AS/NZS ISO 19130.1:2020
ISO 19130-1:2018

Australian/New Zealand Standard™

Geographic information — Imagery sensor models for geopositioning

Part 1: Fundamentals

AS/NZS ISO 19130.1:2020

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First published as AS/NZS ISO 19130.1:2020.

Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee IT-004, Geographical Information/Geomatics.

The objective of this document is to identify 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 document specifies several ways in which information in support of geopositioning can be provided, as follows:

(a) It may be provided as a sensor description with the associated physical and geometric information necessary to rigorously construct a Physical Sensor Model (PSM). For the case where precise geoposition information is needed, this document identifies the mathematical equations for rigorously constructing PSMs that relate 2D image space to 3D ground space and the calculation of the associated propagated errors. This document provides detailed information for three types of passive electro-optical/IR sensors (frame, pushbroom and whiskbroom) and for an active microwave sensing system SAR. It provides a framework by which these sensor models can be extended to other sensor types.

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

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

(d) It can be provided as a set of GCPs that can be used to develop a CM or to refine a PSM or TRM.

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

This document is identical with, and has been reproduced from, ISO 19130-1:2018, *Geographic information — Imagery sensor models for geopositioning — Part 1: Fundamentals.*

As this document has been reproduced from an International Standard, a full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics.*

This first edition of ISO 19130 cancels and replaces ISO/TS 19130:2010, which has been technically revised.

The main changes compared to the previous edition are:

— part number 1 was added to reflect that ISO 19130 is now divided into several parts;

— normative references are updated to reflect revisions;

— Annex B is updated to reference the updated versions of the ISO geographic information standards.

A list of all the parts in the ISO 19130 series, can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document 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 (PSM), a True Replacement Model (TRM) or a Correspondence Model (CM). Detailed PSMs are defined for passive electro-optical visible/ IR sensors (frame, pushbroom and whiskbroom) and for an active microwave sensing system (SAR). A set of components from which models for other sensors can be constructed is also provided. Metadata required for geopositioning using a TRM, a CM, or ground control points (GCPs) 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 document defines the set of metadata elements specified for providing sensor model and other geopositioning data to users. For the case where a PSM 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 CM or a TRM. This document also provides a schema for all of these metadata elements.

Australian/New Zealand Standard

Geographic information — Imagery sensor models for geopositioning

Part 1: Fundamentals

1 Scope

This document 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 document specifies several ways in which information in support of geopositioning can be provided.

a) It may be provided as a sensor description with the associated physical and geometric information necessary to rigorously construct a PSM. For the case where precise geoposition information is needed, this document identifies the mathematical equations for rigorously constructing PSMs that relate 2D image space to 3D ground space and the calculation of the associated propagated errors. This document provides detailed information for three types of passive electro-optical/ IR sensors (frame, pushbroom and whiskbroom) and for an active microwave sensing system SAR. It provides a framework by which these sensor models can be extended to other sensor types.

b) It can be provided as a TRM, using functions whose coefficients are based on a PSM so that they provide information for precise geopositioning, including the calculation of errors, as precisely as the PSM they replace.

c) It can be provided as a CM that provides a functional fitting based on observed relationships between the geopositions of a set of GCPs and their image coordinates.

d) It can be provided as a set of GCPs that can be used to develop a CM or to refine a PSM or TRM.

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

2 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 19103:2015, *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 19115-1:2014, *Geographic information — Metadata — Part 1: Fundamentals*

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 19157:2013, *Geographic information — Data quality*

3 Terms and definitions

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