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# Geographic information — Spatial referencing by coordinates

Information géographique — Système de références spatiales par coordonnées



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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 traison 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 convertees 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 applora by at least 75 % of the member bodies casting a vote.

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 19111 was prepared by Technical Committee ISO/TC 211, Geographic information/Geomatics, in close collaboration with the Open Geospatial Consortium (OGC).



# Introduction

Geographic information contains spatial references which relate the features represented in the data to positions in the real world. Spatial references fall into two categories:

- those using coordinates;
- those based or geographic identifiers.

Spatial referencing by geographic identifiers is defined in ISO 19112<sup>[4]</sup>. This International Standard describes the data elements, relationships and associated metadata required for spatial referencing by coordinates. It describes the elements that are necessary to fully define various types of coordinate systems and coordinate reference systems applicable to geographic information. The subset of elements required is partially dependent upon the type of coordinates. This International Standard also includes optional fields to allow for the inclusion of non-essential coordinate reference system information. The elements are intended to be both machine and human readable.

The traditional separation of horizontal and vertical position has resulted in coordinate reference systems that are horizontal (2D) and vertical (1D) in nature, as opposed to truly three-dimensional. It is established practice to define a three-dimensional position by combining the horizontal coordinates of a point with a height or depth from a different coordinate reference system. In this International Standard, this concept is defined as a compound coordinate reference system.

The concept of coordinates can be expanded from a strictly spatial context to include time. ISO 19108 describes temporal schema. Time can be added as a temporal coordinate reference system within a compound coordinate reference system. It is even as sible to add two time-coordinates, provided the two coordinates describe different independent quantities.

EXAMPLE An example is the time/space position of a subsurface point of which the vertical coordinate is expressed as the two-way travel time of a sound signal in milliseconds, as is common in seismic imaging. A second time-coordinate indicates the time of observation, usually expressed in whole years.

Certain scientific communities use three-dimensional systems where horizontal position is combined with a non-spatial parameter. In these communities, the parameter is considered to be a third, vertical axis. The parameter, although varying monotonically with elevation or depth, does not necessarily vary in a simple manner; thus, conversion from the parameter to height or depth is non-trivial. The parameters concerned are normally absolute measurements and the datum is taken with reference to a direct physical measurement of the parameter. These non-spatial parameters are beyond the scope of the international Standard. However, the modelling constructs described within this International Standard can be applied through a profile specific to a community.

In addition to describing a coordinate reference system, this International Standard provides for the description of a coordinate transformation or a coordinate conversion between wo different coordinate reference systems. With such information, spatial data referred to different coordinate reference systems can be related to one specified coordinate reference system. This facilitates spatial data integration. Alternatively, an audit trail of coordinate reference system manipulations can be maintained.

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# Geographic information — Spatial referencing by coordinates

# 1 Scope

This International standard defines the conceptual schema for the description of spatial referencing by coordinates, optionally extended to spatio-temporal referencing. It describes the minimum data required to define one-, two- and three-dimensional spatial coordinate reference systems with an extension to merged spatial-temporal reference systems. It allows additional descriptive information to be provided. It also describes the information required to change coordinates from one coordinate reference system to another.

In this International Standard, coordinate reference system does not change with time. For coordinate reference systems defined on moving platforms such as cars, ships, aircraft and spacecraft, the transformation to an Earth-fixed ordinate reference system can include a time element.

This International Standard is applicable to producers and users of geographic information. Although it is applicable to digital geographic data, is principles can be extended to many other forms of geographic data such as maps, charts and text documents.

The schema described can be applied to the combination of horizontal position with a third non-spatial parameter which varies monotonically with height or depth. This extension to non-spatial data is beyond the scope of this International Standard but can be implemented through profiles.

### 2 Conformance requirements

This International Standard defines two classes of conformance, Class A for conformance of coordinate reference systems and Class B for coordinate operations between two coordinate reference systems. Any coordinate reference system claiming conformance to the International Standard shall satisfy the requirements given in A.1. Any coordinate operation claiming conformance to this International Standard shall satisfy the requirements given in A.2.

### 3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TS 19103, Geographic information — Conceptual schema language

ISO 19108, Geographic information — Temporal schema

ISO 19115, Geographic information — Metadata

Normative reference to ISO 19115 is restricted as follows. In this International Standard, normative reference to ISO 19115 excludes the MD\_CRS class and its component classes. ISO 19115 class MD\_CRS and its component classes specify descriptions of coordinate reference systems elements. These elements are modelled in this International Standard.

NOTE The MD\_CRS class and its component classes were deleted from ISO 19115:2003 through Technical Corrigendum 1:2006.