INSPIRE
Infrastructure for Spatial Information in Europe

D2.8.I.2 INSPIRE Specification on Geographical Grid Systems - Guidelines

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Foreword
How to read the document?

This guideline describes the INSPIRE Specification on *Geographical grid systems* as developed by the Thematic Working Group *Coordinate reference systems and Geographical grid systems*.

This document includes two executive summaries that provide a quick overview of the INSPIRE data specification process in general, and the content of the data specification on *Geographical grid systems* in particular. We highly recommend that managers, decision makers, and all those new to the INSPIRE process and/or information modelling should read these executive summaries first.

In order to distinguish the INSPIRE spatial data themes from the spatial object types, the INSPIRE spatial data themes are written in *italics* and with capital letter, like *Geographical grid systems.*

The document will be publicly available as a 'non-paper'. It does not represent an official position of the European Commission, and as such can not be invoked in the context of legal procedures.

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Many individuals and organisations have contributed to the development of these Guidelines.

The Thematic Working Group *Coordinate reference systems and Geographical grid systems* (TWG RS) included:
João Torres (TWG Facilitator), Vida Bitenc (TWG Editor), Alessandro Caporali, Paul Crudace, Lars Engberg, Bruno Garayt, Heinz Habrich, external experts Gil Ross, Leendert Dorst and Freddy Fierens (European Commission contact point).

The Drafting Team Data Specifications included:
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The Consolidated UML repository has been set up by Michael Lutz, Anders Friis-Christensen, and Clemens Portele. The INSPIRE Registry has been developed by Angelo Quaglia and Michael Lutz. The INSPIRE Feature Concept Dictionary and Glossary has been consolidated by Darja Lihteneger. The data specification testing has been coordinated by Martin Tuchyna. The Testing Wiki has been set up by Loizos Bailas, Karen Fullerton and Nicole Ostländer. Web communication and tools for the consultations have been developed by Karen Fullerton and Hildegard Gerlach.

The stakeholders participated, as Spatial Data Interested Communities (SDIC) or Legally Mandated Organisations (LMO), in different steps of the development of the data specification development framework documents and the technical guidelines, providing information on questionnaires and user surveys, participating in the consultation process and workshops, testing the draft data specifications and supporting the work of their members in the Thematic Working Groups and Drafting Team Data Specifications.

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Interoperability of Spatial Data Sets and Services General Executive Summary

The challenges regarding the lack of availability, quality, organisation, accessibility, and sharing of spatial information are common to a large number of policies and activities and are experienced across the various levels of public authority in Europe. In order to solve these problems it is necessary to take measures of coordination between the users and providers of spatial information. The Directive 2007/2/EC of the European Parliament and of the Council adopted on 14 March 2007 aims at establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) for environmental policies, or policies and activities that have an impact on the environment.

INSPIRE will be based on the infrastructures for spatial information that are created and maintained by the Member States. To support the establishment of an European infrastructure, Implementing Rules addressing the following components of the infrastructure are being specified: metadata, interoperability of spatial data themes (as described in Annexes I, II, III of the Directive) and spatial data services, network services and technologies, data and service sharing, and monitoring and reporting procedures.

INSPIRE does not require collection of new data. However, after the period specified in the Directive[1] Member States have to make their data available according to the Implementing Rules.

Interoperability in INSPIRE means the possibility to combine spatial data and services from different sources across the European Community in a consistent way without involving specific efforts of humans or machines. It is important to note that "interoperability" is understood as providing access to spatial data sets through network services, typically via Internet. Interoperability may be achieved by either changing (harmonising) and storing existing data sets or transforming them via services for publication in the INSPIRE infrastructure. It is expected that users will spend less time and effort on understanding and integrating data when they build their applications based on data delivered within INSPIRE.

In order to benefit from the endeavours of international standardisation bodies and organisations established under international law their standards and technical means have been referenced, whenever possible.

To facilitate the implementation of INSPIRE, it is important that all stakeholders have the opportunity to participate its specification and development. For this reason, the Commission has put in place a consensus building process involving data users and providers together with representatives of industry, research and government. These stakeholders, organised through Spatial Data Interest Communities (SDIC) and Legally Mandated Organisations (LMO)[2], have provided reference materials, participated in the user requirement and technical[3] surveys, proposed experts for the Data Specification Drafting Team[4] and Thematic Working Groups[5], expressed their views on the drafts of the technical documents of the data specification development framework[6]; they have reviewed and tested the draft data specifications and have been invited to comment the draft structure of the implementing rule on interoperability of spatial data sets and services.

The development framework elaborated by the Data Specification Drafting Team aims at keeping the data specifications of the different themes coherent. It summarises the methodology to be

[1] For Annex I data: within two years of the adoption of the corresponding Implementing Rules for newly collected and extensively restructured data and within 5 years for other data in electronic format still in use

[2] The number of SDICs and LMOs on 21/08/2009 was 301 and 176 respectively

[3] Surveys on unique identifiers and usage of the elements of the spatial and temporal schema,

[4] The Data Specification Drafting Team has been composed of experts from Austria, Belgium, Czech Republic, France, Germany, Greece, Italy, Netherlands, Norway, Poland, Switzerland, UK, and the European Environmental Agency

[5] The Thematic Working Groups of Annex I themes have been composed of experts from Belgium, Czech Republic, Denmark, France, Finland, Germany, Hungary, Italy Netherland, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, UK, the European Commission, and the European Environmental Agency

[6] Four documents describing common principles for data specifications across all spatial data themes. See further details in the text.

used for the data specifications and provides a coherent set of requirements and recommendations to achieve interoperability. The pillars of the framework are four technical documents:

- The Definition of Annex Themes and Scope[7] describes in greater detail the spatial data themes defined in the Directive, and thus provides a sound starting point for the thematic aspects of the data specification development.

- The Generic Conceptual Model[8] defines the elements necessary for interoperability and data harmonisation including cross-theme issues. It specifies requirements and recommendations with regard to data specification elements of common use, like the spatial and temporal schema, unique identifier management, object referencing, a generic network model, some common code lists, etc. Those requirements of the Generic Conceptual Model that are directly implementable will be included in the Implementing Rule on Interoperability of Spatial Data Sets and Services.

- The Methodology for the Development of Data Specifications[9] defines a repeatable methodology, enabling to arrive from user requirements to a data specification through a number of steps including use-case development, initial specification development and analysis of analogies and gaps for further specification refinement.

- The "Guidelines for the Encoding of Spatial Data"[10] defines how geographic information can be encoded to enable transfer processes between the systems of the data providers in the Member States. Even though it does not specify a mandatory encoding rule it sets GML (ISO 19136) as the default encoding for INSPIRE.

Based on the data specification development framework, the Thematic Working Groups have created the INSPIRE data specification for each Annex I theme. The data specifications follow the structure of "ISO 19131 Geographic information - Data product specifications" standard. They include the technical documentation of the application schema, the spatial object types with their properties, and other specifics of the spatial data themes using natural language as well as a formal conceptual schema language[11].

A consolidated model repository, feature concept dictionary, and glossary are being maintained to support the consistent specification development process and potential further reuse of specification elements. The consolidated model consists of the harmonised models of the relevant standards from the ISO 19100 series, the INSPIRE Generic Conceptual Model, and the application schemas[1] developed for each spatial data theme (the latest with two exceptions: the application schemas are not developed for the INSPIRE spatial data themes *Coordinate reference systems* and *Geographical grid systems*).

The multilingual INSPIRE Feature Concept Dictionary contains the definition and description of the INSPIRE themes together with the definition of the spatial object types present in the specification. The INSPIRE Glossary defines all the terms (beyond the spatial object types) necessary for understanding the INSPIRE documentation including the terminology of other components (metadata, network services, data sharing, and monitoring).

By listing a number of requirements and making the necessary recommendations, the data specifications enable full system interoperability across the Member States, within the scope of the application areas targeted by the Directive. They are published as technical guidelines and provide the basis for the content of the Implementing Rule on Interoperability of Spatial Data Sets and Services for data themes included in Annex I of the Directive. The Implementing Rule will be

[7] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.3_Definition_of_Annex_Themes_and_scope_v3.0.pdf
[8] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.5_v3.1.pdf
[9] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.6_v3.0.pdf
[10] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.7_v3.0.pdf
[11] UML – Unified Modelling Language

extracted from the data specifications keeping in mind the technical feasibility as well as cost-benefit considerations. The Implementing Rule will be legally binding for the Member States.

In addition to providing a basis for the interoperability of spatial data in INSPIRE, the data specification development framework and the thematic data specifications can be reused in other environments at local, regional, national and global level contributing to improvements in the coherence and interoperability of data in spatial data infrastructures.

Geographical grid systems
Executive summary

Geographical grid systems are included in Annex I, which means that they are considered as reference data, i.e. data that constitute the spatial frame for linking and/or pointing to other information that belong to specific thematic fields as defined in the INSPIRE Annexes II and III.

The INSPIRE specification on *Geographical grid systems* has been prepared following the participative principle of a consensus building process. The stakeholders, based on their registration as a Spatial Data Interest Community (SDIC) or a Legally Mandated Organisation (LMO) had the opportunity to bring forward user requirements and reference materials, propose experts for the specification development, and participate in the review of the data specifications. The Thematic Working Group responsible for the specification development was composed of geodetic and mapping experts coming from Portugal, Slovenia, France, Germany, Italy, Sweden and the UK, all of them for many years involved in activities aiming to establish uniform geo-referencing within Europe. Due to the close links between and the special technical nature of the two themes of *Coordinate reference systems* and G*eographical grid systems*, the specifications of both themes were developed by one Thematic Working Group.

Geographical grid systems (hereafter: *Grids*) play a specific role that is quite different from the other themes in the Directive's annexes. Contrary to the other themes the *Grids* specification does not concern a downloadable or viewable thematic data set. Rather, it presents a basic functionality allowing the harmonised and interoperable geographic localisation of spatial objects defined by the other INSPIRE thematic data specifications. Therefore, the methodology developed by the Drafting Team on data specifications is only partly applicable to the work of this Thematic Working Group.

The specific task of the definition of the *Geographical grid systems* theme therefore consists in taking the right decisions on the choice of one (or a limited number of) grid systems that will ensure a common basis for the geographical harmonisation between all the other themes defined in the Annexes of the Directive.

The grid specified in this document is intended more for statistical reporting purposes and it is not intended for communities where the grids have to be optimised for data exchange, supercomputer processing and high volume archiving of new data each day.

This document represents the result of the specification of the *Geographical grid systems* theme, which contains elements that will be proposed as part of the draft Implementing Rule on interoperability of spatial data sets and services. These elements are clearly indicated in the document as "requirements". The other parts of the documents give clarification, background information and examples and are intended as part of the technical guidance documents accompanying the Implementing Rules.

The cornerstone of the specification development was the definition of the Directive on *Geographical grid systems* as being "Harmonised multi-resolution grid with a common point of origin and standardised location and size of grid cells". The requirements and recommendations of this theme are based on the results from the "European Reference Grids" workshop[12].

The scope of the theme "Geographical grid systems" covers quadrilateral grids used for indirect geo-referencing of themes with typically coarse resolution and wide (pan-European) geographical extent. The grid is two-dimensional and mainly used for spatial analysis or reporting. A geographical grid is associated with predefined resolutions and a coding system for identifying individual cells.

The grid – proposed as the multipurpose Pan-European standard – is based on the ETRS89 Lambert Azimuthal Equal Area coordinate reference system with the centre of the projection at the point 52º N, 10º E and false northing: Y_0 = 3210000 m, false easting: X_0 = 4321000 m.

[12] http://www.ec-gis.org/sdi/publist/pdfs/annoni-etal2003eur.pdf

Table of contents

1 Scope

This document presents a specification for the spatial data theme *Geographical grid systems* as defined in Annex I of the INSPIRE Directive.

This specification provides the basis for the drafting of Implementing Rules according to Article 7 (1) of the INSPIRE Directive [Directive 2007/2/EC]. The entire specification will be published as implementation guidelines accompanying these Implementing Rules.

2 Definitions

– ‘grid’ means a 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,

– ‘grid cell’ means a cell delineated by grid curves,

– ‘grid point’ means a point located at the intersection of two or more curves in a grid.

3 Overview

3.1 Name and acronyms

INSPIRE specification for the theme *Geographical grid systems.*

3.2 Informal description

Definition:

Harmonised multi-resolution grid with a common point of origin and standardised location and size of grid cells. [Directive 2007/2/EC]

Description:

The scope of the theme “Geographical grid systems” covers quadrilateral grids used for the indirect geo-referencing of themes with typically coarse resolution and wide (pan-European) geographical extent. The grid is two-dimensional and mainly used for Spatial Analysis or Reporting. A geographical grid is associated with predefined resolutions and a coding system for identifying individual cells.

These grids are defined by the projected coordinate reference system.

INSPIRE Geographical grid systems form a geo-referencing framework for the themes where grids with fixed and unambiguously defined location of equal-area grid cells are needed. Mandating or recommending the use of these grid systems for individual INSPIRE themes or specific cross-theme applications is out of scope of this INSPIRE theme.

It is recognised that there is a need to enable grid referencing for regions outside of continental Europe, for example for overseas Member States (MS) territories. For these regions, MS are able to define their own grid, although it must follow the same principles as laid down for the Pan-European Grid and be documented according to ISO19100 standards.

Such MS defined grids will be based on the International Terrestrial Reference System (ITRS), or other geodetic coordinate reference systems compliant with ITRS in areas that are outside the geographical scope of ETRS89. This follows the Requirement 2 of the Implementing Rule on Coordinate reference systems [INSPIRE-DS-CRS], i.e. compliant with the ITRS means that the system definition is based on the definition of the ITRS and there is a well established and described relationship between both systems, according to ISO 19111:2007 Geographic Information – Spatial referencing by coordinates.

The projection will be Lambert Azimuthal Equal Area and an identifier created. Further definition and parameters of the grid system shall follow the definitions as laid down within section 4 in this document.

The requirements and recommendations regarding "Geographical grid systems" are harmonized with the requirements for Coordinate reference systems [INSPIRE-DS-CRS].

3.3 Normative References

[Directive 2007/2/EC] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

[ISO 19111] EN ISO 19111:2007 Geographic information - Spatial referencing by coordinates (ISO 19111:2007)

[ISO 19115] EN ISO 19115:2005, Geographic information – Metadata (ISO 19115:2003)

[ISO 19123] EN ISO 19123:2007, Geographic Information – Schema for coverage geometry and functions

[ISO 19129] ISO/TS 19129:2009, Geographic information – Imagery, gridded and coverage data framework (ISO 19129:2009)

3.4 Information about the creation of the specification

Document title:	INSPIRE Specification on *Geographical grid systems*
Reference date:	2010-04-26
Responsible party:	INSPIRE TWG Coordinate reference systems and Geographical grid systems
Language:	English

3.5 Terms and definitions

Terms and definitions necessary for understanding this document are defined in the INSPIRE Glossary[13].
https://inspire-registry.jrc.ec.europa.eu

3.6 Symbols and abbreviations

CRS	Coordinate reference system
EC	European Commission
EEA	European Environmental Agency
EIONET	Environmental Information and Observation Network
ETRS89	European Terrestrial Reference System 1989
ETRS89-LAEA	Lambert Azimuthal Equal Area coordinate reference system
GCM	Generic Conceptual Model
GRIB	WMO standard for gridded data exchange GRIdded Binary

[13] The INSPIRE Glossary is available from http://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY

	http://www.wmo.ch/pages/prog/www/WMOCodes/GRIB.html
Grid_ETRS89-LAEA	Pan-European Grid
ICAO	International Civil Aviation Organisation
IOC	Intergovernmental Oceanographic Commission
ITRS	International Terrestrial Reference System
MS	Member States
NetCDF	Data Exchange Standard of the Climate and Forecasting community Network Common Data Form http://www.unidata.ucar.edu/netcdf
TWG	Thematic Working Group
WMO	World Meteorological Organisation

3.7 Notation of requirements and recommendations

To make it easier to identify the mandatory requirements and the recommendations for spatial data sets in the text, they are highlighted and numbered.

Requirement X	Requirements are shown using this style.

4 Introduction

One method of storing spatial information with indirect position is by using geographical grids. Grids omit direct spatial reference and average the qualitative properties of the subject. This makes them powerful tools for harmonisation and reduction of the complexity of spatial datasets. Geographical grids are also effective communication means for reporting spatial variability of features.

Technically, grids for geographical data are predefined spatial reference structures composed of cells regular in shape or area. Cells are usually squares based on a given coordinate reference system but, in rare cases, they can be shaped differently, e.g. as hexagons.

There are many types of grids available for different purposes. Ideally, one grid that is useful for all purposes ought to be created but it is not possible for one grid to cover uniformly the whole of Europe. Any type of grid will always have some disadvantages that disqualify it for certain use. The following grid examples are presented to describe the difficulties in selection of a multipurpose grid.

The *World Geographic Reference System* (Georef) is made for aircraft navigation. It is also suitable for global grid mapping. Georef is based on geographical latitude and longitude. The globe is divided into 12 bands of latitude and 24 zones of longitude, each 15 degrees in extent. These 15-degree areas are further divided into one-degree units identified by 15 characters. Georef disadvantages are that the shape, area and distance of cells are distorted.

The *Common European chorological grid reference system* (CGRS) is modified from the military grid reference system (MGRS). The MGRS itself is an alphanumeric version of a numerical UTM (Universal Transverse Mercator) or UPS (Universal Polar Stereographic) grid coordinate. MGRS has some serious disadvantages; cells do not cover the same area or have the same length of sides along latitude. This implies that cell statistics are difficult to calculate.

National grid systems. Most countries have defined grid systems covering their territory, based on the national plane coordinates. Belgium, Great Britain, Denmark, Finland, Ireland, Italy, the Netherlands and Sweden are examples of countries that have defined a national grid system. These systems employ conformal map projections which have some scale and area distortion.

Equal area grids are suitable for generalising data, statistical mapping and analytical work where an equal area of cells is important. The first Workshop on European Reference Grids in Ispra, 27-29 October 2003, recommends the use of the multipurpose European grid based on Lambert Azimuthal Equal Area and ETRS89. Proceedings [EUR 21494 EN] are available from the EIONET GIS page (http://www.eionet.eu.int/gis).

Weather and climate model grids; The Meteorological, Atmospheric and Oceanographic modelling communities produce many new forecast and climatological data models every day in 4 dimensional grids and subsequent projection onto (any) 2 dimensions. These are used for operational weather and ocean forecasting and for climate change research. Here there are existing standards from the WMO (World Meteorological Organisation), ICAO (International Civil Aviation Organisation) and the IOC (Intergovernmental Oceanographic Commission). The high volume data exchange formats include GRIB and NetCDF which are exchanged globally. It is not proposed that the INSPIRE grid specification should be required for use by these communities, who need highly specialised grids. Whenever this data is exchanged, it is expected that the grid definition (usually a mathematical definition) is included as part of the community standard. Where the grid is even more specialised, it is expected that the grid specification will be provided in a reference to an appropriate scientific document. This is the normal procedure used by these communities and their data specification standards.

The grid specified in this document is intended more for statistical reporting purposes and it is not intended for communities where the grids have to be optimised for data exchange, supercomputer processing and high volume archiving of new data each day.

5 Geographical Grid System

A grid typically uses a matrix of n x m cells spanned by 2 axes. As a result, a grid cell can be referenced by a sequence of integer values (one for each axis) that represent the position of the reference cell along each of the axes of the grid. See CV_GridCoordinate as specified in ISO 19123.

The grid – proposed as the multipurpose Pan-European standard – is based on the ETRS89 Lambert Azimuthal Equal Area coordinate reference system with the centre of the projection at the point 52^{o} N, 10^{o} E and false northing: Y_0 = 3210000 m, false easting: X_0 = 4321000 m (CRS identifier in INSPIRE: ETRS89-LAEA).

The grid is designated as Grid_ETRS89-LAEA. For identification of an individual resolution level the cell size in metres is appended to the name.

EXAMPLE The grid at a resolution level of 100km is designated as Grid_ETRS89-LAEA_*100K*.

The origin of Grid_ETRS89-LAEA coincides with the false origin of the ETRS89-LAEA coordinate reference system (Y=0, X=0).

Grid points of grids based on ETRS89-LAEA shall coincide with grid points of the grid.

The grid is defined as a hierarchical one with resolutions of 1m, 10m, 100m, 1000m, 10,000m, 100,000m.

The grid orientation is south-north, west-east.

The grid is designated as Grid_ETRS89-LAEA. For identification of an individual resolution level the cell size in metres is appended.

The reference point of a grid cell shall be the lower left corner of the grid cell.

Requirement 1	The Grid_ETRS89-LAEA as defined in this document shall be used as a geo-referencing framework for the themes where grids with fixed and unambiguously defined locations of equal-area grid cells are needed.

The main intended areas of usage are pan-European spatial analysis and reporting.

Requirement 2	The grid shall be designated as Grid_ETRS89-LAEA. For identification of an individual resolution level the cell size in metres shall be appended (Grid_ETRS89-LAEA_*100K*).

Requirement 3	The reference point of a grid cell for grids based on ETRS89-LAEA shall be the lower left corner of the grid cell.

There is the possibility that some grids based on ETRS89-LAEA don't comply with Grid_ETRS89-LAEA (e.g. 5 m grid resolution). In this case it is necessary to ensure compatibility of all grids based on ETRS89-LAEA.

Requirement 4	For ensuring compatibility, the grid points of all grids based on ETRS89-LAEA shall coincide with grid points at Grid_ETRS89-LAEA.

For the unambiguous referencing and identification of a grid cell, a coding system is needed to identify the cell size and the position of the lower left corner.

The coding system described hereafter follows the recommendations from the European Environmental Agency [EEA 2008].

The cell code is composed of the size of cell and the coordinates of the lower left cell corner in ETRS89-LAEA.

The cell size is denoted in metres ("m") for cell sizes up to 100m or kilometres ("km") for cell sizes from 1000m and above.

EXAMPLE A cell size of 10000 metres is denoted as "10km".

To reduce the length of the string, values for northing and easting (in the ETRS89-LAEA they are named Y and X) are divided by 10^n ("n" is number of zeros in the cell size value). With the given resolutions this means that the zeros are trimmed.

EXAMPLE 1 If the cell size is 1000 metres, the number of zeros in end is 3 and thus the divider is $10^3 = 1000$.

EXAMPLE 2 The cell code "1kmN2599E4695" identifies the 1km grid cell with coordinates of the lower left corner: Y=2599000m, X=4695000m.

Requirement 5	For the unambiguous referencing and identification of a grid cell, the cell code is composed of the size of the cell and the coordinates of the lower left cell corner in ETRS89-LAEA shall be used. The cell size shall be denoted in metres ("m") for cell sizes up to 100m or kilometres ("km") for cell sizes from 1000m and above. Values for northing and easting shall be divided by 10^n, where *n* is the number of trailing zeros in the cell size value.

It is recognised that there is a need to enable grid referencing for regions outside of continental Europe, for example for overseas Member States (MS) territories. For these regions, MS are able to define their own grid, although it must follow the same principles as laid down for the Pan-European Grid and be documented according to ISO19100 standards.

Such MS defined grids will be based on the International Terrestrial Reference System (ITRS), or other geodetic coordinate reference systems compliant with ITRS in areas that are outside the geographical scope of ETRS89. This follows the Requirement 2 of the Implementing Rule on Coordinate reference systems [INSPIRE-DS-CRS], i.e. compliant with the ITRS means that the system definition is based on the definition of the ITRS and there is a well established and described relationship between both systems, according to ISO 19111:2007 Geographic Information – Spatial referencing by coordinates. The projection will be Lambert Azimuthal Equal Area and an identifier created.

Requirement 6	For grid referencing in regions outside of continental Europe MS may define their own grid based on a geodetic coordinate reference system compliant with ITRS and a Lambert Azimuthal Equal Area projection, following the

	same principles as laid down for the Pan-European Grid. In this case, an identifier for the CRS and the corresponding identifier for the grid shall be created.

Example of a correctly constructed grid identifier : 'Grid_ETRS89-LAEA'.

6 Modelling grids

INSPIRE geographical grids themselves, with no values assigned to individual cells, are implemented and exchanged as vector data (lines or polygons). Thematic datasets based on geographical grids are exchanged as tables, lists or as gridded data.

Existing standards enable different modelling of gridded data products and exchanging data in not always compatible formats. The most confusing issue seems to be the relation of grid cell and grid points in discrete surface grids. When discrete surface grids are implemented as discrete point grids, this can cause location shifts of half of the cell size or unwanted cell value interpolations.

When surface grids are implemented as surfaces the above mentioned problems are avoided.

Appendix 1 contains template application schema for Discrete Surface Grid Coverage (from [ISO 19129]).

This surface grid schema does not apply to 3 and 4 dimensional specialised grids of the weather, ocean and climate modelling communities, nor to the general parametric display projections taken from such models.

Requirement 7	Data exchanged using numerical modelling theme-specific grids shall use standards in which the grid definition is either included with the data, or linked by reference to an appropriate scientific document describing the grid.

7 Manipulation with grid values

Reference grids are mainly used for exchanging discrete values assigned to individual cells. When discrete values referred to one grid (e.g. sampling results) are converted to a different grid, there is no possibility to maintain the original thematic information. "Proceedings & Recommendations" from the European Reference Grids Workshop [EUR 21494 EN] provide an exhaustive source on descriptions of the methods used when such conversion is required. A more compact source of relevant instructions is the "Guide to Geographic Data and Maps" [EEA 2008]. A general rule is to select the most suitable methodology, to use the original (not already derived) data, and to describe in detail the applied processing steps.

Controlling and recording resampling steps provides the needed input for calculation of expected errors.

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[IERS] www.iers.org – IERS website for information on the ITRS

[EUREF] www.euref.eu or www.euref-iag.net – EUREF website for information on the ETRS89 and the EVRS

[IHO] www.iho.int – IHO website for information on Hydrography

[WMO] www.wmo.int – World Meteorological Organization

[ICAO] www.icao.int – International Civil Aviation Organization

[IOC] ioc-unesco.org – Intergovernmental Oceanographic Commission

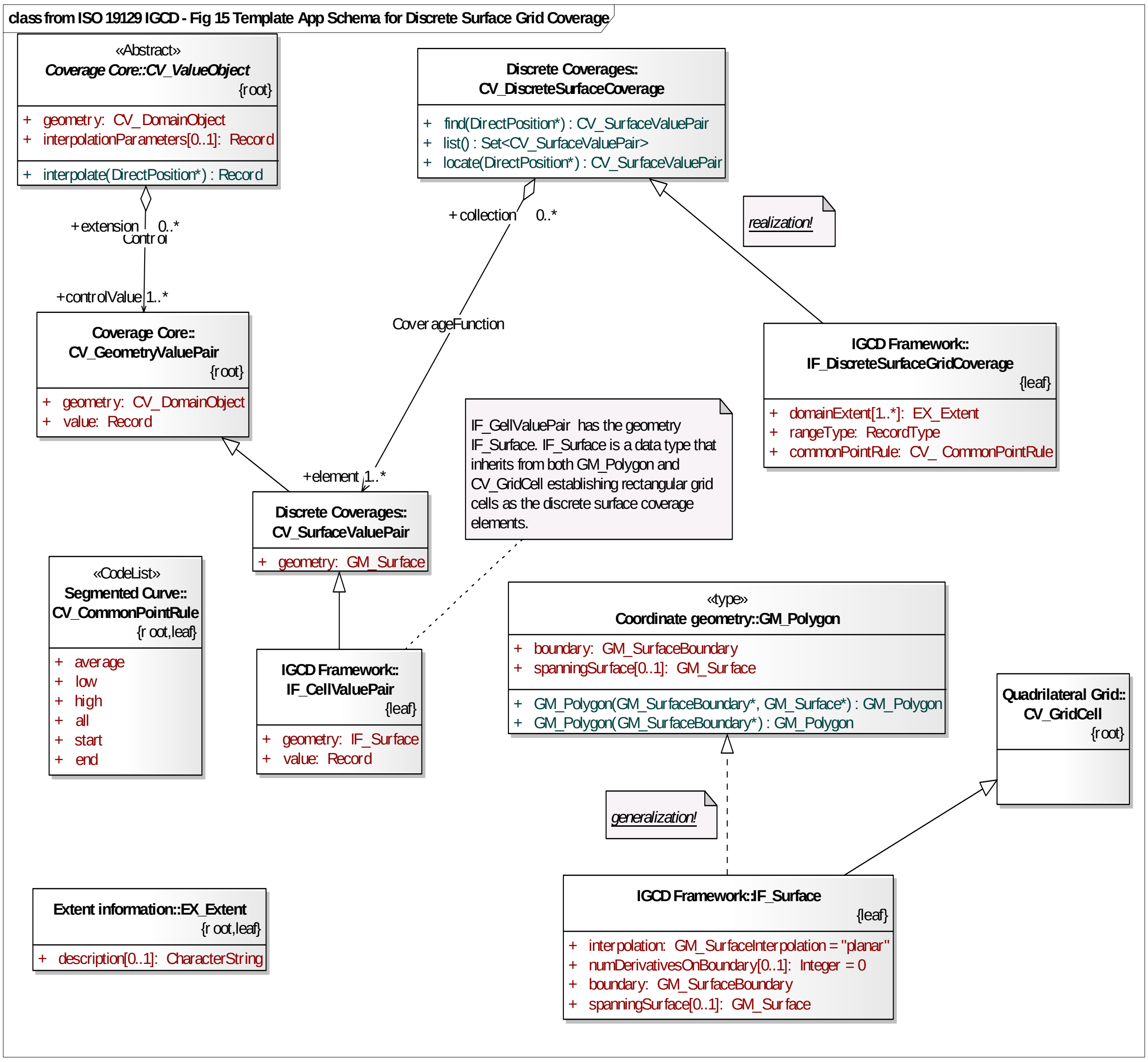
[GRIB] (GRIdded Binary) – WMO operational open data standard for multiple-dimensioned array data, exchanged daily by WMO, ICAO and IOC, http://www.wmo.ch/pages/prog/www/WMOCodes/OperationalCodes.html

[NetCDF] (Network Common Data Form) - Data Exchange Standard of the Climate and Forecasting community, http://www.unidata.ucar.edu/software/netcdf/

14 http://www.ec-gis.org/sdi/publist/pdfs/annoni-etal2003eur.pdf

15 http://www.ec-gis.org/sdi/publist/pdfs/annoni2005eurgrids.pdf

Appendix 1: Template application schema



Template Application Schema for “Discrete Surface Grid Coverage” from ISO 19129