image coordinates

4.15
cross-track
perpendicular to the direction in which the collection platform moves

4.16
data
reinterpretable representation of information in a formalised manner suitable for communication, interpretation, or processing

[ISO/IEC 2382-1:1993, definition 01.01.02]

4.17
datum
parameter or set of parameters that define the position of the origin, the scale, and the orientation of a **coordinate system**

[ISO 19111:2007, definition 4.14]

4.18
detector
device that generates an output signal in response to an energy input

4.19
Doppler angle
⟨SAR⟩ angle between the velocity vector and the **range vector**

4.20
Doppler shift
wavelength change resulting from relative motion of source and **detector**

NOTE   In the **SAR** context, it is the frequency shift imposed on a radar signal due to relative motion between the transmitter and the object being illuminated.

4.21
ellipsoid
surface formed by the rotation of an ellipse about a main axis

[ISO 19111:2007, definition 4.17]

NOTE   The Earth ellipsoid is a mathematical ellipsoid figure of the Earth which is used as a reference frame for computations in geodesy, astronomy and the geosciences.

4.22
ellipsoidal coordinate system
geodetic coordinate system
coordinate system in which position is specified by **geodetic latitude**, **geodetic longitude** and (in the three-dimensional case) **ellipsoidal height**

[ISO 19111:2007, definition 4.18]

4.23
ellipsoidal height
geodetic height
h
distance of a point from the **ellipsoid** measured along the perpendicular from the ellipsoid to this point, positive if upwards or outside of the ellipsoid

[ISO 19111:2007, definition 4.19]

NOTE   Only used as part of a three-dimensional **ellipsoidal coordinate system** and never on its own.

4.24
error propagation
process of determining the uncertainties of derived quantities from the known uncertainties of the quantities on which the derived quantity is dependent

NOTE   Error propagation is governed by the mathematical function relating the derived quantity to the quantities from which it was derived.

iTeh STANDARD PREVIEW

(standards.iteh.ai)

4.25
external coordinate reference system
coordinate reference system whose **datum** is independent of the object that is located by it

SIST-TS ISO/TS 19130:2010
https://standards.iteh.ai/catalog/standards/sist/9c040cdc-b96c-49da-9d81-
4f1ffef3c801/sist-ts-iso-ts-19130-2010

4.26
fiducial centre
point determined on the basis of the camera **fiducial marks**

NOTE   When there are four fiducial marks, fiducial centre is the intersection of the two lines connecting the pairs of opposite fiducial marks.

4.27
fiducial mark
index marks, typically four or eight rigidly connected with the camera body, which form **images** on the film negative and define the **image coordinate reference system**

NOTE   When a camera is calibrated the distances between fiducial marks are precisely measured and assigned **coordinates** that assist in correcting for film distortion.

4.28
frame sensor
sensor that detects and collects all of the **data** for an **image** (frame / rectangle) at an instant of time

4.29
geodetic datum
datum describing the relationship of a two- or three-dimensional **coordinate system** to the Earth

[ISO 19111:2007, definition 4.24]

NOTE   In most cases, the geodetic datum includes an **ellipsoid** description.

4.30
geodetic latitude
ellipsoidal latitude
φ
angle from the equatorial plane to the perpendicular to the ellipsoid through a given point, northwards treated as positive

[ISO 19111:2007, definition 4.25]

4.31
geodetic longitude
ellipsoidal longitude
λ
angle from the prime meridian plane to the meridian plane of a given point, eastward treated as positive

[ISO 19111:2007, definition 4.26]

4.32
geoid
equipotential surface of the Earth's gravity field which is everywhere perpendicular to the direction of gravity and which best fits mean sea level either locally or globally

[ISO 19111:2007, definition 4.27]

4.33
geographic information
information concerning phenomena implicitly or explicitly associated with a location relative to the Earth

[ISO 19101:2002, definition 4.16]

4.34
geolocating
geopositioning an object using a **Physical Sensor Model** or a **True Replacement Model**

4.35
geolocation information
information used to determine geographic location corresponding to **image** location

[ISO 19115-2:2009, definition 4.11]

4.36
geopositioning
determining the geographic position of an object

NOTE   While there are many methods for geopositioning, this Technical Specification is focused on geopositioning from **image coordinates**.

4.37
georeferencing
geopositioning an object using a **Correspondence Model** derived from a set of points for which both ground and **image coordinate**s are known

4.38
gimbal
mechanical device consisting of two or more rings connected in such a way that each rotates freely around an axis that is a diameter of the next ring toward the outermost ring of the set

NOTE   An object mounted on a three-ring gimbal will remain horizontally suspended on a plane between the rings regardless as to the stability of the base.

4.39
grazing angle
⟨SAR⟩ vertical angle from the local surface tangent plane to the **slant range** direction

4.40
grid
network composed of two or more sets of curves in which the members of each set intersect the members of the other sets in an algorithmic way

[ISO 19123:2005, definition 4.1.23]

NOTE   The curves partition a space into grid cells.

4.41
grid coordinates
sequence of two or more numbers specifying a position with respect to its location on a **grid**

[ISO 19115-2:2009, definition 4.16]

4.42
ground control point
point on the earth that has an accurately known geographic position

[ISO 19115-2:2009, definition 4.18]

4.43
ground range
⟨SAR⟩ magnitude of the **range vector** projected onto the ground

NOTE   Ground range of an **image** is represented by the distance from the nadir point of the antenna to a point in the scene. Usually measured in the horizontal plane, but can also be measured as true distance along the ground, DEM, **geoid** or **ellipsoid** surface.

4.44
GRP
ground reference point
3D position of a reference point on the ground for a given synthetic aperture

NOTE   It is usually the centre point of an **image** (Spotlight) or an image line (Stripmap). It is usually expressed in ECEF **coordinates** in metres.

4.45
ground sampling distance
linear distance between **pixel** centres on the ground

NOTE   This definition also applies for water surfaces.

4.46
gyroscope
device consisting of a spinning rotor mounted in a **gimbal** so that its axis of rotation maintains a fixed orientation

NOTE   The rotor spins on a fixed axis while the structure around it rotates or tilts. In airplanes, the pitch and orientation of the airplane is measured against the steady spin of the gyroscope. In space, where the four compass points are meaningless, the gyroscope's axis of rotation is used as a reference point for navigation. An inertial navigation system includes three gimbal-mounted gyroscopes, used to measure roll, pitch, and yaw.

4.47
image
gridded coverage whose **attribute** values are a numerical representation of a physical parameter

[ISO 19115-2:2009, definition 4.19]

NOTE   The physical parameters are the result of measurement by a **sensor** or a prediction from a model.