

# INSPIRE Good Practice: OGC compliant INSPIRE Coverage data and service implementation

## Name of the GP

OGC compliant INSPIRE Coverage data and service implementation.

## Description of the GP

Raster data appear across many INSPIRE themes from Annex II (4 themes) and Annex III (9 themes), specifically in the form of coverages, a format standardised by the Open Geospatial Consortium (OGC) and offered using different types of geospatial services.

The different INSPIRE themes in the scope use two different approaches to serve coverage data to the user: either offered by a Web Coverage Service (WCS) as features, or by a Sensor Observation Service (SOS) as observation results. Each of these types of services provides, as a default encoding option, coverage data as features according the OGC CIS 1.0 standard, or as discrete observations based on ISO 19156:2011 (O&M) according INSPIRE D2.9 v3.0, respectively.

Over the last years the community of implementers has identified issues on making this data interoperable in the context of the INSPIRE Directive, being them mainly due to immaturity of the underlying coverage standards in force, which introduced some inconsistencies in the INSPIRE framework at conceptual level - possibly because misinterpretation - and lack of definition at implementation level. This situation led to application schemas incompatible with OGC CIS 1.0, having elements not foreseen by the implementation standard. Additionally, the INSPIRE Technical Guidance documents are not concrete enough to clarify how to implement interoperable INSPIRE coverage data and services.

Since 2014 a number of OGC, ISO and INSPIRE experts have teamed up in the scope of the activities of the INSPIRE Community Forum to identify the related issues and overcome the drawbacks by establish best practices, evaluated and demonstrated through sample services.

The good practice achieved as a result of these work constitutes a functional solution to align INSPIRE coverages to OGC standards, amending in a simple way the existing INSPIRE XSD coverage schemas by moving any INSPIRE extensions to the coverage metadata bucket, being it one of the components of an OGC compliant CIS 1.0 coverage.

The solution is aimed to clarify how INSPIRE (raster) coverage data have to be implemented for assuring an interoperable data provision for a wide list of Annex II and III themes.

This Good Practice has emerged in the first half of 2020, being presented in a [dedicated hands-on workshop in the INSPIRE 2020 Online Conference](#), in the [62<sup>nd</sup> MIG-T meeting on 2<sup>nd</sup> July 2020](#) (as a discussion document), and formally presented as an INSPIRE Good Practice candidate in the [63<sup>rd</sup> MIG-T meeting on 13<sup>th</sup> October 2020](#), where it was endorsed as a candidate.

## INSPIRE component(s)

INSPIRE Data (raster spatial representation type)

INSPIRE Network Services

## References

### Normative reference

This good practice is based on and fully complies with the OGC (Open Geospatial Consortium) standards on Coverage data:

- At abstract, conceptual level, with [OGC Abstract Topic 6](#) which is identical to [ISO 19123](#).
- At concrete, interoperable level with the **OGC Coverage Implementation Schema (CIS)**, which is adopted by ISO as [19123-2](#).

Several versions of the OGC Coverage Implementation Schema (CIS) exist:

- **CIS 1.0**, formerly known as “GML 3.2.1 Application Schema – Coverages” (GMLCOV), is **adopted as default encoding by those INSPIRE themes serving coverage data as features**.
- CIS 1.1, which provides a comprehensive, more consistent schema for grid coverages. It is backwards compatible with its predecessor (CIS 1.0) and constitutes the future standard to be adopted in medium term in the scope of the INSPIRE Maintenance and Implementation Framework.

Find here [more details on coverage standardisation](#).

NOTE: This good practice is based on CIS 1.0. While the [OGC API-Coverages](#) draft (currently under discussion) is based on CIS 1.1, and CIS 1.1 is backwards compatible with CIS 1.0, compatibility to this upcoming standard is in principle assured.

### Other references

- **Discussion document**

A [Discussion Document](#) fully explaining this INSPIRE Good Practice on the implementation of INSPIRE Coverage data and services is available in order to spread the word and promote the use of the amended schemas (also available in the documentation of the [62nd MIG-T meeting](#)).

- **Dedicated web page**

Additionally, a plain description of this good practice is available in [this dedicated page in the INSPIRE Community Forum](#).

- **Demonstration service**

The good practice is complemented by a **Coverage Demonstration Service**, powered by the rasdaman WCS engine, providing data for various INSPIRE raster data themes (Elevation, Orthoimagery and Land cover), which allows the user to play with different service requests to get INSPIRE coverage data and metadata, analyse and combine different data layers (cross-theme fusion), download and present the final results:

<https://inspire-wcs.eu>

- **Workshop “INSPIRE Coverages, Demystified”**

The good practice and the demonstration service were presented in the [Workshop “INSPIRE Coverages, Demystified”](#) ([presentations](#) / [video](#)) during the [INSPIRE 2020 Online Conference](#).

- **Article “INSPIRE coverages: an analysis and some suggestions”**

The article is available at [Springer.com](#), constituting a preliminary analysis of the issues identified.

## Relevance & expected benefits

This good practice addresses the issues identified since 2014 by the community of implementers when trying to implement INSPIRE coverage data and make it interoperable in the context of the INSPIRE Directive according OGC CIS 1.0. The underlying problem was the lack of clarity and immaturity of the coverage standards in force (GML 3.2.1, GML 3.3 and CIS 1.0 – which in fact presents inconsistencies between them) when the INSPIRE Technical Guidelines were drafted and approved, causing misinterpretation.

Moreover, a number of additional properties found necessary in the scope of the Directive were appended to the INSPIRE coverage application schemas (from now on, INSPIRE extensions), resulting in an encoding not foreseen in the CIS 1.0 implementation standard, preventing their interoperability.

As a result, it is not immediately clear from the INSPIRE Technical Guidance documents and coverage application schemas how to implement interoperable INSPIRE coverage data according the OGC standards.

The expected benefits of adopting this good practice are enumerated below:

- Reuse the solution described in this good practice for boosting an efficient and interoperable provision of (raster) coverage data, in the scope of an ample list of thematic domains of the INSPIRE Directive, most of them among the urgent environmental priority agenda:
  - Annex II: Elevation (EL), Land cover (LC), Orthoimagery (OI), Geology (GE).
  - Annex III: Soil (SO), Land use (LU), Natural risk zones (NZ), Environmental Monitoring Facilities (EF), Atmospheric conditions (AC), Meteorological geographical features (MF), Oceanographic geographical features (OF), Energy resources (ER), Species Distribution (SD).
- Assure the compliance of INSPIRE coverage data according OGC CIS 1.0, standard currently adopted by most INSPIRE themes dealing with data of this kind as default encoding option, solving the issues above-mentioned.
- Establish a common, agreed basis for achieving interoperability of data served by INSPIRE WCS services, avoiding disparate data encodings.
- Ease the community of data providers to set up coverage data and WCS services, allowing users to experience the potential of coverage data and WCS services, which may underpin the exploitation of additional processing services (WCPS) playing a crucial role in raster data analytics.

## Intended Outcome

- Interoperable provision of INSPIRE coverage data according OGC CIS 1.0, naturally to be offered through WCS services, for the list of themes identified above.
- Facilitation of the tasks for the implementation of coverage data and services, providing the INSPIRE community with a common, clear implementation path to be reused by many.
- Underpinning of raster data analytics based on the availability of INSPIRE coverage data (i.e. data cubes), cornerstone for boosting big data technologies across Europe.

## Evidence of implementation & support

This good practice can be implemented in any WCS software solution claiming conformance to CIS 1.0 – Known implementations are enumerated in the [OGC Coverages DWG Public Wiki](#).

It has been put in practice by several data providers by reusing a common endpoint (<https://inspire.rasdaman.org/rasdaman/ows?>) based on the rasdaman WCS/WCPS engine, offering sample INSPIRE coverage datasets in the scope of the Elevation, Orthoimagery and Land cover themes:

- [Institut Cartogràfic i Geològic de Catalunya \(ICGC\)](#), Spain - INSPIRE Themes covered: Elevation, Orthoimagery and Land cover.
- [Landesamt für Vermessung und Geoinformation Schleswig-Holstein \(SH\)](#), Germany - INSPIRE Themes covered: Elevation.
- [Finnish Environment Institute \(SYKE\)](#), Finland - INSPIRE Themes covered: Land cover.

Sample service request using coverage data from the above-mentioned providers are available through the <https://inspire-wcs.eu> demonstration service.

Other data providers have additionally expressed their interest in implementing the good practice, looking forward for its endorsement by INSPIRE MIG-T in order to invest resources to develop a comprehensive INSPIRE implementation. The list includes:

- [European Environment Agency \(EEA\)](#) - Especially interested in its application to INSPIRE Soil.
- [Finnish Geospatial Research Institute \(NLSF\)](#), Finland - Mostly concerned with boosting INSPIRE Land cover and Land use raster data according UN-GGIM environmental priorities.
- [Instituto Geográfico Nacional \(IGN\)](#), Spain - Mainly devoted to promoting harmonised INSPIRE WCS Elevation and Orthoimagery services.
- German geospatial community attending to the (virtual) [INTERGEO Conference](#), where a series of webinars on this INSPIRE coverage implementation good practice were requested.

Moreover, the good practice has received positive feedback through the INSPIRE Community Forum and its [related activities](#), particularly during the [Workshop “INSPIRE Coverages, Demystified”](#) hosted in the [INSPIRE 2020 Online Conference](#), where it was officially presented accompanied by a hands-on WCS/WCPS service demonstration. [A dedicated discussion thread](#) in the Software & Tools group of the INSPIRE Community Forum has been open for both, providing feedback and sharing information about the good practice, as well as for engaging additional data providers.

Lastly, state that the good practice is supported by [DataCove.EU](#) and [rasdaman.com](#) while being compliant to the OGC standards on implementation of coverages and WCS services adopted by INSPIRE, which has been referred in the normative reference section. This assures an interoperable adoption by a wide range of software vendors as well as a smooth transition in future potential updates of the applicable standards.

## Limitations

Despite this good practice is applicable to the 13 themes from INSPIRE Annex II and III enumerated above, currently existing sample implementations based on it are limited to the Elevation, Orthoimagery and Land cover themes, available through the demonstration service.

Therefore, some theme-specific issues and gaps require further analysis and attention when endorsing this good practice and applying it to the rest of themes in the scope. This involves the generation of

amended application schemas according this good practice for such themes, and deeper concretions on the provision of coverage data through SOS in particular.

Support to WCS according this candidate good practice by the INSPIRE Reference Validator and the INSPIRE Geoportal should be additionally tackled.

All these aspects need further attention by MIG-T in an eventual endorsement of the good practice.