2 Overview

2.1 Name

INSPIRE data specification for the theme Coordinate Reference Systems.

2.2 Informal description

Definition:
Systems for uniquely referencing spatial information in space as a set of coordinates \( (X, Y, Z) \) and/or latitude, longitude and height, based on a geodetic horizontal and vertical datum. [Directive 2007/2/EC]

Description:
The scope of the theme Coordinate reference systems covers the Geodetic Coordinate Reference Systems (CRS) required for uniquely referencing spatial information in space as a set of coordinates \( (X, Y, Z) \) and/or latitude \( (\varphi) \), longitude \( (\lambda) \) and either ellipsoidal \( (h) \) or gravity-related height \( (H) \).

This specification establishes:

a. The geodetic datums and coordinate reference systems to be used when making spatial data sets available for INSPIRE, unless otherwise required for data of a specific theme.

   Particularly, the following ones are adopted:

   - The European Terrestrial Reference System 1989 (ETRS89), as geodetic datum within its scope.
   - The European Vertical Reference System (EVRS), to express gravity-related heights on land within its scope.
   - The Lowest Astronomical Tide (LAT), as reference surface to express depth values representing the sea floor in marine areas with an appreciable tidal range.
   - The Mean Sea Level (MSL), or a well-defined reference level close to the MSL, as reference surface to express depth values representing the sea floor in marine areas without an appreciable tidal range, in open oceans and effectively in waters deeper than 200 metres.

b. Plane coordinates reference systems (map projections) adopted and recommended for different purposes, covering the requirements of the INSPIRE transformation services and view services as well.

   Particularly, at least the coordinate reference systems for two-dimensional geodetic coordinates (latitude, longitude) shall be available for the display of spatial data sets with the view network service (Regulation No 976/2009\(^1\)).

c. The identifiers for the different types of coordinates that shall be used.

The document also provides rules and guidance on geodetic coordinate reference systems, vertical reference systems and map projections for their use outside of continental Europe (e.g. overseas territories).

In general the referencing by parameters and temporal reference systems are out of scope of the theme CRS.

2.3 Normative References

<table>
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<th>Description</th>
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<tr>
<td>IHO TRA2.5</td>
<td>Datums and Benchmarks in IHO M3 Resolutions of the International Hydrographic Organization, version updated to September 2008</td>
</tr>
<tr>
<td>ISO 6709</td>
<td>ISO 6709:2008 (Standard representation of geographical point position by coordinates)</td>
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<tr>
<td>ISO 19111-2</td>
<td>EN ISO 19111-2:2012 Geographic information - Spatial referencing by coordinates – Part 2: Extension for parametric values</td>
</tr>
<tr>
<td>ISO/Ts 19127</td>
<td>ISO/Ts 19127:2005, Geographic information -- Geodetic codes and parameters</td>
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2.4 Terms and definitions

General terms and definitions helpful for understanding the INSPIRE data specification documents are defined in the INSPIRE Glossary².

Specifically, for the theme Coordinate Reference Systems, the following terms are defined:

(1) compound coordinate reference system

² The INSPIRE Glossary is available from http://inspire-registry.jrc.ec.europa.euregisters/GLOSSARY
Coordinate reference system using two independent coordinate reference systems, one for the horizontal component and one for the vertical component, to describe a position [EN ISO 19111:2007, Geographic information — Spatial referencing by coordinates]

(2) coordinate reference system
Coordinate system which is related to the real world by a datum [EN ISO 19111:2007, Geographic information — Spatial referencing by coordinates]

NOTE  This definition includes coordinate systems based on geodetic or cartesian coordinates and coordinate systems based on map projections.

(3) coordinate system
Set of mathematical rules for specifying how coordinates are to be assigned to points [EN ISO 19111:2007, Geographic information — Spatial referencing by coordinates]

(4) datum
Parameter or set of parameters that define the position of the origin, the scale, and the orientation of a coordinate system [EN ISO 19111:2007, Geographic information — Spatial referencing by coordinates]

(5) geodetic coordinate system
Coordinate system in which position is specified by geodetic latitude, geodetic longitude and (in the three-dimensional case) ellipsoidal height [EN ISO 19111:2007, Geographic information — Spatial referencing by coordinates]

(6) geodetic datum
Datum describing the relationship of a coordinate system to the Earth [EN ISO 19111:2007, Geographic information — Spatial referencing by coordinates]

(7) lowest astronomical tide
(LAT) Lowest tide level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions [IHO TRA2.5]

(8) map projection
Change of coordinates, based on a one-to-one relationship, from a geodetic coordinate system to a plane, based on the same datum [EN ISO 19111:2007, Geographic information — Spatial referencing by coordinates]

(9) mean sea level
(MSL) Average height of the surface of the sea at a tide station for all stages of the tide over a 19-year period, usually determined from hourly height readings measured from a fixed predetermined reference level (chart datum) [IHO TRA2.5]

2.5 Symbols and abbreviations

| CRS       | Coordinate Reference System          |
| EC        | European Commission                  |
| ETRS89    | European Terrestrial Reference System 1989 |
| ETRS89-EVRS | Compound Coordinate Reference System ETRS89-EVRS |
| ETRS89-LAEA | Projection Lambert Azimuthal Equal Area |
| ETRS89-LCC  | Projection Lambert Conformal Conic     |
| ETRS89-TMzn | Projection Transverse Mercator        |
| EUREF      | Reference Frame Sub-commission for Europe of the IAG |
| EVRS       | European Vertical Reference System    |
| GCM        | Generic Conceptual Model              |
| GRS80      | Geodetic Reference System 1980        |
| IAG        | International Association of Geodesy  |
2.6 How the Technical Guidelines map to the Implementing Rules

The schematic diagram in Figure 1 gives an overview of the relationships between the INSPIRE legal acts (the INSPIRE Directive and Implementing Rules) and the INSPIRE Technical Guidelines. The INSPIRE Directive and Implementing Rules include legally binding requirements that describe, usually on an abstract level, what Member States must implement.

In contrast, the Technical Guidelines define how Member States might implement the requirements included in the INSPIRE Implementing Rules. As such, they may include non-binding technical requirements that must be satisfied if a Member State data provider chooses to conform to the Technical Guidelines. Implementing these Technical Guidelines will maximise the interoperability of INSPIRE spatial data sets.

Figure 1 - Relationship between INSPIRE Implementing Rules and Technical Guidelines

2.6.1 Requirements
The purpose of these Technical Guidelines (Data specifications on Coordinate Reference Systems) is to provide practical guidance for implementation that is guided by, and satisfies, the (legally binding) requirements included for the spatial data theme Coordinate Reference Systems in the Regulation (Implementing Rules) on interoperability of spatial data sets and services. These requirements are highlighted in this document as follows:

**IR Requirement**

_Article / Annex / Section no._

_Title / Heading_

This style is used for requirements contained in the Implementing Rules on interoperability of spatial data sets and services (Commission Regulation (EU) No 1089/2010).

For each of these IR requirements, these Technical Guidelines contain additional explanations and examples.

**Note** The Abstract Test Suite (ATS) in Annex A contains conformance tests that directly check conformance with these IR requirements.

Furthermore, these Technical Guidelines may propose a specific technical implementation for satisfying an IR requirement. In such cases, these Technical Guidelines may contain additional technical requirements that need to be met in order to be conformant with the corresponding IR requirement when using this proposed implementation. These technical requirements are highlighted as follows:

**TG Requirement**

_This style is used for requirements for a specific technical solution proposed in these Technical Guidelines for an IR requirement._

**Note** 1 Conformance of a data set with the TG requirement(s) included in the ATS implies conformance with the corresponding IR requirement(s).

**Note** 2 In addition to the requirements included in the Implementing Rules on interoperability of spatial data sets and services, the INSPIRE Directive includes further legally binding obligations that put additional requirements on data providers. For example, Art. 10(2) requires that Member States shall, where appropriate, decide by mutual consent on the depiction and position of geographical features whose location spans the frontier between two or more Member States. General guidance for how to meet these obligations is provided in the INSPIRE framework documents.

**2.6.2 Recommendations**

In addition to IR and TG requirements, these Technical Guidelines may also include a number of recommendations for facilitating implementation or for further and coherent development of an interoperable infrastructure.

**Recommendation**

_This style is used for recommendations._

**Note** The implementation of recommendations is not mandatory. Compliance with these Technical Guidelines or the legal obligation does not depend on the fulfilment of the recommendations.

**2.6.3 Conformance**

Annex A includes the abstract test suite for checking conformance with the requirements included in these Technical Guidelines and the corresponding parts of the Implementing Rules (Commission Regulation (EU) No 1089/2010).