

## 2 Overview

### 2.1 Name

INSPIRE data specification for the theme *Atmospheric Conditions and Meteorological Geographical Features*.

### 2.2 Informal description

#### **Definition:**

Theme III-13, Atmospheric Conditions:

Physical conditions in the atmosphere. Includes spatial data based on measurements, on models or on a combination thereof and includes measurements locations. [Directive 2007/2/EC]

Theme III-14, Meteorological Geographical Features:

Weather conditions and their measurements: precipitation, temperature, evapotranspiration, wind speed and direction. [Directive 2007/2/EC]

#### **Description:**

A very wide range of activities related to environmental protection require input information on meteorological conditions. Meteorological and related data (land /ocean surface conditions, etc.) held operationally within the European Meteorological Infrastructure (EMI, comprising the national meteorological services collaborating through EUMETNET and the two European organisations ECMWF and EUMETSAT which also report to the national meteorological services) include data on:

- Wind and turbulence
  - Wind vector
  - Wind gust and turbulence
  - Wind shear
- Temperature
  - air
  - ground
- Hydrological elements
  - Humidity
  - Soil moisture
  - Snowdepth
  - Evaporation
  - Rainfall / water equivalent of snow (accumulated and rate of)
- Radiation
  - Long- and short- wave radiation
  - Sunshine duration
  - Surface albedo
- Observed phenomena
  - Visibility
  - Weather
  - Cloud cover
  - Ice deposit

available as climatological estimates, actual measured values, and for most of them forecast values at various time ranges.

Similarly a large variety of air quality related data is available at a number of services throughout Europe.

The overall volume of data is huge. There are several centres in Europe that archive multi-terabytes of meteorological/oceanographic/climatological model data every day, and a substantial part of this is shared between centres and users who can handle data on this massive scale. Globally observed data received at nearly all meteorological centres in Europe is similarly multi-gigabyte in volume. Such resources are not primarily shared using the Internet, but through high capacity dedicated links. For public data access, the data is moderated and summarised into much smaller information products which users can handle using common internet tools.

The derogation in Article 14.2 of the Directive:

"Member States may allow a public authority supplying a service referred to in point (b) of Article 11(1)"

which refers to "View Services":

"...to apply charges where such charges secure the maintenance of spatial data sets and corresponding data services, especially in cases involving very large volumes of frequently updated data."

is intended to apply to View Services from Meteorological Centres. Every layer (or "field") of a numerical model of different parameters, levels in the vertical and at different times in the future is capable of being treated through a view service as a "map of the atmosphere". While geographic centres may hold a few maps where a view service applies, for meteorological centres, taking into account the number of layers in a numerical model, models of the atmosphere, stratosphere, ocean surface and ocean depths, the number of times a model is run, intermediate runs, ensembles and runs from derived or embedded models which each meteorological centre uses to focus on its regions of interest – but NOT including climate model runs – it is conservatively estimated that there are 100,000 new "maps of the atmosphere" produced daily across Europe.

Considering the Use Cases presented in Annex B it can be said that the whole of this data is potentially useful with respect to achieving the objectives of the INSPIRE Directive. Therefore, a phased approach has been defined where data can be progressively integrated into the INSPIRE framework.

- For the first implementation a basic data set following as closely as possible the text of the Directive is required as a mandatory minimum,
- In addition to this basic set a recommended data set is defined to better match the needs of the identified Use Cases; this data set, or part of it, could become mandatory later on at a further stage of the INSPIRE development, but SDIC and LMOs are encouraged to implement it, resources permitting, without waiting for this stage.
- Most importantly the present data specifications have been developed so as not to exclude any type of atmospheric data including air quality data. Therefore they can be used from the start by any operator willing to integrate its data into the interoperable environment defined for INSPIRE and to make users benefit from it.

For all types of data only the final processed form of the data may fall within scope; interim results of any processing chain are explicitly excluded from scope.

Many aviation meteorological data products are defined in aviation regulations which are maintained jointly by ICAO and WMO (both recognised by ISO as standards bodies); these are currently excluded from the scope of AC-MF. However, if meteorological elements required by INSPIRE extend up into the atmosphere, they will naturally impinge on aviation regulations. Data modelling for INSPIRE, as it expands should avoid conflicting with these aviation regulations.

With respect to the distinction between the two themes "Atmospheric Conditions" and "Meteorological Geographical Features", no criteria could be found to make it operational, so the version 2 of the data specification document was prepared to cover both themes in one document. It appeared that this did not cause any difficulty with the user needs expressed through the identified Use Cases nor with any of the issues raised during the commenting period on version 2. Therefore, the merging of the two themes into one theme labelled "Atmospheric Conditions and Meteorological Geographical Features" has been proposed and the present version of the data specification document is provided under this label only.

## **2.2.1 Definition of the mandatory and recommended data sets**

**Recommendation 1** The data made available should include, but not be limited to, the following parameters, spatial coverage and resolution, temporal coverage and resolution.

#### **List of mandatory parameters**

- wind speed and direction
- temperature
- relative humidity
- evaporation amount
- precipitation amount

#### **Spatial coverage and resolution**

- Data observed at the Regional Basic Synoptic Network (RBSN), which is a WMO-managed observing network aiming at assisting in defining the state of the atmosphere at least on a scale of the order of 200 km in the horizontal and six to 12 hours in time (ref. WMO Resolution 40, Cg XII).

#### **Temporal coverage and resolution**

- Past and present data as available
- Wind, temperature and humidity: 6-hourly data
- Evaporation and precipitation: daily data, 24-hour accumulated

#### **List of recommended parameters**

##### *Meteorological data*

- wind speed and direction
- wind gust speed
- temperature
- relative humidity
- evaporation amount
- precipitation amount
- precipitation rate
- precipitation type
- total snow depth
- pressure reduced to mean sea level
- total cloud cover
- visibility
- global solar radiation
- long-wave radiation
- short-wave radiation

Products derived from meteorological satellite data at level 3 or higher (variables mapped on uniform space-time grid scales)<sup>1</sup>, which are measures of atmospheric properties (e.g. cloud cover) are considered to be in scope. Satellite positioning and pre-processing information, and level 2 and lower data are excluded from scope. Further background information can be found in informative Annex G.

#### **- Temporal coverage and resolution**

- Coverage: past, present and forecast data. Past data include climatological information, e.g. monthly means, extremes etc. Forecast data include climate information from numerical simulations

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<sup>1</sup> For full definition of satellite processing levels, see for example: [http://en.wikipedia.org/wiki/Remote\\_sensing#Data\\_processing\\_levels](http://en.wikipedia.org/wiki/Remote_sensing#Data_processing_levels)

Only the latest real-time weather forecast is considered in scope, as it provides on average the best prediction of the weather. However, hindcasts (non-real-time simulations of atmospheric conditions) may fall within scope

For climate projections, only long-term time-means are considered to be in scope; data at a high temporal resolution is excluded

- Resolution: in line with the current practice in operational meteorology
- Spatial coverage and resolution
  - In line with the current practice in operational meteorology. For past and present information the use of numerical modelling output is strongly encouraged to overcome the limitation of the observing networks.

#### *Air quality data*

Air quality data whose monitoring is required under Directives 2004/107/EC and 2008/50/EC is recommended for inclusion. The list of parameters is shown in the informative Annex H.

#### **Products out of scope**

The following products are excluded from scope for both mandatory and recommended parameters:

- Offline archives stored on tape.
- Partially-processed information
- Observational calibration information
- Intermediate forecast runs
- Model diagnostic data
- 3rd Party data
- Non-operational data
- Research data

#### **Definition:**

Theme III-13, *Atmospheric Conditions*:

Physical conditions in the atmosphere. Includes spatial data based on measurements, on models or on a combination thereof and includes measurements locations. [Directive 2007/2/EC]

Theme III-14, *Meteorological Geographical Features*:

Weather conditions and their measurements: precipitation, temperature, evapotranspiration, wind speed and direction. [Directive 2007/2/EC]

#### **Description:**

The INSPIRE themes “Atmospheric Conditions” and “Meteorological Geographical Features” are covered together in one Data specification. These themes provide basic concepts and data models for environmental protection related activities requiring information on atmospheric conditions like weather, climate and air quality.

Entry in the INSPIRE registry: <http://inspire.ec.europa.eu/theme/ac/>

## **2.3 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 19107] EN ISO 19107:2005, Geographic Information – Spatial Schema

[ISO 19108] EN ISO 19108:2005, Geographic Information – Temporal Schema

[ISO 19108-c] ISO 19108:2002/Cor 1:2006, Geographic Information – Temporal Schema, Technical Corrigendum 1

- [ISO 19111] EN ISO 19111:2007 Geographic information - Spatial referencing by coordinates (ISO 19111:2007)
- [ISO 19113] EN ISO 19113:2005, Geographic Information – Quality principles
- [ISO 19115] EN ISO 19115:2005, Geographic information – Metadata (ISO 19115:2003)
- [ISO 19118] EN ISO 19118:2006, Geographic information – Encoding (ISO 19118:2005)
- [ISO 19123] EN ISO 19123:2007, Geographic Information – Schema for coverage geometry and functions
- [ISO 19125-1] EN ISO 19125-1:2004, Geographic Information – Simple feature access – Part 1: Common architecture
- [ISO 19135] EN ISO 19135:2007 Geographic information – Procedures for item registration (ISO 19135:2005)
- [ISO 19138] ISO/TS 19138:2006, Geographic Information – Data quality measures
- [ISO 19139] ISO/TS 19139:2007, Geographic information – Metadata – XML schema implementation
- [ISO 19157] ISO/DIS 19157, Geographic information – Data quality
- [OGC 06-103r4] Implementation Specification for Geographic Information - Simple feature access – Part 1: Common Architecture v1.2.1
- NOTE This is an updated version of "EN ISO 19125-1:2004, Geographic information – Simple feature access – Part 1: Common architecture".
- [Regulation 1205/2008/EC] Regulation 1205/2008/EC implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata
- [ISO 19109] ISO 19109:2006, Geographic Information — Rules for application schemas
- [ISO 19156] ISO 19156: 2011, Geographic information - Observations and measurements
- [WMO 306] Manual on Codes WMO - No 306, Volumes I.1 and I.2, World Meteorological Organisation, ISBN 978-92-63-10306-2.
- WMO Manual on the Global Observing System (WMO-No 544)
- WMO Manual on the Global Data-processing and Forecasting System (WMO-No. 485)
- WMO Manual on the WIS (subject to WMO Congress-XVI 2011 approval)

## 2.4 Terms and definitions

General terms and definitions helpful for understanding the INSPIRE data specification documents are defined in the INSPIRE Glossary<sup>2</sup>.

## 2.5 Symbols and abbreviations

ATS	Abstract Test Suite
CSML	Climate Science Modelling Language
EC	European Commission
ECMWF	European Centre for Medium-Range Weather Forecasts
EEA	European Environmental Agency
EMI	European Meteorological Infrastructure
ETRS89	European Terrestrial Reference System 1989
ETRS89-LAEA	Lambert Azimuthal Equal Area
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EVRS	European Vertical Reference System
GCM	General Conceptual Model
GML	Geography Markup Language
IR	Implementing Rule
ISDSS	Interoperability of Spatial Data Sets and Services
ISO	International Organization for Standardization
ITRS	International Terrestrial Reference System
LAT	Lowest Astronomical Tide
LMO	Legally Mandated Organisation
SDIC	Spatial Data Interest Community
TG	Technical Guidance
UML	Unified Modeling Language
UTC	Coordinated Universal Time
WMO	World Meteorological Organization
XML	EXtensible Markup Language

## 2.6 How the Technical Guidelines map to the Implementing Rules

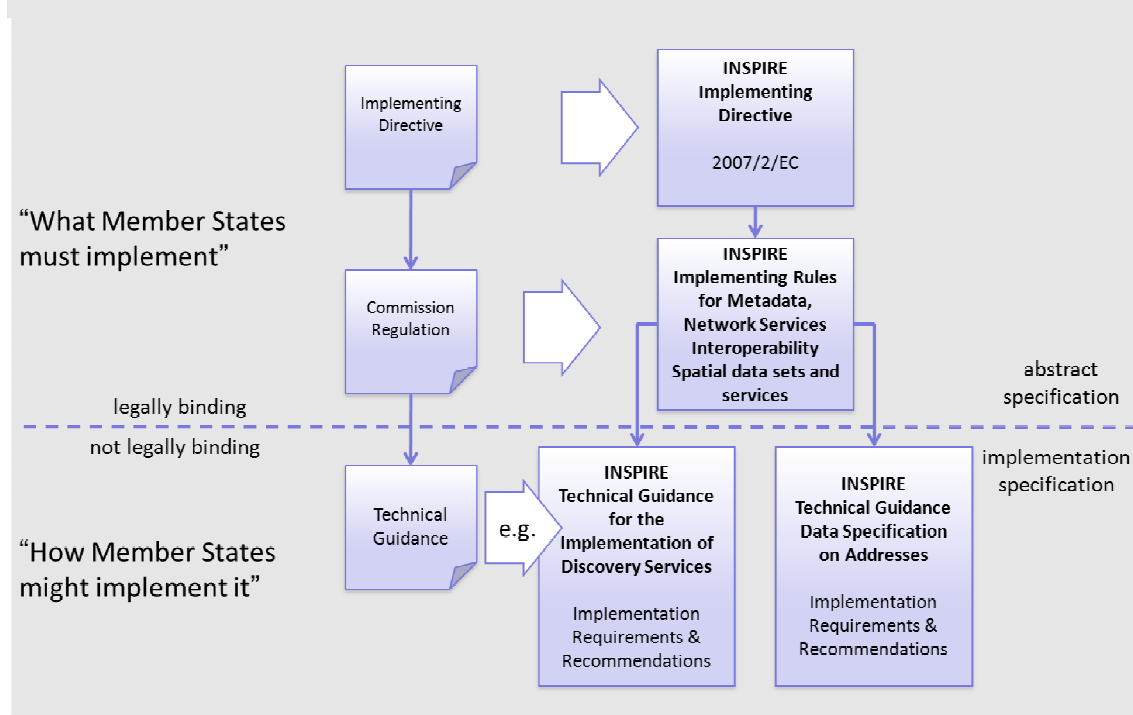
The schematic diagram in Figure 1 gives an overview of the relationships between the INSPIRE legal acts (the INSPIRE Directive and Implementing Rules) and the INSPIRE Technical Guidelines. The INSPIRE Directive and Implementing Rules include legally binding requirements that describe, usually on an abstract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

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<sup>2</sup> The INSPIRE Glossary is available from <http://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY>

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 *Atmospheric Conditions and Meteorological Geographical Features*) is to provide practical guidance for implementation that is guided by, and satisfies, the (legally binding) requirements included for the spatial data theme Atmospheric Conditions and Meteorological Geographical Features in the Regulation (Implementing Rules) on interoperability of spatial data sets and services. These requirements are highlighted in this document as follows:

<p style="text-align: center;"><b>IR Requirement</b> Article / Annex / Section no. <b>Title / Heading</b></p> <p>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).</p>
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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 X** 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 X** Recommendations are shown using this style.

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).