

# Guidelines for Joining the European Drought Observatory (EDO)

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The European Drought Observatory (EDO) is currently under development at the European Commission's Joint Research Centre. Following GEOSS, the former EuroGEOSS project (2009-2011, <http://www.eurogeoss.eu>) and INSPIRE regulations; EDO is based on open web services and aims at connecting drought data providers on continental, multinational, national, regional, and local levels.

The guidelines described in this document have been implemented and tested by partners of the EuroGEOSS project and aim to support potential partners in joining the European Drought Observatory. The current version 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:

- 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 was developed by the University of Zaragoza in the frame of the EuroGEOSS project and is now hosted by EDO. 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 Interactive MapViewer**<sup>1</sup>, using Open Web Services. Additional services for data download or for the analysis of time-series can be implemented, if needed/requested.
- d) **Maintenance:** A drought observatory serves the purposes of monitoring, analysing and forecasting of droughts. These tasks require the continuous availability of the information, keeping the indicators up-to-date and assuring that the web mapping services are running.

The different steps are illustrated in Figure 1. Further information concerning the four main steps is provided below.

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<sup>1</sup> <http://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1111>

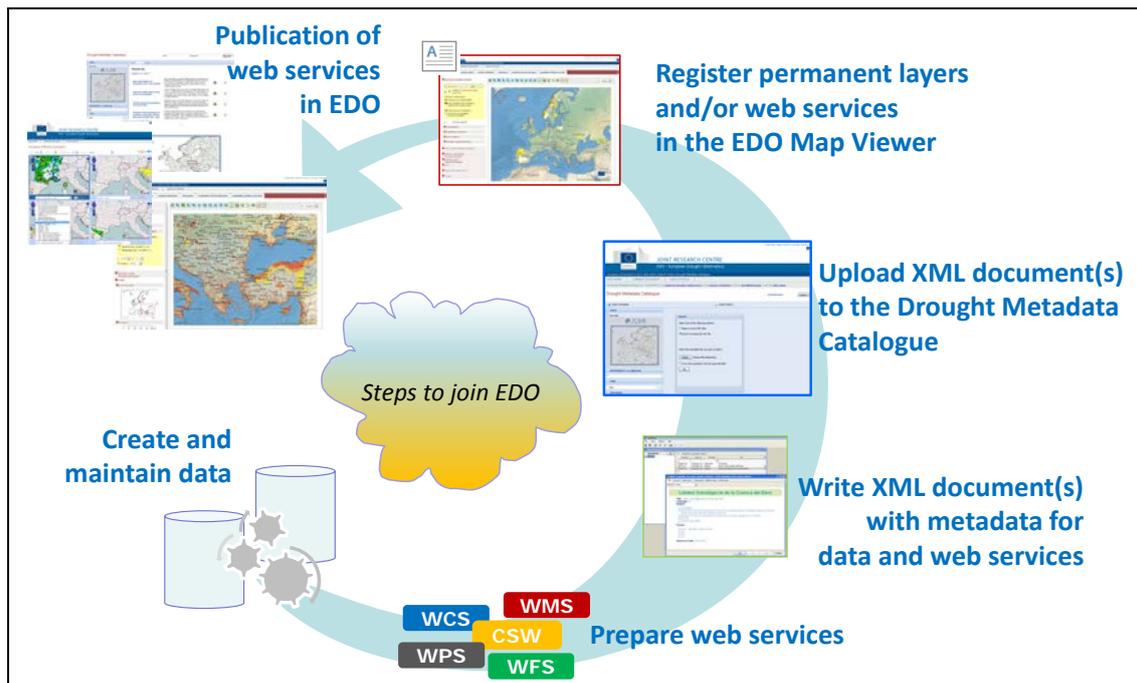


Figure 1: Steps in joining EDO

### **(a) Drought index preparation**

A drought index provides quantitative information relating to the severity of drought conditions. A range of established indices are available covering different compartments of the water cycle, including rainfall, snow pack, soil moisture river flow, reservoirs, groundwater, and vegetation vigour. Additional important indicators cover temperature extremes (i.e. heat and cold waves).

Currently (2017) indicators for the following variables are available in EDO:

#### At continental scale:

- Rainfall (monthly values and Standardized Precipitation Indices for different accumulation periods)
- Snow pack (Standardized Snow Pack Indicator)
- Soil moisture (pf and soil moisture anomalies)
- River flows (low-flow indicator)
- Vegetation Vigour (fraction of absorbed Photosynthetically Active Radiation and anomaly)
- Temperature (absolute values and anomalies)
- Temperature Extremes (Heat and Cold Waves)

Indicators are usually updated in 10 day or monthly intervals and expressed as absolute values and as anomalies with respect to the long-term climatology.

In addition, a Combined Drought Indicator (CDI) providing warning levels for ecosystem and agricultural drought is provided.

At other scales:

- A series of Standardized Precipitation Indices for South Eastern Europe (Drought Management Centre for South-eastern Europe, DMCSEE)
- A series of Standardized Precipitation Indices for Slovenia (Slovenian Environment Agency, EARS)
- Groundwater bodies and piezometric levels and trends for France (BRGM)
- Standardized Precipitation Indices and different hydrologic indicators for the Ebro River Basin in Spain (Ebro River Basin Authority)

These indicators are calculated and maintained at the partner institutions and made available in EDO through Web Mapping Services.

## **(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 therefore need to be provided for the drought indicators and for 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>.

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 also 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. and is provided with several **keywords** that describe the data providers' resources. These keywords allow for a detailed search for drought data and services that correspond to the search criteria of a drought expert.

The metadata can be provided in the **language** of the dataset, respectively the language of the data producing institution. In any case, an English version of the metadata is required.

The availability of a website with a description of the provided drought indicators is of added value. The EDO MapViewer 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 is advised.

### **Supporting technologies**

The generation of the minimal set of metadata is supported by the INSPIRE metadata editor: <http://inspire-geoportal.ec.europa.eu/editor/>. 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. The version of CatMDEdit used at the end of EuroGEOSS project was 4.6.5, while the last available for download at present is 5.0.

After their generation the metadata need to be uploaded in the Drought Metadata Catalogue. A username and password are required for this purpose. The EDO team can provide support for the procedure of uploading and editing metadata in the catalogue.

## **(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 can be registered to the European Drought Observatory: Web Map Service (WMS), Web Feature Service (WFS), and Web Coverage Service (WCS). Partners have to provide at least a Web Map Service (WMS) 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 allows for downloading the data provided by the service. These services are useful for performing analyses of drought-related resources in specific software packages (e.g. ArcInfo, QGIS) as the functionality of analysing raster maps in a map viewer is limited. The supply of WCS through partners of EDO is recommended 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, for example aggregation of grid cells, administrative units or river basins affected by drought.

### **Where are the services published in EDO?**

#### *WMS Service*

Each WMS service must be registered in the Drought Metadata Catalogue and as a “Permanent Layer” in the EDO MapViewer as a component of the sub-group of “Regional / National / Local Drought Information” layers. It is also possible to define a query on any index layer using a WMS GetFeatureInfo request.

The EDO website offers another tool to display and compare drought indices registered as permanent layers: “Side by Side Maps” is aimed to compare maps of four different indices at the same date, or maps of the same index at four different dates, or any combination of layers and 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 regional, national or 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.
- A link to a webpage of the partner website describing the index
- A URL for the legend as static image or WMS GetLegendGraphic request. The legend should be available at least in English. Additional languages can be accepted.
- 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 in the layer’s context menu, accessed by right click, within the EDO MapViewer. However, other solutions (e.g. add links to partner WCS/WFS from dedicated WCS/WFS webpages) can be discussed.

### **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. The suite of available map servers for providing open web services is large; two examples

are the OsGeo 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.

#### **(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 GetCapabilities 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**

EDO – European Drought Observatory	<a href="http://edo.jrc.ec.europa.eu">http://edo.jrc.ec.europa.eu</a>
EuroGEOSS project	<a href="http://www.eurogeoss.eu">http://www.eurogeoss.eu</a>
GEOSS	<a href="http://www.earthobservations.org/geoss.shtml">http://www.earthobservations.org/geoss.shtml</a>
INSPIRE Directive	<a href="http://inspire.jrc.ec.europa.eu">http://inspire.jrc.ec.europa.eu</a>
Open Geospatial Consortium	<a href="http://www.opengeospatial.org">http://www.opengeospatial.org</a>