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UNIT B06 - Digital Economy

INSPIRE Community Forum
on Environmental Monitoring & Observations
Phase 2 - 2020 activity report (Deliverable – D2)

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1. STATE OF PLAY IN THE THEMATIC DOMAIN

(Summary of the thematic domain activity related to the implementation and use of INSPIRE)

1.1. Overview / list of relevant EU Projects/technology/SW activities (title, short description, URL link)

1.1.1. API4INSPIRE

The API4INSPIRE project will be of special interest to the EF and O&M communities, as in addition to evaluating the potential of the newly defined OGC API for use within the INSPIRE domain, this project will include SensorThings API in this evaluation. This project is making good progress despite issues due to cancelled events, and will be shifting its dissemination activities into the virtual space.

https://github.com/DataCoveEU/API4INSPIRE

1.1.2. Ad-Hoc Air-Quality API

Illustrating the power of APIs for rapid provision of timely data access, the API4INSPIRE project spun off this activity based on current events. The initial trigger pertained to news reports on the influence of Corona induced lockdowns around the world on air quality. In a first step, the Austrian INSPIRE air quality were harvested, the data transformed and reprovided via SensorThings API for easier access and integration into applications. Based on the feedback received, this activity was extended to other European MS by accessing near-real-time data made available via the EEA. This activity highlighted the power of standardized data, as such an ad-hoc activity would not have been possible without well defined data models in place.

More information: https://www.linkedin.com/pulse/ad-hoc-austrian-air-quality-api-kathi-schleidt/

1.1.3. Covid Things

A further interesting activity to emerge in the last months has been a dedicated SensorThings API endpoint providing up-to-date data on the current Covid-19 epidemic created by the University of Applied Sciences Stuttgart. Data is regularly harvested from various sources, foremost the Johns Hopkins Coronavirus Resource Center, Robert Koch Institute and Worldometers.info. In addition, a dashboard has been created to allow users to explore and visualize the available data.

More information: http://193.196.138.56:8080/STACOVID/

1.1.4. SensorThings API INSPIRE Good Practice

Based on the data mapping in the geosciences article "Extending INSPIRE to the Internet of Things through SensorThings API" - https://doi.org/10.3390/geosciences8060221, at present work is proceeding on aligning SensorThings API with the INSPIRE Download Service requirements. This work is being continued through the API4INSPIRE project.

More information: https://github.com/DataCoveEU/SensorThings

1.1.5. SensorThings API Standard Update

In order to support the requirements stemming from INSPIRE identified in the course of the Good Practice mentioned above, various extensions have been made to the SensorThings standard. It has been possible to include these modifications in the currently ongoing OGC work

on SensorThings API V1.1, that has now been finalized and is waiting for approval from the relevant OGC boards.

More information: https://github.com/opengeospatial/sensorthings/issues

1.1.6. *O&M Standard Update*

At present, the OGC is reviewing the current O&M 2.0 standard, and working on an update to version 3.0. This work is being done jointly with ISO, and will lead to an update of ISO 19156, whereby there is an aim to be as far as possible backwards compatible. Once this work has been finalized, the O&M based INSPIRE specifications should be revisited.

1.2. Overview / list of selected good / highly visited / highly replied Forum contributions (your short description + link to the Forum content)

1.2.1. *Validation Issues [74 Views]*

As the deadlines for finalization of INSPIRE services draw close, more focus is being place on the correct validation of provided datasets and service endpoints. This in turn serves to highlight various points of confusion pertaining to the requirements. In some cases, MS are still working with the 3.0 version of the schemas instead of the updated versions under 4.0, that in turn leads to issues with these old schema files. In addition, it shows that various software systems still have issues pertaining to the correct provision of data utilizing the INSPIRE data models

https://inspire.ec.europa.eu/forum/discussion/view/264717/inspire-validator-error-one-of-httpwwwopengisnetgml32abstractfeature-is-expected

https://inspire.ec.europa.eu/forum/discussion/view/264607/schema-ef-inspire-validator-error-cannot-find-the-declaration-of-element-gmlfeaturecollection

1.2.2. *Theme vs. General Metadata Requirements [417 views]*

The question was if metadata attributes not specifically mentioned within the thematic data specification are required in the dataset metadata, specific example pertained to the language of the meta-record. It was clarified that while the data specifications provide theme specific additions to the general dataset metadata, the general metadata requirements are valid regardless.

https://inspire.ec.europa.eu/forum/discussion/view/261060/data-specification-on-environmental-monitoring-facilities

1.2.3. *GNSS stations and EF Scope [230 views]*

The question pertained to whether GNSS (assuming Global Navigation Satellite Systems) are relevant to INSPIRE and if such data could be provided via the EF specification. Answer was that EF can handle such data, and probably in INSPIRE scope.

https://inspire.ec.europa.eu/forum/discussion/view/261427/gnss-monitoring-station

1.2.4. *EF&O&M Nitty Gritty [122]*

A very informative deep dive into the nitty gritty of INSPIRE EF modelling. What starts as a simple question pertaining to the link between EMFs and their observations blossoms to cover a wide range of important aspects, from the hierarchy of the abstract classes to the importance of clear URIs for referencing.

https://inspire.ec.europa.eu/forum/discussion/view/227809/environmentalmonitoringfacility-hasobservation-attribute

1.3. Overview / list of relevant existing applications, services (Title, description, URL link)

1.3.1. *Ad-Hoc Air-Quality API*

Air quality data fulfilling all INSPIRE requirements provided by SensorThings API:

API: https://airquality-frost.docker01.ilt-dmz.iosb.fraunhofer.de/v1.1

Viewer: https://wg-brgm.docker01.ilt-dmz.iosb.fraunhofer.de/servlet/is/121/

1.3.2. *EF and O&M Best Practices*

Various examples, foremost from the SeaDataNet project

https://inspire.ec.europa.eu/forum/pages/view/30357/efom-best-practices

1.3.3. *Linked EF Example*

A simple static EF example with two sampling points, but including data, all references properly linked, viewable in QGIS

https://github.com/DataCoveEU/INSPIRE_EF

1.3.4. *Austrian Air Quality Services*

Still not formally listed on the GeoPortal due to administrative obscurities, but the closest to a correctly functional EF service that could be found.

http://luft.umweltbundesamt.at/inspire/wfs?service=WFS&version=2.0.0&request=GetCapabilities

http://luft.umweltbundesamt.at/inspire/sos?service=SOS&request=getCapabilities&version=2.0.0

1.4. Overview and assessment of the availability of thematic domain data sets in the EU Geoportal

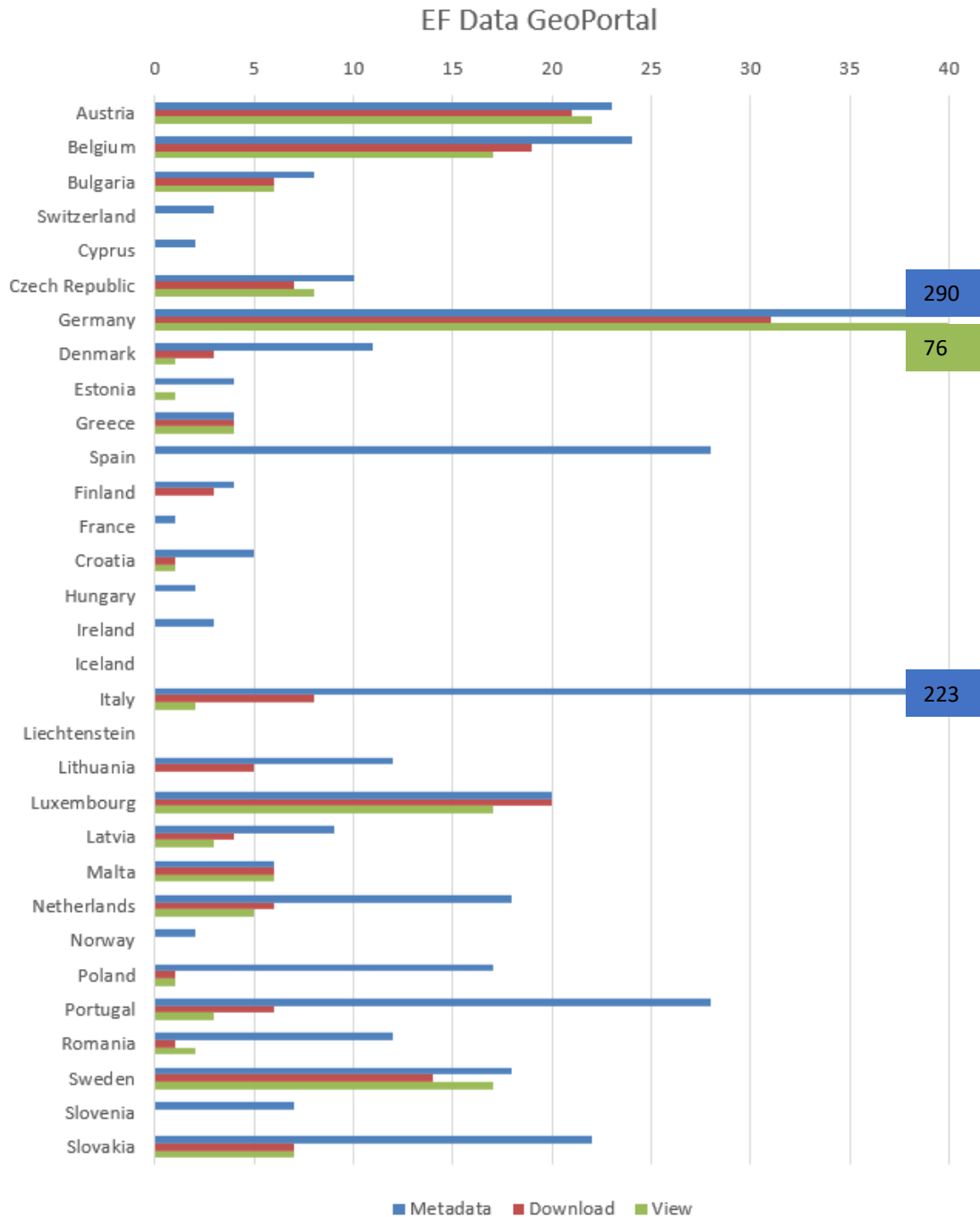The Figure 1 provides an overview of the availability of EF datasets on the Geoportal.

Figure 1: Overview of INSPIRE Services by Country

The visualization also clearly shows the discrepancy between theory (datasets for which a metadata record has been provided) and praxis (datasets for which actual view or download services are available). This is further highlighted in the diagrams below, that show the percentage of view and download services available in comparison to the number of datasets for which metadata records have been reported.
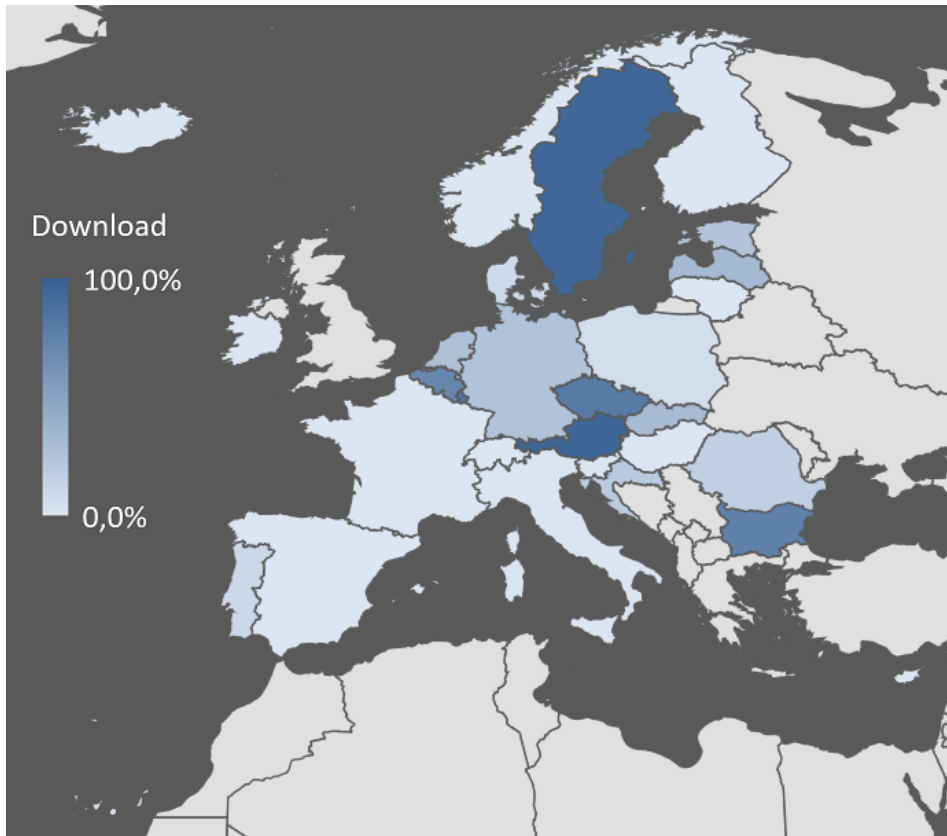
Figure 2: Percentage datasets available as Download Service by Country
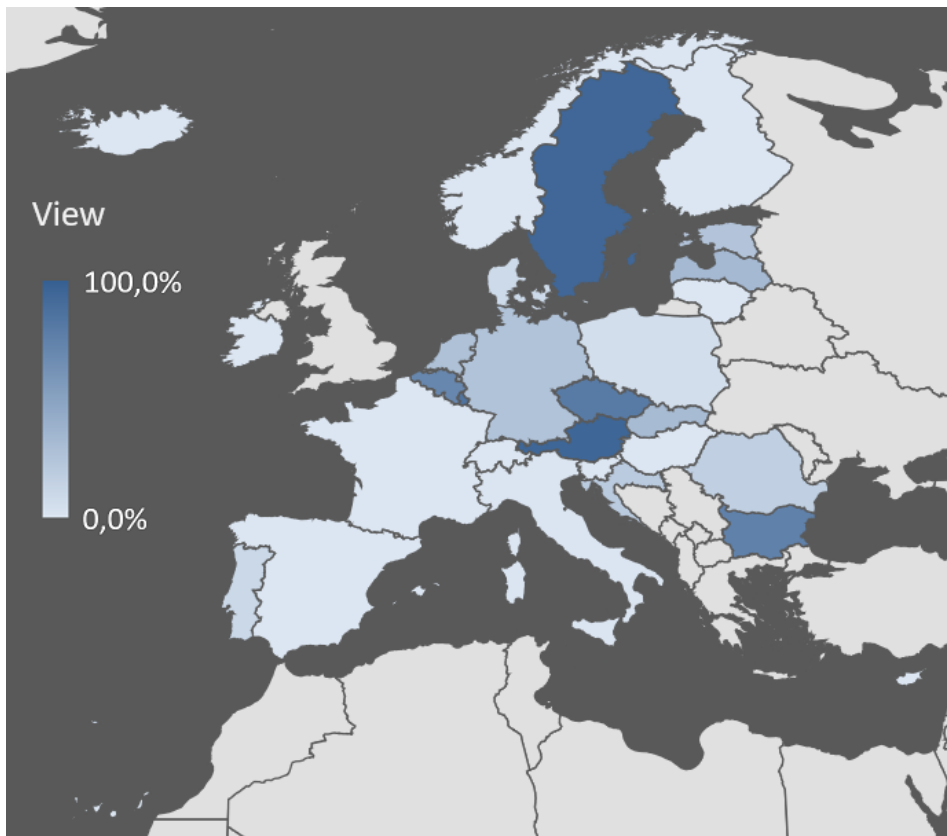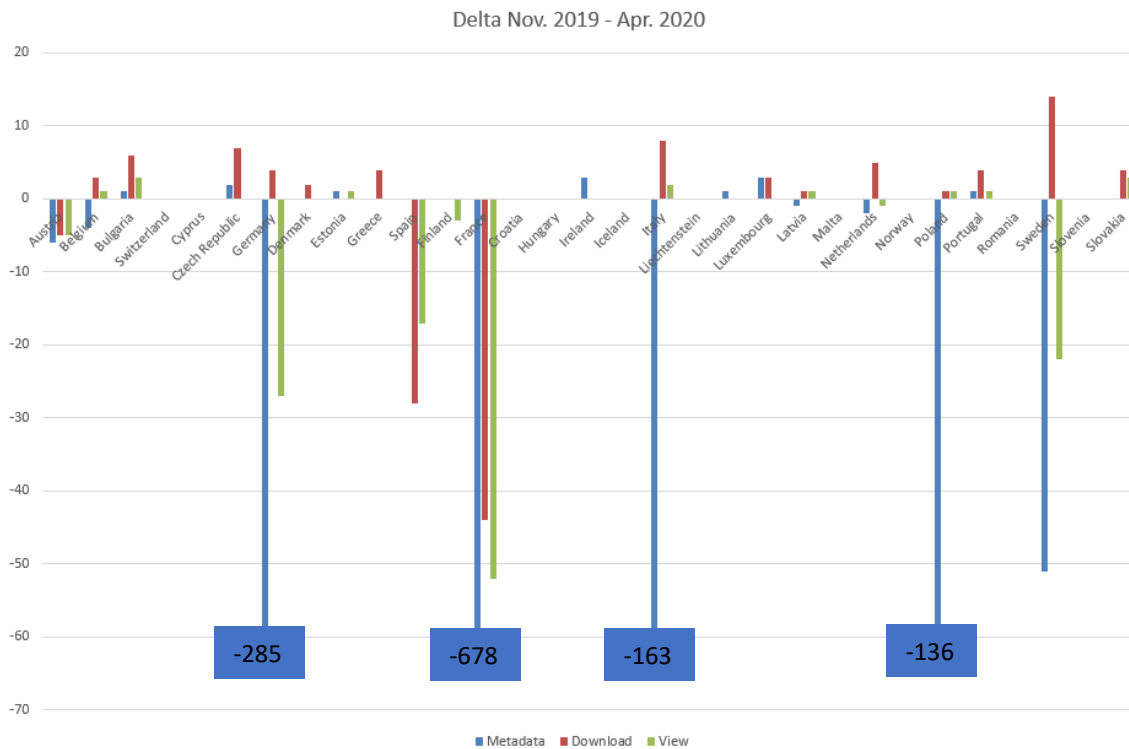

Figure 3: Percentage datasets available as View Service by Country

This gap should have long been closed, at least through the provision of non-harmonized download services.

Interesting is also the fluctuation in number of metadata, view and download service records available to the Geoportal by MS. A bit troubling is the marked decrease especially in the number of metadata records provided by some MS, whereby this could also just be a sign of "housekeeping", with administrators revisiting and cleaning the data being provided.

1.4.1. *Missing datasets*

Several European environmental reporting obligations require member states to set up monitoring facilities within their countries as well as report data on these facilities, and at times on their data, to the European Environment Agency. Minimal Set is:

- Air Quality (AQD)
- Water Quality/Quantity (WFD)
- Bathing Water
- Waste Water (UWWTD)

Thus it is strange that several European MS have less than 4 metadata sets mentioned.

In addition, there should at least be unharmonized data available by now, but half the MS have 0 datasets listed under the download service, over a third do not provide a view service. Also, where download services are indicated, these very often do not work.

1.4.2. *Withheld datasets*

To my understanding, the publication of measurements on bathing water quality is obligatory. I find it strange to find this information withheld in the EF data. The following was available from Luxemburg[1]:

```
<ef:hasObservation
nilReason="http://inspire.ec.europa.eu/codelist/VoidReasonValue/Withheld">
```

1.4.3. *Wrongly listed datasets*

PS data is often provided under EF (example referenced below), my subjective impression is that as PS pertains to the Environment, people often wrongly assume that also pertains to EF. It may be worth clarifying the link between PS and EF (actually between SD and EF) to the community, the possibility of linking occurrence data from EFs to SD.

SD-like data also appears under EF, i.e. grids with references to species occurrence[2].

There are also many noise datasets[3] under EF. This has long been unclear to me where this goes. Modelled noise data is foreseen under human health, many of these datasets are double listed, unclear if some primary noise measurement data will follow, but to my understanding, most noise data is currently modelled.

1.4.4. *Pertaining to the Geoportal*

Note: it would be valuable if the Geoportal would differentiate download services by degree of harmonization. As present one must click into the individual dataset in order to see if the data is available as:

1. Static file – unharmonized: Shapefile, SpatiaLite, GML, sometimes zipped to make it impossible to even know what's being offered without download

2. Static file – harmonized: GML dataset

3. OWS – unharmonized: some sort of OGC Download Service, but not fulfilling all INSPIRE requirements (either data harmonization or service requirements)

4. OWS – harmonized: what we all hope to one day see!

Further, in the case of harmonized OWS it would be valuable to check if the INSPIRE Theme being provided is correct. Under EF, we find several cases of INSPIRE PS data being provided under interesting titles, i.e. pertaining to measuring poles in the North Sea[4].

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[1]   https://inspire-geoportal.ec.europa.eu/download_details.html?view=downloadDetails&resourceId=%2FINSPIRE-93ee1068-1dc3-11e7-a02d-52540023a883_20190726-120451%2Fservices%2F1%2FPullResults%2F201-220%2Fdatasets%2F18&expandedSection=metadata

[2]   https://inspire-geoportal.ec.europa.eu/download_details.html?view=downloadDetails&resourceId=%2FINSPIRE-c1e5f7f2-3b35-11e9-a83c-52540023a883_20191023-154828%2Fservices%2F1%2FPullResults%2F15881-15900%2Fdatasets%2F9&expandedSection=metadata

[3]   https://inspire-geoportal.ec.europa.eu/download_details.html?view=downloadDetails&resourceId=%2FINSPIRE-c1e5f7f2-3b35-11e9-a83c-52540023a883_20191023-154828%2Fservices%2F1%2FPullResults%2F19021-19040%2Fdatasets%2F11&expandedSection=metadata

[4]   https://inspire-geoportal.ec.europa.eu/download_details.html?view=downloadDetails&resourceId=%2FINSPIRE-b285fced-4eb6-11e8-a459-52540023a883_20191029-080410%2Fservices%2F1%2FPullResults%2F1-140%2Fdatasets%2F31&expandedSection=metadata

Also – there are discrepancies between the overview and the detail records. Going through the records that claim to have a download service, I have found one that then claims "No download services found for this dataset"[5]. At the same time, the Austrian SOS service[6] still is not shown, although this may also be due to issues in the details of the metadata[7].

Pertaining to the usability of the Geoportal, it would be nice if options such as language settings could be maintained once set. When one opens individual records in new tabs, one must currently always request translation, page for page.

2. OVERVIEW OF THE FACILITATOR'S ACTIVITY

2.1. Facilitator Activity 11.2019 – 04-2020

2.1.1. OGC ELFIE - Environmental Linked Features Interoperability Experiment @ ISESS

The initial OGC Environmental Linked Features Interoperability Experiment (ELFIE) sought sustainable and automatable solutions to link multi-disciplinary, multi-organization environmental data without the requirement to transfer custody or burden of maintenance of data. It builds on W3C best practices, providing guidance and a common approach on utilizing JSON-LD for encoding environmental feature data and observational data, as well as semantically defined interlinkages based on schema.org and other relevant vocabularies. Using these technologies, it bridged the divide between the great flexibility and power of OGC services and the more focused and specific technologies that drive modern web development.

The outcomes of ELFIE were brought to life through the BLiv Viewer[8] by BRGM as well as the DataCove transformation software (on-the-fly transformation of SensorThings data to ELFIE JSON-LD requirements)[9], allowing participants to explore the possibilities offered by such technological advancements.

http://www.isess.net/

2.1.2. Global Soil Information System (GloSIS)

A major development in the last year pertaining to the provision of soil data has emerged in the form of the FAOs activities toward the creation of a Global Soil Information System (GloSIS). For this work, all requirements stemming from FAO guidance documents were taken into account; in addition, all relevant existing soil data information models were reviewed, their strengths and weaknesses documented.

Based on this analysis, ISO 28258 was selected as the basis for GloSIS and a data model defined based on the requirements. This data model is currently undergoing review and will soon be

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[5] https://inspire-geoportal.ec.europa.eu/download_details.html?view=downloadDetails&resourceId=%2FINSPIRE-61494ff5-6fad-11e8-b649-52540023a883_20191108-094442%2Fservices%2F1%2FPullResults%2F551-600%2Fdatasets%2F14&expandedSection=metadata

[6] https://inspire-geoportal.ec.europa.eu/download_details.html?view=downloadDetails&resourceId=%2FINSPIRE-61494ff5-6fad-11e8-b649-52540023a883_20191108-094442%2Fservices%2F1%2FPullResults%2F701-737%2Fdatasets%2F11&expandedSection=metadata

[7] https://inspire-geoportal.ec.europa.eu/resources/INSPIRE-61494ff5-6fad-11e8-b649-52540023a883_20191108-094442/services/1/PullResults/701-737/11.iso19139.xml

[8] http://farfouille.brgm-rec.fr/Bliv/

[9] http://guid.datacove.eu/BRGM/fet/521

tested. One of the outcomes of this work has been a set of codelists derived from the FAO guidance documents; these codelists have been provided in a hierarchical electronic format suited to the generation of diverse codelist formats (in the initial delivery the codelists have been provided in the GML data dictionary format).

These codelists could provide a valuable complement to INSPIRE, as codelists pertaining to Soil in INSPIRE are either empty or missing. In addition, this work should be coordinated with INSPIRE; while the data models are quite similar, the INSPIRE and ISO 28258 models diverged before finalization, leading to discrepancies between the two models.

2.1.3. _API4INSPIRE_

The API4INSPIRE project is exploring the benefit of the introduction of the new OGC API based standards OGC API – Features and OGC SensorThings API into the INSPIRE and beyond domain. An evaluation methodology has been defined for assessing the costs and benefits incurred in introducing these new technologies, and a deployment plan is in the process of finalization.

The API4INSPIRE project foresees the provision of 3 data nests, providing spatiotemporally collocated sets of complementary data, openly available for experimentation with data provision via the new APIs. These data nests can be summarized as follows:

- **Airy Austria:** A collection of air quality and meteorology data complemented with air transport data. The air quality data has now been extended across a large stretch of central Europe.

- **Urban Data Platform Hamburg:** Various Smart City Sensors from the city of Hamburg paired with road traffic networks. In addition, access to sensors within Energy Campus of the Hamburg University of Applied Sciences provides a wide field for experimentation with the SensorThings API.

- **Franco-Germanic Flow:** In this nest we focus on water resources on both sides of the Rhine river. The provided datasets include hydrography, hydrogeology and transport networks water together with water quantity and quality measurements and information on flood risk.

In lieu of live face-to-face events due to Corona-related lock-downs and travel restrictions, this project will shift to the virtual domain (see also Planned Events)

2.2. Planned Events

2.2.1. _INSPIRE/api_

The API4INSPIRE project had originally planned on holding an INSPIRE APIthon at this year's INSPIRE Conference in Dubrovnik, a second event foreseen for this fall's FOSS4G. As these events will not be taking place as planned, these activities are being shifted to the virtual space. In addition, additional data sources are being dynamically added to the project as available and deemed valuable based on current events.

https://indico.unidu.hr/event/2/contributions/45/contribution.pdf

2.2.2. *INSPIRE Coverages, Demystified*

Workshop on the use of WCS and WCPS within INSPIRE. Included recent work done together with Peter Baumann and Jordi Escriu on adapting the existing INSPIRE Coverage based data models to the requirements of the WCS service specification while retaining all requirements stemming from the relevant INSPIRE data specification and IR. Example datasets for LC, IO and EL were made available via a WCS deployment kindly made available by rasdaman[10]; WCPS requests working on these datasets provided by DataCove[11].

https://indico.unidu.hr/event/2/contributions/34/contribution.pdf

3. FACILITATOR'S SUGGESTIONS FOR IMPROVEMENTS

In addition to closely monitoring the forum activity pertaining to Environmental Monitoring Facilities and the use of the Observations and Measurements schema within INSPIRE, the facilitator has also been engaged in various other domains, either those pertaining to the utilization of O&M, those related to ongoing work on the UN FAO GloSIS and also general issues that pertain to a wide variety of data themes.

On this general level, there is still a lack of clarity pertaining to the identification of features being provided. While various documents have been created providing suggestions on how to provide a consistent and resolvable identifier scheme, MS are still looking for formal guidance on this topic. This topic is well discussed in the following thread.

https://inspire.ec.europa.eu/forum/discussion/view/264948/inspireid-guidance-for-the-inspire-priority-datasets-and-environmental-reporting-obligations

3.1. Atmospheric & Oceanographic

Various issues have emerged within the Atmospheric & Oceanographic domain. As these are closely related to O&M issues, they are also covered here.

Two of the issues pertain to the provision of trajectory and profile observations within this domain. The concerns here are twofold:

- To what extent are the profileObservation and trajectoryObservation types provided within the GCM formally foreseen for provision within INSPIRE. While these datatypes aptly reflect the types of data to be provided, they are marked as "informative". Guidance would be appreciated on if these types may be used for the provision of INSPIRE data. https://inspire.ec.europa.eu/forum/discussion/view/264104/profileobservation-and-trajectoryobservation-valid-for-of-data

- In addition, it is presently not possible to correctly provide data for a trajectoryObservation, as the timeLocationValueTriple foreseen for the provision of the resulting values is defective, allowing only for Time and Location, no Value. https://inspire.ec.europa.eu/forum/discussion/view/166102/trajectoryobservation-result-omsotimelocationvaluetriple-defective

The marine community would also be interested in harmonizing the work required in data provision for EMODnet vs. INSPIRE. EMODnet utilizes CDI files for the provision of metadata; while these are also based on the ISO 19115 format, there are subtle differences in how the

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[10] http://ows.rasdaman.org/rasdaman/ows

[11] https://github.com/DataCoveEU/INSPIRE_Coverage

data is to be provided. In addition, reuse of the EMODnet bathymetry data (BAG files) has been discussed. At present, there are no known activities on harmonizing these disparate data formats, requiring all data providers to generate two different formats for data provision.

https://inspire.ec.europa.eu/forum/discussion/view/264053/which-are-the-issues-on-inspire-compliance-of-emodnet-bathymetry-cdis

In addition, there is still a lack of clarity as to what data is to be provided under INSPIRE Themes. While some data providers have understood that providing monitoring data implies providing data on the environmental monitoring facility generating this data, others are working on the assumption that this is not necessary, seeing the individual INSPIRE themes as unrelated silos. For those data providers interesting in providing linkage, no official guidance is available.

https://inspire.ec.europa.eu/forum/discussion/view/263990/implementation-of-relations-from-of-to-ef-and-sr

3.2. Soil

Several of the current issues pertaining to the soil domain are in regard to the codelists to be used to annotate the data provided. At present, most of the codelists provided for the soil domain are empty (especially troubling as they are also marked as not extendable, thus not giving MS the option or providing alternative references). As many of these codelists have been created during the specification of the FAO GloSIS data model, it would be worth investigating if these resources could either be imported to the INSPIRE registry, or if alternatives for provision and use of these codeslists within INSPIRE could be found.

https://inspire.ec.europa.eu/forum/discussion/view/232658/wrb-soil-type-classification

https://inspire.ec.europa.eu/forum/discussion/view/26781/technical-questions-regarding-and-examples-for-the-handling-of-registries-and-their-entries

https://inspire.ec.europa.eu/forum/discussion/view/264219/how-to-provide-a-observableproperty-in-a-valid-gml-file-for-the-soil-theme

One especially pressing issue in the soil domain pertains to a missing attribute connecting the SoilDerivedObject to its corresponding observations. This issue is twofold:

- In the 4.0 version of the INSPIRE Soil Schema, the association soilDerivedObjectObservation was missing from the schema. It has now been added to the draft version of the soil schema, but there is no clarity as to when this schema version will be formally accepted, or if data provided using it is valid.

- Based on an informal analysis of the data model, the soilDerivedObjectObservation should actually have had cardinality 0..* as all the other soil associations to Observations. Unfortunately, this error has not been corrected, allowing for only one Observation to be provided per object (not realistic)

https://inspire.ec.europa.eu/forum/discussion/view/186450/missing-associations-to-om-observation-in-xsd

Concerning is also the lack of clarity pertaining to the scope of data to be provided. Based on the INSPIRE Directive the general understanding is that data available to the data provider and corresponding to the concepts defined by the INSPIRE feature types is to be provided. However, data providers are quite creative in their argumentation as to why data is not to be provided. In one case, a statement pertaining to minimal metadata requirements is used to argue that data need not be provided.

https://inspire.ec.europa.eu/forum/discussion/view/265305/minimum-features

Finally, as in all INSPIRE themes, complete and realistic examples would provide a great deal of help to data providers in understanding the formal requirements as well as various technical aspects of encoding such as the correct usage of xlinks (also related to the general point above pertaining to identifiers.

https://inspire.ec.europa.eu/forum/discussion/view/265180/soil-theme-struggling-with-conversion-to-soilsite-soilplot-and-observedsoilprofile-in-fme

4. CONCLUSIONS

While MS continue to progress in their implementation of the INSPIRE requirements, there are several pressing issues that make this nearly impossible for at least some thematic areas. These issues pertain to the following areas:

- **Codelists**: This has been an issue since the onset of INSPIRE, with clear codelist requirements from the UML data specifications not being correctly formalized to the IRs or provided via the INSPIRE registry. While in some cases it was possible to remediate these issues (e.g. for EF where defined codelists were not transposed, the content has been provided via the registry regardless. Unclear is to what extent the use of these codelists are mandatory since the IRs remain unclear). In other cases, these issues persist, as described in various topics above

- **Errors in Schema Files**: In some cases, the transposition from the UML data models to the XSD schemas made available for use by MS was not performed correctly. While these issues have been repeatedly thematized, little to no progress has been made. Providing corrected schema files as draft versions is not satisfactory.

- **Identifiers**: Again, an old issue, with various recommendations, but no clear guidance forward. This is especially distressing as disparate use of identifier schemes will hinder interoperability. While it is clear based on the current state of the legislation that the EC cannot require a specific solution, a strong recommendation could provide guidance to MS.

- **Examples**: a recurrent issue across themes is the lack of examples. For EF, this issue has been addressed by the creation of a consistent example set made available on GitHub, together with various pages providing links to existing good practices. Such resources would be valuable for all data themes.