

Geospatial data dissemination in geographically specific EU Operational Programmes

Konstantinos Evangelidis, Konstantinos Papatheodorou and Anastasios Agrianidis

Abstract - This paper deals with geospatial data dissemination in EU Cooperation Programmes where the adjacency of the beneficiaries or their existence in an area with common geographical features is important. Through the experiences gained by the participation of authors in a BSB JOP, a WebGIS end user interface is presented along with the particularities and special requirements identified during project implementation.

Keywords – Geospatial Dissemination, Geospatial Interoperability, Web GIS

1. Introduction

Data dissemination was always a significant activity in all types of European Commission (EC) Operational Programmes (OP) and its legislative framework is continuously updated with new regulations and decisions [1], [2], [3]. Special dissemination requirements are defined for programmes where the spatial reference of the beneficiaries matters as for example happens in cross-border areas or interregional cooperation. In such cases, as most important particularity could be considered the need to apply the results and outputs of the projects in a boundary-specific area.

Extending the above rationale, one realizes the significance of the spatial identity of the data involved. The adjacency of the involved beneficiaries or their existence in a common area of the map justifies the employment of Geoinformation technologies for spatial data handling and management, with most representative tools, Geographic Information Systems (GIS). GIS today encompasses many critical aspects of geospatial data dissemination, including metadata information, geospatial web services, geospatial data sharing and interoperability, and all of the aforementioned terms are strongly related to the term WebGIS.

K. Evangelidis is with Technological Educational Institute of Central Macedonia, 62124, Serres, Greece, phone: +30-23210-49406 (e-mail: kevan@teicm.gr)

K. Papatheodorou is with Technological Educational Institute of Central Macedonia, 62124, Serres, Greece, (e-mail: kevan@teicm.gr)

A. Agrianidis is with Technological Educational Institute of Central Macedonia, 62124, Serres, Greece, (e-mail: aagrianidis@hotmail.com)

In this respect this paper exploits the experience gained by its authors' through their involvement in a Black Sea Basin (BSB) OP called SciNetNatHaz (A Scientific Network for Earthquake, Landslide and Flood Hazard Prevention). One of the basic targets of the SciNetNatHaz project was the collection, harmonization, coding and free/open access of data related to ELF (Earthquakes-Landslides-Floods) hazards. At the final stage, all data and results produced had to be published through a Web GIS platform. The particularities and special requirements raised in such a project lead to the design and development of an ergonomic end-user interface that is expected to serve the needs of representing not only the spatial information over the map, but also the related methodologies and descriptions.

2. Spatial Data Requirements

To conform with the EC legislative framework [1], [2], [3], as regards spatial data, the following critical topics are identified

2.1 Metadata creation

Metadata creation is an absolute necessity for data which are going to be distributed (open/freely accessed) because they provide valuable information necessary for their evaluation. Metadata records (descriptive data about the data) are files of information which describe the fundamental characteristics of a data file, an information resource or a geospatial service. It represents the “who”, “what”, “when”, “where”, “why” and “how” of the resource [1].

EC has released a Directive which came into force on 15th May 2007, the INSPIRE Directive (Infrastructure for Spatial Information in the European Community, Directive 2007/2/EC). According to that, the European Union (EU) aims to create a Spatial Data Infrastructure (SDI) in order to facilitate the sharing of environmental spatial information among public sector organisations as well as the public access to spatial information across Europe, providing that way a better policy-making across boundaries [2].

For the implementation of aforementioned Directive regarding metadata, the European Commission (EC) released the Regulation (EC) No 1205/2008 of 3 December 2008 as well as supportive documents [3]

2.2 Data Interoperability

The cooperative nature of the border dependant projects, raise the need to consistently combine spatial data from different sources, to share them among various end-users belonging to different authorities and to extensively exploit them through different applications. Furthermore, in a long term, the generated spatial data and project results will have to be discoverable, easy to be identified, the degree of their suitability will have to be evaluated and the terms of their usage to be explicitly defined. Thus, geospatial data involved throughout project activities will certainly have to conform to the EU INSPIRE directive [4], to ensure their compatibility and usability in a Community and transboundary context. In addition, interoperability of geospatial data from multiple sources will be achieved by defining the domain values

to be used for attributes and the association roles of spatial object types and data types as specified by the EU regulation No 1089/2010 [5], implementing INSPIRE directive.

2.3 Input from recognized EU projects

Valuable input from relevant projects dealing with identical or similar spatial entities, is expected to form the reference base for developing the data models on the lowest possible level and the accompanying metadata. The above are critical towards the development of an operational geographic database exploitable on future developments.

2.4 Invocable geospatial web services

To achieve geospatial data services interoperability and harmonisation, project actions have to be aligned with the EU regulation No 1312/2014 [6], implementing INSPIRE directive as regards interoperability of spatial data services. All geospatial data have to be served under invocable spatial data services. To conform with spatial data services harmonization requirements the appropriate open geospatial web services introduced by Open Geospatial Consortium have to be adopted. Towards this direction, the WebGIS development should be rather based on open source software components, such as for example those provided by the OSGeo [7] foundation, as regards both the final end-user web interface and the initial data preparation as well as the creation of the appropriate geospatial web services.

3. WebGIS Development

The WebGIS development is exclusively based on open source software components, not only as regards the final end-user web interface but also as regards the initial data preparation as well as the creation of the appropriate geospatial web services.

Figure 1 displays the development process workflow, its discrete stages and the technical details during the transition between them. The following stages are identified:

1. Data Preparation
2. Metadata Creation
3. Desktop GIS - Spatial Data Presentation
4. Map Server - Web Map Services creation
5. WebGIS - End user interface development

The following paragraphs describe in detail each stage and the intermediate processes.

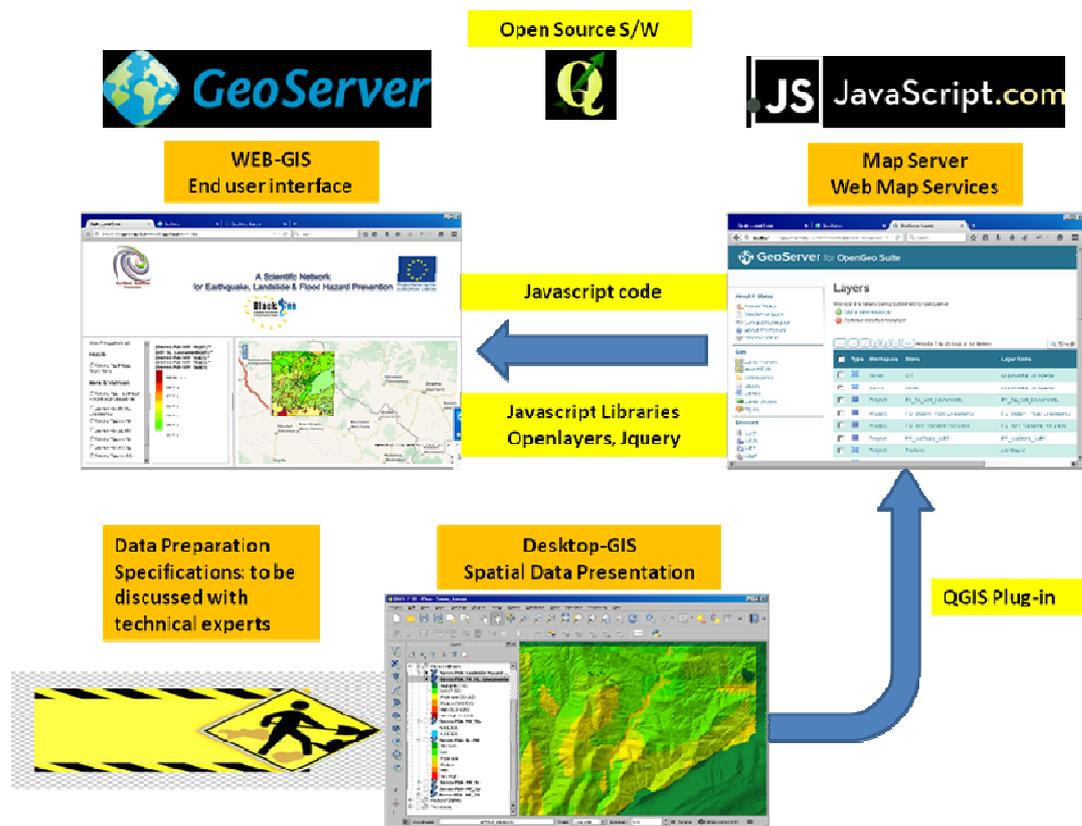


Fig. 1. WebGIS development Workflow

3.1. Data Preparation

At this preliminary phase, basic data including topographic and geologic maps, hydrologic and meteorological data as well as additional information regarding past earthquake, landslide and flood events were collected from various sources from all the participating countries. Data were classified according to their theme, processed, harmonized, coded and prepared for further use. Metadata were also created according to the INSPIRE provisions using the online INSPIRE template.

Data were evaluated for their reliability in order to be used within the scopes of the project and those who failed the evaluation were rejected. Data which had a positive evaluation were forwarded for further processing which included all stages of the harmonization process: geo-referencing, spatial adjustments, reference system transformation, coding and metadata creation according to the INSPIRE provisions.

Data preparation refers to the following data categories:

- General data (morfometric, geological, engineering etc.)
- Results after the application of selected methodologies

Depending on the hazard (flood, landslide or earthquake), the study area and the above mentioned categories, the following tree structure was adopted:

- Hierarchy Level 1: Hazard (Floods or Landslides or Earthquakes)
- Hierarchy Level 2: Pilot Implementation Area (e.g. Serres, Nymfaia etc.)
- Hierarchy Level 3: Data category (General Data or Results)

It should be stressed that designing the data models adopted during this phase, had taken into consideration considered past relevant projects carried out in the past (synergies with previous research), as this is an EC spatial data requirement. Project Such is considered the InGeoClouds [8] dealt with similar dataproject whichso the provided the design data models dealing with earthquakes and landslides have been adopted from this project and and has been extended to fit theby SciNetNatHaz [9] project requirements. An expansion to this model was also necessary in order to incorporate and manage to also cover data related to regarding floods

3.2. Metadata Creation

In this phase of the project's implementation, the metadata file (records) for each collected dataset were produced according to the aforementioned INSPIRE Directive and the related Regulations. The implementation of this procedure was based on the online tool "Metadata Editor" provided by the EC, INSPIRE Geo-portal [10]. The image below (Fig. 4) depicts the graphical user interface (GUI) of the metadata editor tool.

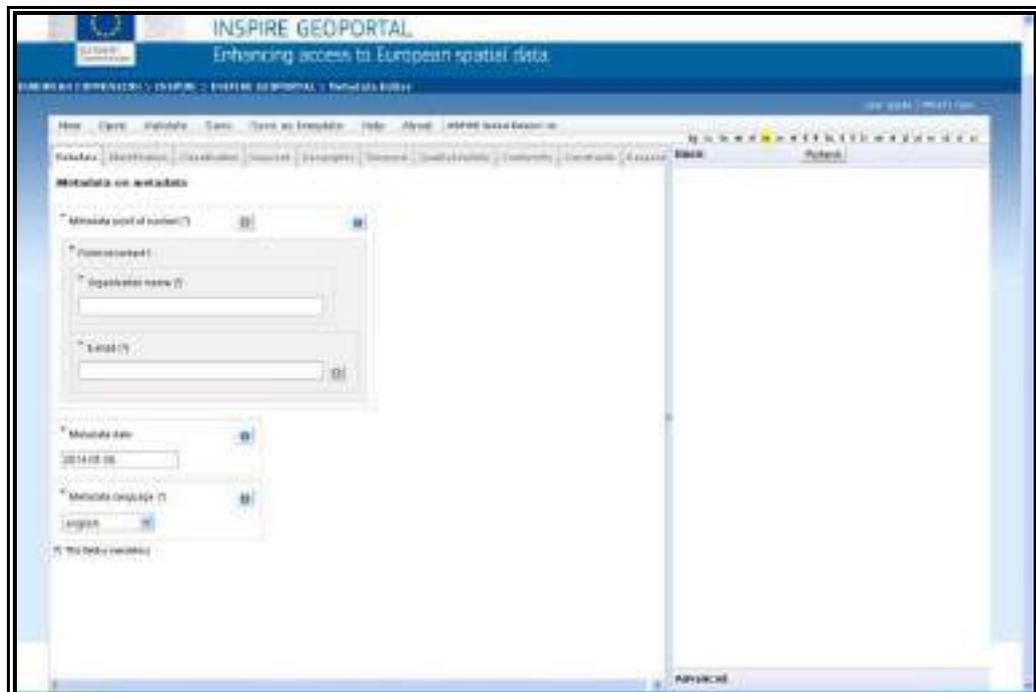


Fig. 2. INSPIRE compatible Metadata Editor

After the completion of the mandatory fields of information, the created records of metadata were saved in eXtensible Markup Language (XML) format, which is readable among various types of software including GI Systems. The metadata editor provides additionally a validation tool in order to examine the integrity of the generated metadata file.

3.3. Desktop GIS - Spatial Data Presentation

At this stage data prepared on stage 1 are imported in the selected desktop GIS environment. For every pilot implementation area a QGIS [11] project is deployed containing the appropriate groups of data, spatial reference, symbology, description and metadata information.

Below, the steps of the QGIS project deployment are briefly described.

Step 1: Organizing data in the specified tree structure

In order to organize data the appropriate groups of data belonging to the same category have to be created. Grouping data is an area and hazard specific procedure. For example the groups created for presenting a hazard assessment contain morphometric and engineering geology data in the general data category, as shown in figure 3. In the same figure, the methodologies adopted are represented by different groups such as "Mora Vahrson" and "Hazus".

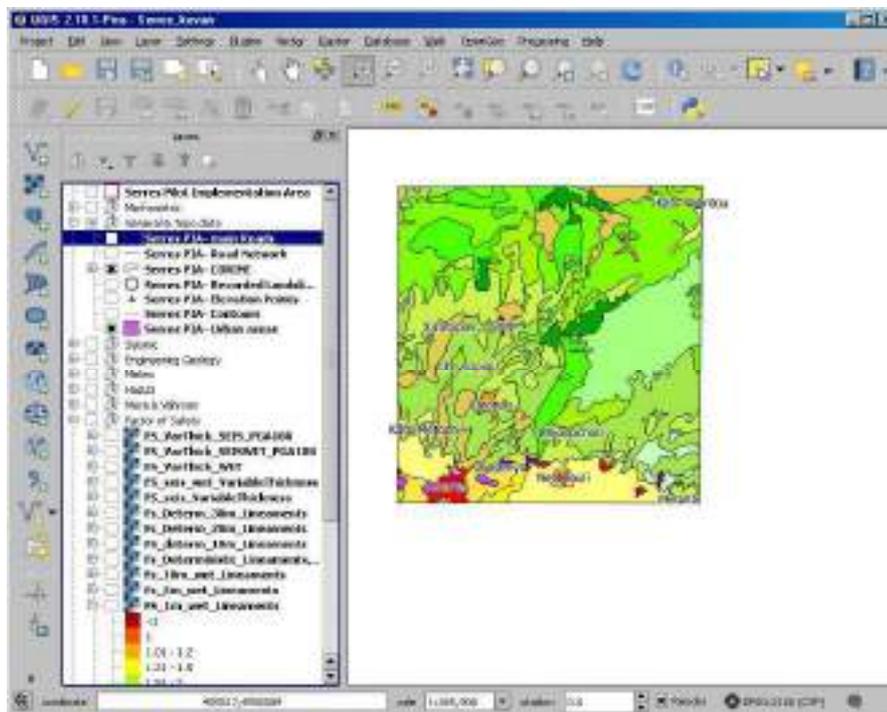


Fig. 3. Organizing data for presenting a Hazard assessment

Step 2: Symbolizing data

Data symbology is crucial for interpreting the results of an assessment. By specifying the range of values that correspond to a color, a legend is created for every layer and this symbology (Figure 4) will be transferred also at the WebGIS interface.

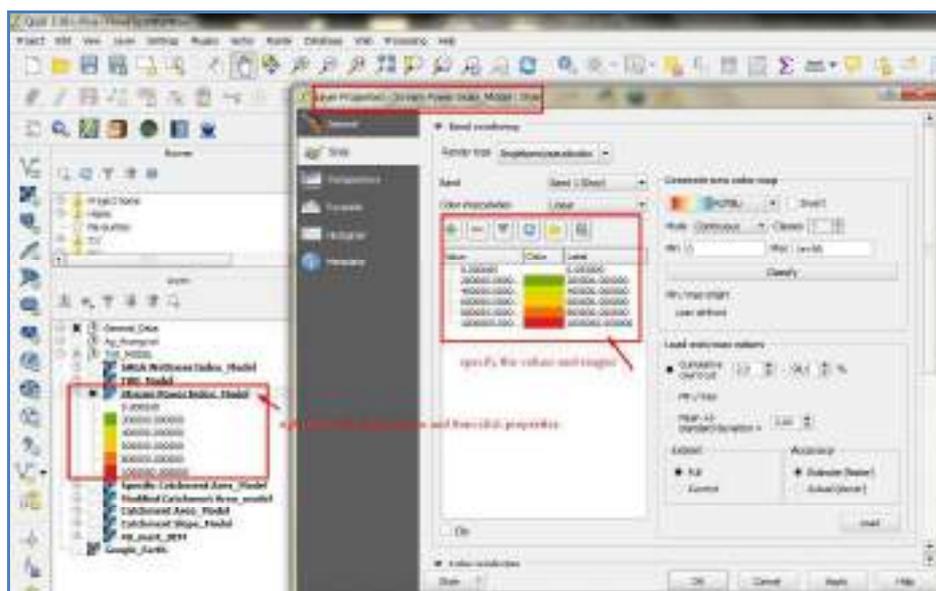


Fig. 4. Data Symbology

Step 3: Defining spatial reference

All data should belong to the same spatial reference system, which is WGS84 (EPSG: 4326)

3.4 Map Server - Web Map Services creation

Desktop GIS data have to be transformed in a way that will allow its web publishing. An open source map server is employed for this purpose, which belongs to the same foundation as the desktop GIS software selected. Geoserver [12], is a web mapping project of the OSGeo [13] foundation, providing high level capabilities for sharing geospatial data. GeoServer supports OGC [14] compliant standards such as Web Feature Service (WFS), Web Map Service (WMS), and Web Coverage Service (WCS).

For every group layer a related workspace was created in order to store its layers. Every layer of the QGIS project was imported via a the appropriate plug-in in the map server and a related Web Map Service was developed and parameterized as shown in Figure 5.

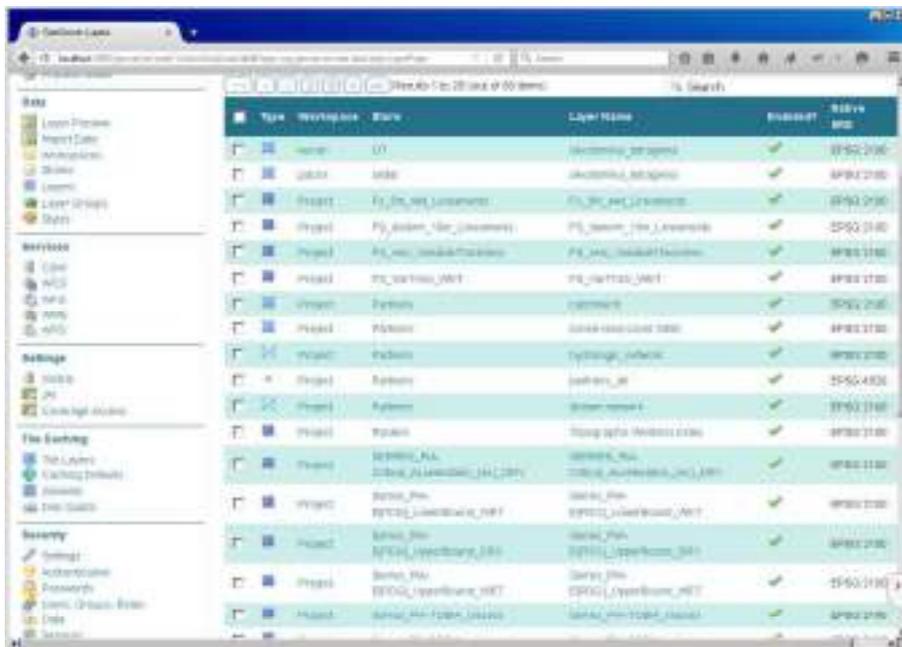


Fig. 5. Creating geospatial web services

3.5. WebGIS - End user interface development

The WebGIS end user interface provides delivers a high quality navigation experience by providing project thematic layers spatial representations and aton the same time, metadata and comments on the respective related methodologies used as well as information related to and technical specifications information, simultaneously using three panes: the Layer, the Metadata/Information and the Map panes (Fig. 6).

All of the WebGIS Interface functionality was developed with Javascript [15] and HTML. The functional requirements as regards spatial data performance have been satisfied by employing OpenLayers [16] Javascript libraries. For the purposes of dividing the interface area in functional subareas, JQuery [17] Javascript libraries were employed.

The WebGIS Interface was designed according to proven WebGIS projects such as "Eyes on the forest" [18] and contains three functional areas as follows:

- The left area (pane) containing the table of contents of the WebGIS environment: the About section area, the base layers section area and a section area for every major category (Floods, Earthquakes and Landslides). Any of the above areas unwraps further content subareas when selected, which in most cases represent thematic areas with spatial vector and raster datasets. The structure of the various levels of layers follows the one adopted in stage 2 "Desktop GIS - Spatial Data Presentation"
- The middle area which reveals metadata information along with technical details for the selected topic of the left area. It is worth

mentioning that the middle area provides the corresponding to the left pane content information even on mouse over the desired layer.

- The right pane which contains the map of the selected pilot implementation area and the selected in the left pane spatial data layers.

The end user is allowed to customize the above areas with the desired width or to hide left and/or middle pane.

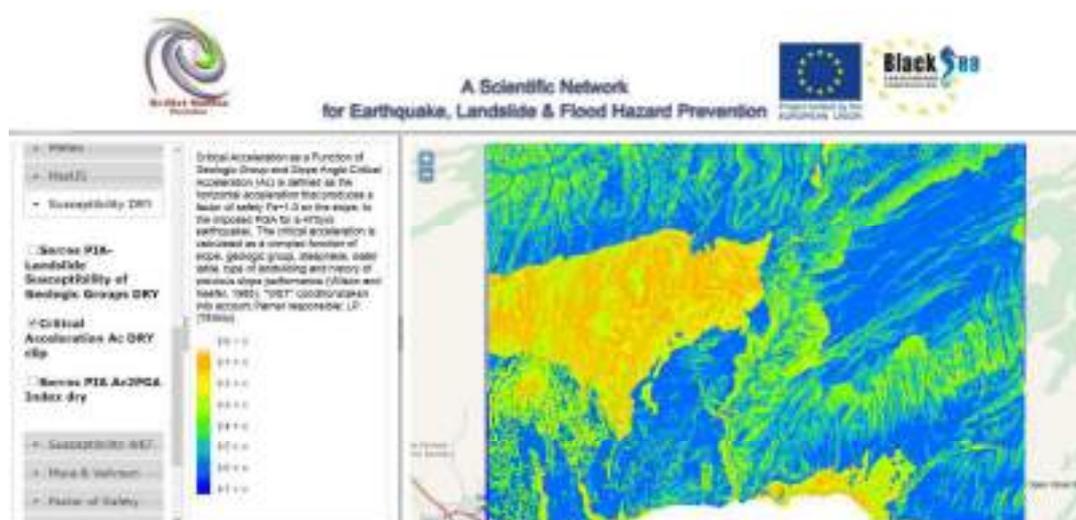


Fig. 6. The WebGIS end user interface. Layers pane (left): Critical Acceleration under DRY conditions is selected; Description/Information pane (middle): the legend and some technical info; and the respective Map on the right pane

4. Conclusions - Further Developments

Throughout the whole development process of the SciNetNatHaz project the various experts involved realized the significance of a proper WebGIS interface as the key component for the success of the dissemination activities. However, the WebGIS experts and developers faced the common difficulties met in cooperative projects involving partners from different countries with different groups of expertise and different priorities during project implementation. The above differentiations were affected the WebGIS scheduled workflow and further corrective actions had to be taken with most significant ones: a) additional presentations of the WebGIS progress in stakeholders meetings b) special training on the spatial data development activities and c) working groups between GIS experts and ELF software experts.

Further actions concerning the WebGIS environment include, enhancement with other publicly available geospatial web services in the area of ELF as well as sophisticated animations illustrating the progress of phenomena related to ELF based on spatiotemporal data

5. Acknowledgements

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