Guidelines for Joining the Prototype of a European Drought Observatory
– Draft Document –

The prototype of a European Drought Observatory (EDO) is currently under development at the EC-JRC (European Commission, Joint Research Centre). Following GEOSS and INSPIRE regulations, EDO is based on open web services and aims at connecting drought data providers on continental, national/multinational, and regional/local levels.

The FP 7 project EuroGEOSS contributes to the development of the interoperable infrastructure used in the EDO prototype (http://www.eurogeoss.eu/default.aspx). The guidelines described in this document have been implemented and tested by partners of the EuroGEOSS project. The current version of the prototype of EDO is available at http://edo.jrc.ec.europa.eu.

The connection of data and services from providers across Europe requires the implementation of interoperability arrangements. These interoperability arrangements can be summarized in **four main steps** that need to be accomplished for joining the prototype of a European Drought Observatory:

a) **Drought index preparation**: EDO incorporates drought indices that are generated at European level by JRC and at other levels by the partner institutions. While a few commonly agreed drought indices should be available at all levels, the choice of additional drought indices is up to the data provider since different partners have different data collections, expertise, and requirements. Likewise the spatial resolution (i.e. scale of presentation) of the drought indices varies from one level to another.

b) **Index (resource) description**: The search and discovery of available drought indices is facilitated by a **metadata catalogue** for drought resources that has been developed by the University of Zaragoza in the frame of the EuroGEOSS project (http://eurogeoss.unizar.es/Search/Search.html). All drought indices and the services providing these data (see point c) need to be documented with up-to-date metadata descriptions.

c) **Service publication**: The selected drought indices can be visualized in the **EDO map viewer** [1], using Open Web Services. Additional services for data download or for the analysis of time-series could be implemented in the course of the project, if needed.

d) **Maintenance**: A drought observatory serves the purposes of monitoring, analysing and forecasting of droughts. These tasks require the secured availability of drought indices from partner institutions. Keeping the services of drought data up-to-date with current drought information and assuring that the services are running is, therefore, of great importance for EDO.

Further information concerning these four steps is provided below.

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[1] http://edo.jrc.ec.europa.eu/php/index.php?action=view&id=201

Ad a) Drought index preparation

A drought index provides quantitative information relating to the severity of drought conditions. A range of indices are available that provide measures of drought at various stages of the water cycle from the meteorological precipitation input through to soil moisture availability, hydrological and vegetation related indices. Currently available examples of drought indices in EDO are the Standard Precipitation Index (SPI), soil moisture estimates and two vegetation indices for all of Europe as provided by JRC, as well as groundwater bodies and piezometric levels for France from the French Geological Survey, a composite drought indicator for Spain from the Spanish water information system, and a hydrologic index of the Ebro river catchment in Spain, and SPI and WBA indices for South-Eastern Europe (DMCSEE) and Slovenia.

The calculation of the drought index/indices is performed at the partner institution according to their expertise, data collections and requirements.

Ad b) Resource Description and Metadata Requirements

The quality of the search and discovery functionality of the metadata catalogue depends on the quality of the metadata elements. Complete and up-to-date metadata are a key to the success of the system. Metadata need to be provided on drought data and the services providing these data.

The **minimal requirements** regarding metadata are the **INSPIRE metadata elements**. This set of metadata serves the purpose of resource discovery and is mandatory across Europe according to the European INSPIRE Directive. The sections of the INSPIRE directive cover metadata, identification, classification, keywords, geographic resolution, temporal resolution, quality & validity, conformity, constraints and responsible organisation. A detailed description of the Directive is available at: http://inspire.jrc.ec.europa.eu/index.cfm.

In the EuroGEOSS project a need of **extending this basic set** of metadata elements for elements that allow drought-experts to retrieve relevant information on drought indices was identified. The developed drought metadata model details the history (lineage) of the dataset, the method used for generating the drought indices as well as information on data format, representation, updating frequency, source data, etc.

The drought work package has collected **keywords** that describe the partners' resources. These keywords allow a detailed search for drought data and services that correspond to the search criteria of a drought expert.

The metadata should be provided in the **language** of the dataset respectively the language of the data producing institution. An English version of the metadata is also required.

The availability of a website with a description of the provided drought indicators is of added value. The EDO map viewer provides a link to such web pages through an info-button.

The supply of INSPIRE metadata is mandatory for the data and services provided. It is not mandatory to include the elements of the extended metadata model and the

drought-specific keywords in the metadata. The advantages of these extended descriptions are however considerable and the use of these elements advised.

Supporting technologies
The generation of the minimal set of metadata is supported by the INSPIRE metadata editor: http://www.inspire-geoportal.eu/index.cfm/pageid/342. The web-based editor produces XML files that can be stored offline and edited at a later moment in time.

The University of Zaragoza has developed a free metadata editor called CatMDEdit. It is available at: http://catmdedit.sourceforge.net/ and allows extending INSPIRE metadata for additional metadata elements as the ones mentioned above. CatMDEdit was also extended for drought-related keywords to facilitate the inclusion of the keywords in the metadata entries.

After their generation the metadata need to be uploaded in the metadata catalogue. A username and password are required for this purpose. University of Zaragoza provided a support document describing the procedure of uploading and editing metadata in the catalogue (http://eurogeoss.unizar.es/home/EuroGEOSS_guidelines_updating_metadata_in_catalogue.pdf).

Ad c) Service Publication and Open Web Service

The supply of drought-related resources is done with Open Web Services (OWS) that follow the specifications of the Open Geospatial Consortium (OGC). There are three sets of services that are implemented and evaluated in the course of the EuroGEOSS project. Partners have to provide at least a web map service of a drought index for joining the prototype of EDO.

Web map services (WMS): WMS provide raster maps of drought-related data. As said above, the provision of this kind of service is the minimal requirement for joining the European Drought Observatory. Since WMS provide raster images and not raw data, issues with restrictions on the use of data can be largely avoided. The service is set up by the partners and then linked to the existing infrastructure.

An extension of WMS is a WMS with a time component (WMS-t). These services allow the retrieval of maps that show the drought-index at a specified moment in time. This extension is useful, because most of the drought-related data are available as time series.

Web coverage services (WCS): WCS data supply raster data as raw data in various formats such as GeoTIFF or NetCDF. Calling a WCS leads you to a download of the data provided by the service. These services are useful for performing analyses of drought-related resources in specific software as the functionality of analysing raster maps in a map viewer is limited. The supply of WCS through partners of EDO is very welcome as long as there are no conflicting restrictions of data use from the providers' side.

Web feature services (WFS): WFS are used to supply information on vector features. Apart from drought indices that may require the use of a WFS service, the intended use of WFS in the context of EDO is to supply time series graphs of the drought data from partners. EDO does already include a function for the generation

of time series graphs, but this function is not based on WFS and considers only data from the JRC. The extension of this function with WFS would allow creating time series graphs of, for example, the Standard Precipitation Index coming from two or more different partners (currently this is only possible for data provide by JRC). The summary of data from different partners in such graphs allows comparing the values of the indices.

Where are the services published in EDO?

WMS Service
By default, each of the WMS services registered in EuroGEOSS Metadata Catalogue can be loaded upon request in EDO MapViewer as a "EuroGEOSS Catalogue-Retrieved Layer", using EuroGEOSS Metadata Catalogue to search and append it to the map viewer's layer list.
Moreover, a partner can ask to register a significant subset of his indices as a "Permanent Layer" of the EDO MapViewer: in this way the layer is always available within the map viewer in a specific sub-group of "National / International Drought Information" or "Regional / Local Drought Information" layer lists.
It is also possible to define a query on any index layer using a WMS GetFeatureInfo request, as done, for example, for the BRGM Piezometers layer.
A new version of the EDO website (and EDO MapViewer as well) is planned to be published by the end of 2011. This new version will offer two new tools to display and compare drought indices registered as permanent layers: "Compare Indicators" (to compare maps of four different indices at the same date) and "Indicator Snapshots" (to compare maps of the same index at four different dates).

To register a layer as a permanent layer in EDO, a partner needs to provide the following information:
- A contact person (name and e-mail address) for communication between EDO staff and partner staff
- The name of the agency delivering the index
- The name of the index to be displayed within the EDO MapViewer
- The name of the subgroup to be defined in EDO MapViewer (if not present yet), specifying if the index is at national/international or at regional/local scale
- A short description (abstract) of the index
- The GetCapabilities URL of the WMS service delivering the index; the version of WMS must be 1.3.0 or later.
- A link to a webpage of the partner website describing the index
- The list of languages (English mandatory, French and Spanish optional) in which the index name (title), abstract, and legends are translated for multi-language support
- The URLs of images used for translated legends; the legend in the native language can be retrieved by the WMS GetLegendGraphic request
- The period for which the index is available (e.g. from 1990 to now)
- The periodicity of the index (yearly, monthly, 10-daily, etc.)
- The tag in index GetCapabilities where time information is stored (`<wms:Extent name="time"`, or `<wms:Dimension name="time"`)

WCS, WFS Services
The default way how a partner can ask to insert a link to his WCS or WFS service in EDO is to add a special button near the layer name within the EDO MapViewer.
However, other solutions (e.g. add links to partner WCS/WFS from the EDO WCS/WFS webpage) can be discussed after publication of the new EDO website.

Multi-language support

During the EuroGEOSS project all partners agreed to provide their data translated in three languages: English, Spanish, and French. To register an index as a permanent layer in the EDO MapViewer and related applications, at least the English translation is required. In order to provide this multi-language support, a special application – named connector - was implemented by BRGM. It is available for both Java (eXows Connector) and PHP (PHP Connector) OWS servers. For each index title, abstract, and legend must be provided with translations.

Information on Used Technology
The partners who want to join EDO are asked to set up open web services – at least a WMS. The actual implementation of such a service follows well known procedures and can be completed in a manageable amount of time. The suite of available map servers for providing open web services is large; two examples are the UMN MapServer and Geoserver. The partners are free to implement the service according to their requirements; some general rules such as descriptive naming of data layers are self-evident.

Ad d) Maintenance and Updating

The partners are asked to keep the data provided in the service up-to-date. This means that the service should always provide the latest available calculation of the drought index that was prepared at the partner institution. The technical staff of the JRC has to be notified when the updating of indices involves changes of layer names or similar in order to keep the system working. The description of the WMS in the so-called GetCapabilties document should contain the date of the data provided with the service for allowing checking the timeliness of the service.

Cartography and Interoperable Issues
The partners are relatively free in deciding on the cartographic representation of the drought indices. Currently some partners provide maps with three colours reminding of a traffic light for representing a drought index; this representation proved useful. The partners are asked to include an indication of the area that they serve with data in light grey. This background colour allows differentiating between regions for which no data are collected from those for which no drought occurrence is reported.

Communication with JRC
The establishment of the link to an open web service from a new partner will involve direct communication with the technical staff of JRC. During the integration process it is possible to define procedures related to updating and changing of the service as well as to develop customized solutions.
For each step of the index registration JRC staff is available to provide further clarifications, if needed.

Relevant Links

Prototype of EDO – European Drought Observatory	http://edo.jrc.ec.europa.eu/php/index.php?action=view&id=201
EuroGEOSS project	http://www.eurogeoss.eu/default.aspx
GEOSS	http://www.earthobservations.org/geoss.shtml
INSPIRE Directive	http://inspire.jrc.ec.europa.eu/index.cfm
Metadata support document from University of Zaragoza	http://eurogeoss.unizar.es/home/EuroGEOSS_guidelines_updating_metadata_in_catalogue.pdf
Open Geospatial Consortium	http://www.opengeospatial.org/