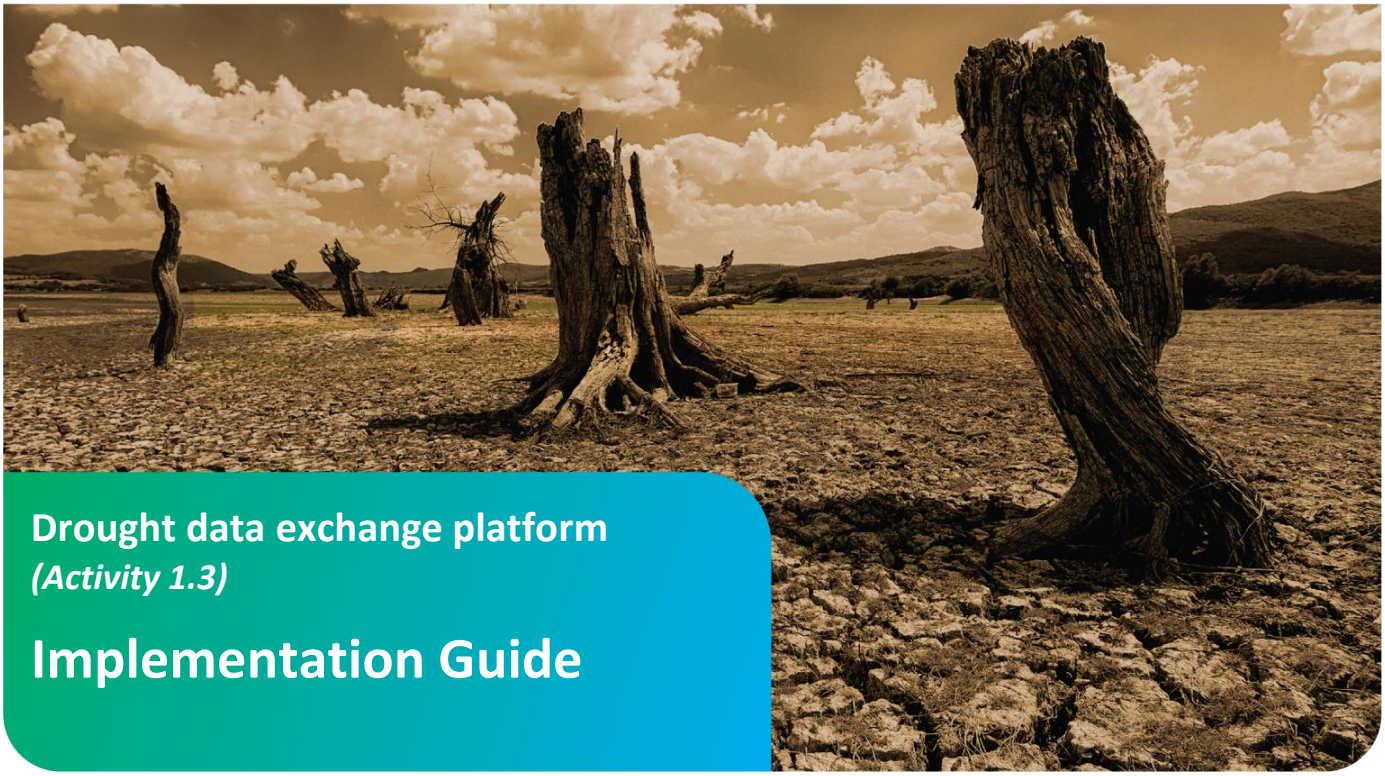
Integrated Drought Management
Programme in Central and Eastern Europe



Drought data exchange platform
(Activity 1.3)

Implementation Guide

www.gwpceeforum.org

Global Water Partnership Central and Eastern Europe (GWP CEE), Regional Secretariat
Slovak Hydrometeorological Institute, Jeseniova 17, 833 15 Bratislava, Slovakia
Phone: +421 2 5941 5224, Fax: +421 2 5941 5273, e-mail: gwpcee@shmu.sk
info@gwp.org

Contents

1. Introduction and overview

Drought is a natural phenomenon occurring in all climates. It is a temporary, negative and severe deviation along a significant time period and over a large region from average precipitation values, which is defined as meteorological drought and might lead to agricultural, hydrological and socioeconomic drought, depending on its severity and duration.

One part of drought mitigation strategies is drought management platform. It is information architecture and an intelligent infrastructure that enables exchange of data, relevant for drought analysis, as well as continuous automated sensing, monitoring and decision support for drought risk management operations.

Drought management platforms are used by drought monitoring centers:

- *Bureau of Meteorology (BOM)*: http://www.bom.gov.au/climate/drought/ - Australia,
- *IGAD clima prediction and application center (ICPAC):* http://www.icpac.net/ - Africa,
- *Global Drought Monitor* (GDM): http://drought.mssl.ucl.ac.uk - UK,
- *SPEI Global Drought Monitor*: http://sac.csic.es/spei/map/maps.html - South America,
- *Chile drought monitor*: http://sac.csic.es/spei/map/maps.html - Chile,
- *The National Integrated Drought Information System (NIDIS)* and *National Drought Mitigation Center* (*NDMC)*: http://drought.unl.edu/ - USA,
- *European Drought Observatory (EDO):* http://edo.jrc.ec.europa.eu/ –Europe[1],
- *Drought Management Centre for Southeastern Europe (DMCSEE):* http://www.dmcsee.org/ – South-East Europe,
- *Integrated Drought Management Programme (IDMP)*: http://www.droughtmanagement.info/

Drought is often represented in terms of drought indices. One of most popular is SPI (Standardized Precipitation Index[2]). It is an index based on the probability of occurrence of a given amount of precipitation, and the probabilities are standardized so that an index of zero indicates the median precipitation amount. The index is negative for deficit of precipitation and positive for suficit. Value of -1 is often used as indicator for drought onset. Also popular, particularly in USA, is PDSI (Palmer Drought Severity Index[3]), which measures the departure of moisture supply. Besides precipitation it also takes into account temperature. Palmer also developed some other indices: PHDI (Palmer Hydrological Drought Index[3]), CMI (Crop Moisture Index[4]) etc. One of the oldest indices is HTC (Hydrothermal Coefficient[5]), which is widely used in Eastern Europe. In recent years also popular is SPEI (Standardized Precipitation Evapotranspiration Index[6]).
There are also many indicators based on satellite data. One of them is fAPAR (fraction of Absorbed Photosynthetically Active Radiation[7]). It represents the fraction of the solar energy absorbed by the vegetation canopy which is a biophysical variable directly related to the primary productivity of the

[1] Similar platform for Africa is *African Drought Observatory (ADO,* http://edo.jrc.ec.europa.eu/ado/ado.html).
[2] McKee et al. (1993)
[3] Palmer (1965), http://en.wikipedia.org/wiki/Palmer_Drought_Index
[4] Palmer (1968)
[5] Selianinov (1928)
[6] Vicente-Serrano et al. (2010), http://sac.csic.es/spei/home.html
[7] Baret et al. (2007), http://en.wikipedia.org/wiki/FAPAR

vegetation. Also popular are NDVI (Normalized Difference Vegetation Index[8]), NDWI (Normalized Difference Water Index[9]) and NDDI (Normalized Difference Drought Index).
In recent years also quite popular are indices which combines different other indices. One of these indices is CDI (Combined Drought Indicator[10]), which is based on SPI, soil moisture and fAPAR. Another one is VegDRI (Vegetation Drought Response Index[11]), which uses satellite-based observations of vegetation conditions, climate data, and other biophysical information.

More information on above mentioned drought monitoring centers[12] and their available products is listed in Table 1.

Table 1: Drought monitor and their available products.

product\monitor	BOM Australia	ICPAC Africa	GDM UK	South America	Chile	NDMC USA	EDO Europe	DMCSEE South-East Europe
meteorological parameters	✓	✓	✓	×	✓	✓	✓	✓
complex indicators	×	SPI, drought index	SPI, PDSI	SPEI	SPI, CDI	SPI, CMI, PDSI	SPI, CDI	SPI
NWP[13] products	×	×	×	×	×	×	×	✓
remote sensing data	NDVI	×	×	×	fAPAR, NDVI, NDWI	VegDRI, NDVI	fAPAR, NDWI	✓
field reports	×	×	×	×	×	✓	×	✓
impact data	×	×	×	×	×	✓	×	✓
bulletins	✓	✓	×	×	×	✓	✓	✓

[8] Tucker (1997), http://en.wikipedia.org/wiki/Normalized_Difference_Vegetation_Index
[9] Gao (1996)
[10] Sepulcre-Canto et. al (2012)
[11] Brown et. al (2008), http://vegdri.unl.edu/FAQ.aspx
[12] droughtmanagement.info is not mentioned in the table since currently it not real data exchange drought management platform; it is a platform where guidance material and information on all aspects of drought management can be found.

[13] Numerical weather prediction

2. Selection of IDMP platform

There are several options for selection of data exchange platform for IDMP project. Main consideration was in decision to develop new services or to attach IDMP project to one of existing systems. If decision to develop new services was taken, the logical choice would be to upgrade platform, developed specially for IDM program – droughtmanagement.info. Applying DMCSEE platform and services would require similar resources as building services within droughtmanagement.info platform, therefore DMCSEE platform was not considered. The other option was to profit from past developments and to merge GWP partners and their data with existing services; in that case according to our opinion the logical choice is European Drought Observatory (EDO).
We have considered arguments for both options. Arguments for and against use of each option can be found in Table 2.

Table 2: Pros and cons for selecting droughtmanagement.info and EDO as IDMP platform.

	Droughtmanagement.info	EDO
Pros	• new drought management platform developed specially for the IDMP program and is therefore tailored to its goals	• central point/platform regarding drought in Europe • long term commitment to European countries (also not limited to European Union members) and users • continuity of outcomes of the projects (data are available after the end of the project) • large past investments into infrastructure (platform has been extensively tested, it is stable and provides many features) • relatively easy to integrate, support from JRC staff
Cons	• in early development stage, user services (such as access to data, mapping tools etc.) are inexistent • a lot of resources needed to implement drought data exchange platform	• user interface is very technical and too complicated for users outside of scientific community

Developing a new platform would take time and resources, also after the project end. Since we don't have such resources available within this project, the decisive factor were needed resources for the establishment of platform and EDO platform was chosen. EDO (Fig. 1) is developed by Institute for Environment and Sustainability (IES[14]) of Joint Research Centre (JRC[15]), a department of the European Commission providing independent scientific and technological support for EU policy-making.

EDO provides:

- continental overview of information on drought,
- visualization and analysis,
- seamless access to regional and national drought information.

[14] http://ies.jrc.ec.europa.eu/index.php
[15] http://ec.europa.eu/dgs/jrc/

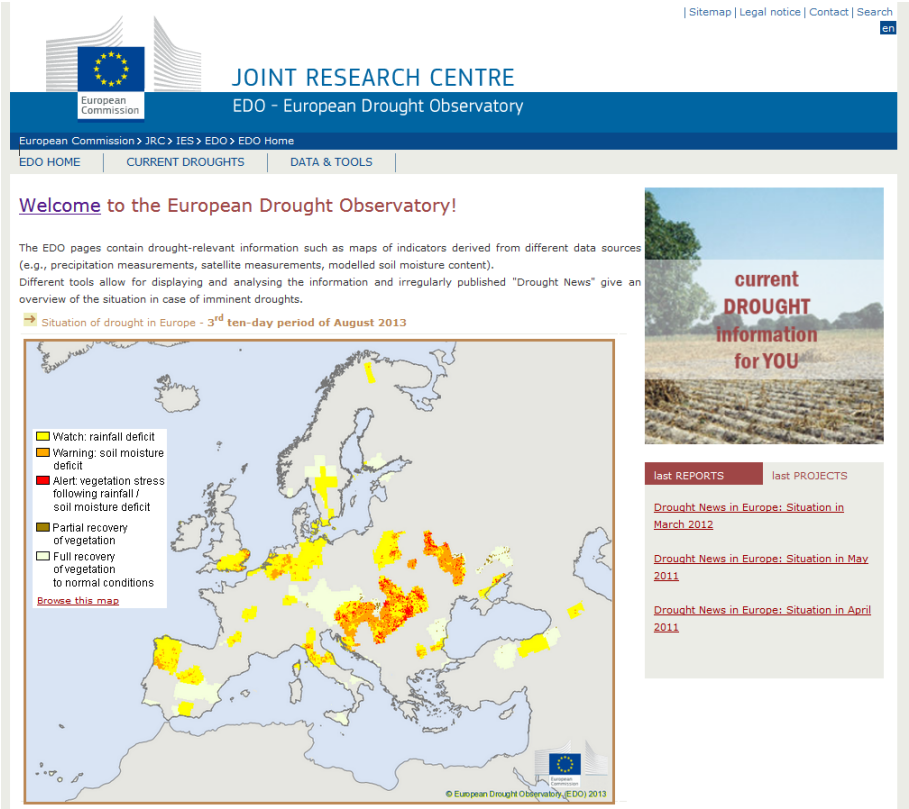


Figure 1: EDO homepage (http://edo.jrc.ec.europa.eu/) with map of current droughts based on combined index CDI.

As many continental and global monitoring platforms, EDO also intensely uses modelling systems for drought status assessment. However, many meteorological variables (above all precipitation amount) are very difficult to accurately simulate using only remote sensing measurements and conventional measurements available in global exchange. Thus country drought products prepared from local measurements are crucial for drought status assessment.

3. Geographical information system[16]

A geographical information system (GIS) is a system designed to capture, store, manipulate, analyze, manage and visualize all types of geographical data. Two groups of GIS data types can be distinguished: raster and vector, which is then divided to points, lines and polygons.
Outputs of GIS are saved into special formats, which also usually include information about coordinate system, resolution, boundaries, etc.

3.1 Raster

A **raster** data type is, in essence, any type of digital image. Its type consists of rows and columns of cells, with each cell storing a single value (Fig. 2). Raster data can be images with each pixel/cell containing a color value. While a raster cell stores a single value, it can be extended by using raster bands to represent RGB (red, green, blue) colors and other options. The resolution of the raster data set is its cell width in ground units. Example of raster file type is map of drought index.

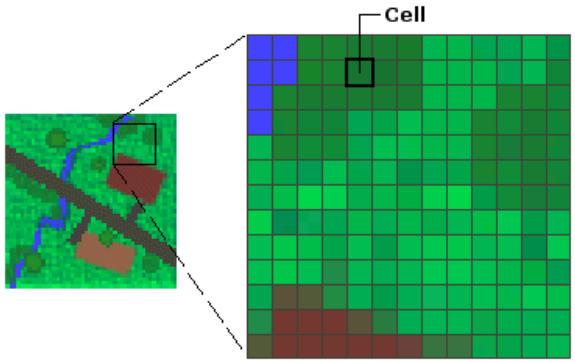


Figure 2: Example of raster data type (figure from http://kmlear.files.wordpress.com/2010/01/raster.gif)

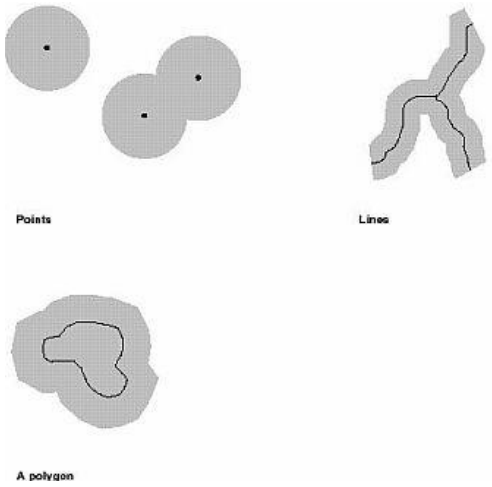


Figure 3: Example of vector data types (figure from http://hds.essex.ac.uk/g2gp/gis/fig42.jpg).

3.2 Vector

A **vector** data type can be divided into three groups (Fig. 3):

- *Points*
  Points are used for geographical features that can best be expressed by a single point (location). Example is value of drought index on the stations.
- *Lines* or *polylines*
  One-dimensional lines or polylines are used for linear features such as rivers, roads, railroads, trails, and topographic lines.
- *Polygons*
  Two-dimensional polygons are used for geographical features that cover a particular area of the Earth's surface. Example is value of drought index for region.

[16] Mostly based on http://en.wikipedia.org/wiki/Geographic_Information_System and http://en.wikipedia.org/wiki/GIS_file_formats.

Creating raster from vectors is done with interpolation. Different interpolation methods are known: the nearest neighbor method, triangulation, inverse distance weighting method, interpolation with splines, geostatistical methods (various implementations of kriging[17], autocorellation models etc.). Kriging family is commonly used method for preparing maps of drought indexes from station data, since some methods can also take into account different physiographic parameters.

3.3 Mapping[18]

In the process of map making the surface of the Earth is usually represented with ellipsoidal surfaces, which is then projected on a map formed into a cylinder, cone or flat plane (Fig. 4). Since a map is a small-scale representation of the Earth's surface it is necessary to apply some kind of scale reduction.

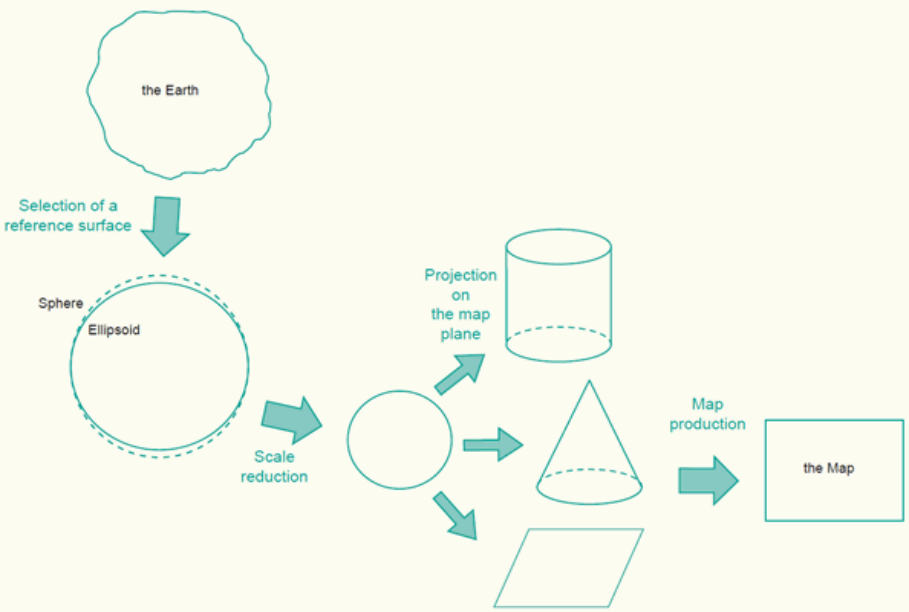


Figure 4: The process of representing the Earth on a flat map (figure from http://kartoweb.itc.nl/geometrics/Bitmaps/Intro%201.6a.gif)

An Earth ellipsoid[19] is a mathematical figure approximating the shape of the Earth. The parameters determined are usually the semi-major axis, *a*, and either the semi-minor axis, *b*, or the inverse flattening, *1/f* (Fig. 5). There are many different ellipsoids defined in the world, some well-known are the WGS84, GRS80 and Bessel.

To measure locations accurately, the selected ellipsoid should fit the area of interest. Therefore a horizontal datum (also called geodetic datum[20]) is established, which is an ellipsoid but positioned and oriented in such a way that it best fits to the area or country of interest (Fig. 6). There are a few hundred of these local horizontal datums defined in the world. However in recent years most popular are global (or geocentric) datums, such as WGS84[21].

[17] Cressie (1993), http://en.wikipedia.org/wiki/Kriging
[18] Mostly based on http://kartoweb.itc.nl/geometrics/index.html and http://resources.arcgis.com/en/help/main/10.1/index.html.
[19] http://en.wikipedia.org/wiki/Earth_ellipsoid
[20] http://en.wikipedia.org/wiki/Geodetic_datum
[21] http://en.wikipedia.org/wiki/World_Geodetic_System

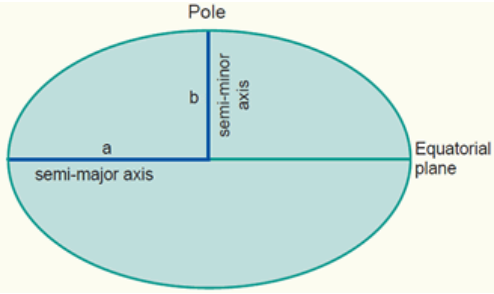


Figure 5: A cross section of an ellipsoid, used to represent the Earth (figure from http://kartoweb.itc.nl/geometrics/Bitmaps/Intro%201.7a.gif)

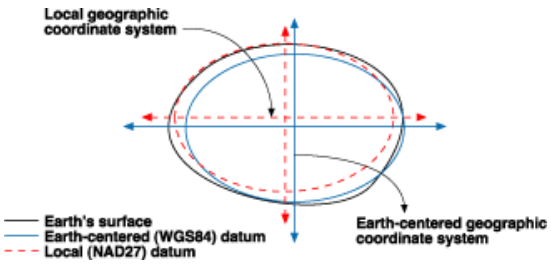


Figure 6: Horizontal datum (figure from http://courses.washington.edu/gis250/lessons/projection/images_av3/datum.gif).

Map projections[22] are typically classified according to the geometric surface from which they are derived. The three classes of map projections are cylindrical, conical and planar or azimuthal (Fig. 7). Examples for cylindrical projection are equirectangular projection[23] (also called geographic or "latlong") (Fig. 8), Mercator[24] (Fig. 9) and its derivates, for conic Lambert Conformal Conic projection[25] and for planar Stereographic projection[26].
Furthermore map projections can be classified by preservation of a metric property. Equal-area projections correctly represent area sizes, equidistant map projections correctly represent distances (in certain directions), while conformal map projections correctly represent angles and shapes (of small areas).

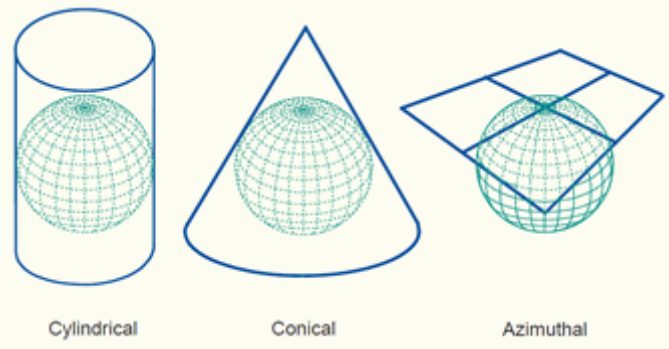


Figure 7: The three classes of map projections: cylindrical, conical and azimuthal (figure from http://kartoweb.itc.nl/geometrics/Bitmaps/Intro%204.10a.gif)

[22] http://en.wikipedia.org/wiki/Map_projection, list of map projections: http://en.wikipedia.org/wiki/List_of_map_projections
[23] http://en.wikipedia.org/wiki/Equirectangular_projection
[24] http://en.wikipedia.org/wiki/Mercator_projection
[25] http://en.wikipedia.org/wiki/Lambert_conformal_conic_projection
[26] http://en.wikipedia.org/wiki/Stereographic_projection

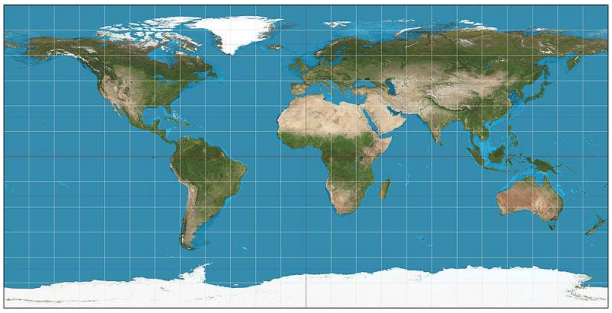


Figure 8: Equirectangular projection (figure from http://upload.wikimedia.org/wikipedia/commons/thumb/8/83/Equirectangular_projection_SW.jpg/800px-Equirectangular_projection_SW.jpg .)

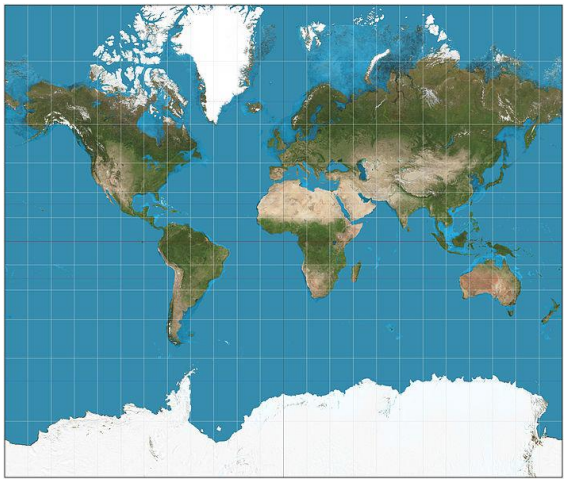


Figure 9: Mercator projection (figure from http://upload.wikimedia.org/wikipedia/commons/f/f4/Mercator_projection_SW.jpg).

A coordinate system enables every location on the Earth to be specified by a set of numbers or letters. Most popular coordinate system is latitude-longitude coordinate system (also called geographic coordinate system[27]), where position on Earth is given by latitude and longitude. Also commonly used coordinate system is Universal Transverse Mercator coordinate system (UTM[28]), which divides Earth into sixty zones (UTM zone number), each 6 ° of longitude in width. Each of the 60 zones uses a transverse Mercator projection that can map a region of large North-South extent with low distortion. A position on the Earth is given by the UTM zone number, East and North coordinate in meters. The Gauss–Krüger system[29], popular in Central Europe, is similar to the universal transverse Mercator system, but the central meridians of the Gauss–Krüger zones are only 3° apart, as opposed to 6° in UTM.
In GIS, coordinate reference systems and coordinate transformations can be defined with European Petroleum Survey Group (EPSG) Geodetic Parameters Dataset[30], a list of univocal four-digit numbers.

Web mapping[31] is the process of designing, implementing, generating and delivering maps on the Internet and its product. In recent years there has been an explosion of web mapping applications (also called Web GIS), such as Google Maps[32].
For web mapping, the Open Geospatial Consortium (OGC[33]) has defined standardized services, such as the *Web Map Service (WMS[34]*). WMS is mainly a view service, displaying geospatial information in a raster format.

[27] http://en.wikipedia.org/wiki/Geographic_coordinate_system
[28] http://en.wikipedia.org/wiki/Universal_Transverse_Mercator_coordinate_system
[29] http://en.wikipedia.org/wiki/Gauss%E2%80%93Kr%C3%BCger_coordinate_system
[30] http://www.epsg.org/ ; List of all EPSG codes: http://spatialreference.org/ref/epsg/.
[31] Based on http://en.wikipedia.org/wiki/Web_mapping.
[32] https://maps.google.com/
[33] http://www.opengeospatial.org/
[34] http://www.opengeospatial.org/standards/wms, http://en.wikipedia.org/wiki/Web_Map_Service

4. European Drought Observatory (EDO)

Two main tools on EDO are EDO MapViewer[35], a web mapping service (Fig. 10), and Drought Metadata Catalogue[36] (Fig. 11), a web application for searching and updating the drought metadata catalogue.

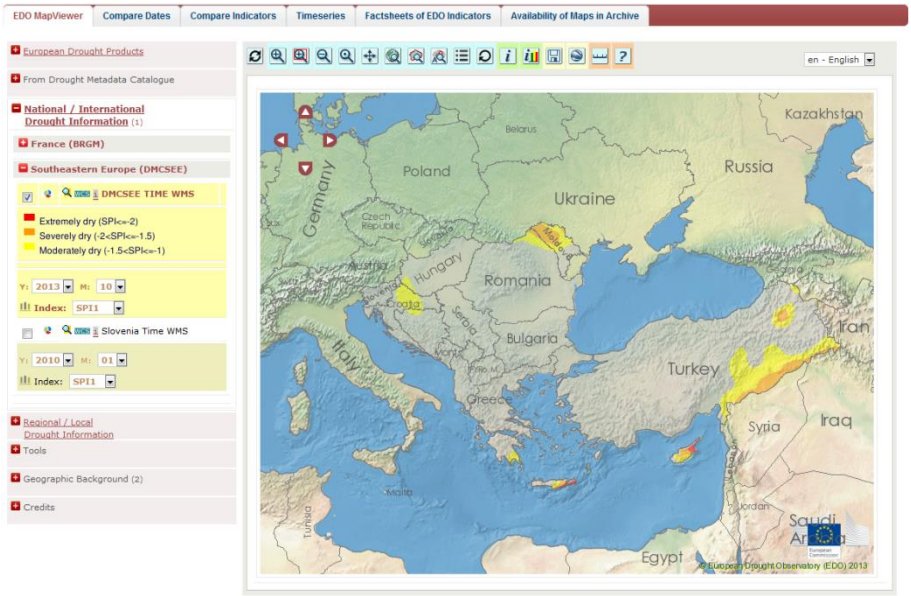


Figure 10. EDO MapViewer showing SPI1 for October 2013 from external source DMCSEE.

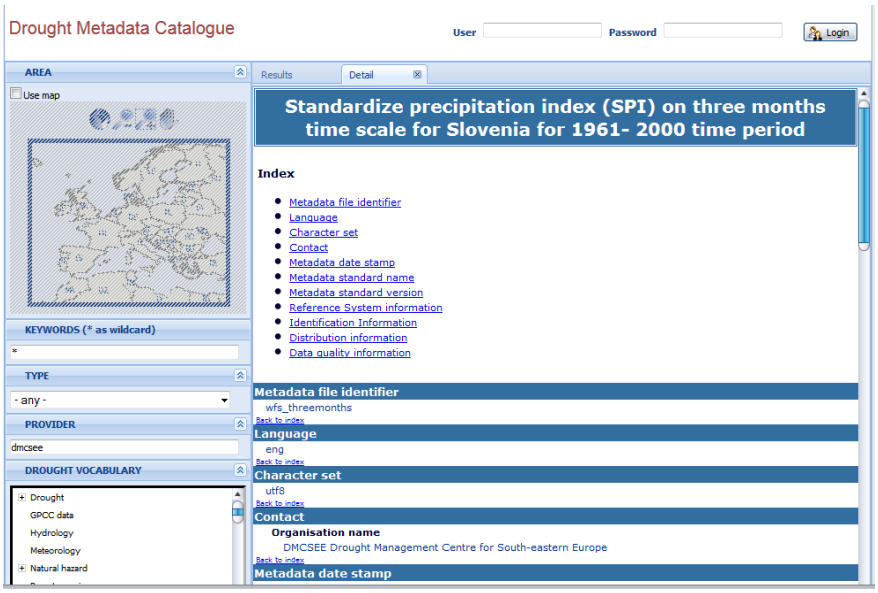


Figure 11: EDO Drought Metadata Catalogue example for DMCSEE.

[35] http://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1120
[36] http://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1103

EDO MapViewer enables the visualization, overlay/comparison and interrogation of spatial datasets over the Internet, using also WMS protocol. More examples of usage of EDO MapViewer can be found in the Appendix A.

Drought Metadata Catalogue was developed by the University of Zaragoza for EuroGEOSS FP7 Project[37]. The Catalogue is INSPIRE (Infrastructure for Spatial Information in the European Community)[38] compliant. The catalogue functionalities were improved including a "Drought Vocabulary"[39], defined and implemented during the project. The catalogue provides search, discovery and preview facilities of spatial and non – spatial metadata. More information about Drought Metadata Catalogue search functionalities can be found in the Appendix A.

[37] EuroGEOSS demonstrated the added value to the scientific community and society of making existing systems and applications interoperable and used within the GEOSS and INSPIRE frameworks. EDO was greatly upgraded during this project.
More information about project: http://www.eurogeoss.eu.

[38] INSPIRE is an EU initiative to establish an infrastructure for spatial information in Europe.
More information: http://inspire.ec.europa.eu/.

[39] More information available in http://www.eurogeoss.eu/Documents/D%205%202b_final.pdf, keywords can be found in the Appendix B.

5. Integration of new data into EDO

Partners are expected to collect existing national data (SPI and any other indicators that are used in partner's countries for identifying or forecasting drought) and make them available through EDO. Data can be in raster or vector format (shared via WMS protocol), links to documents (field reports, bulletins etc.) or national web pages providing drought information.

IDMP project description will be added to EDO webpage[40] as shown on Figure 12.

Figure 12: Example of project description for EuroGEOSS (http://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1004).

5.1 Drought Metadata Catalogue

In Drought Metadata Catalogue information about drought can be added with abstract (description of variable), keywords, link and contact. This information can be data (raster or vector), links to documents (field reports, bulletins etc.) or national web pages providing drought information. Real-time or near real-time information is preferred, however climatological information can also be added.
This task is obligatory for partners.

5.1.1 Metadata

Metadata[41] can be simply described with "data about data". In the Drought Metadata Catalogue metadata are descriptive: data providing information about of the data with standard language. Example of metadata is indicator name, indicator description, organization, availability etc.

[40] Under Home -> Projects: http://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1004.

Metadata are stored in a service called metadata catalogue which allows easily browsing of summary of all the data. Other users, organizations or companies can also find the data if catalogues are publicly available. Metadata catalogues are essential to enable interoperability.

5.1.2 Needed information

Needed information can be divided into few subsections:

- Organization
  - Name of the organization responsible for the indicator.
- Contact (e-mail)
- Indicator name
- Indicator description
  - How is the indicator created? Which software was used for preparation? Is it done manually or automatically through a spatial model or GIS analysis?
  - How the component was assessed: Monitored, Calculated, Estimated.
  - What is calibration period?
  - What is the frequency of updating information?
- Availability of information
  - Is the information available to the public? If so, link to the webpage.
- Data Range Available
  - Indicate the range of data from which information is available.
- Geographic extent
- Keywords[42]
  - Type of drought
    - Which is the type of drought that the indicator assesses?
  - Etc.

5.1.3 Preparing metadata

Metadata are saved in XML[43] (Extensible Markup Language) file format. This is a textual data format, therefore it is both human-readable and machine-readable. It is widely used for the representation of arbitrary data structures, for example in web services.

There is a variety of free, commercial and on-line software tools available to support metadata development:

- CatMDEdit (http://catmdedit.sourceforge.net/, free),
- INSPIRE Metadata Editor (http://inspire-geoportal.ec.europa.eu/editor/, free, online),
- ESRI ArcCatalog (part of ArcGIS: http://www.esri.com/software/arcgis/),
- ISO Metadata Editor (http://www.crepad.rcanaria.es/metadata/en/index_en.htm, free),
- Altova XML Editor (http://www.altova.com/xml-editor/),
- Etc.

---

[41] http://en.wikipedia.org/wiki/Metadata
[42] Possible keywords can be found in the Appendix B.
[43] http://en.wikipedia.org/wiki/XML

For Drought Metadata Catalogue two options are preferred: CatMDEdit and online INSPIRE Metadata Editor. Both have some advantages and disadvantages. CatMDEdit includes all the sections of interest for metadata (keywords) however it is not easy to use. On the other hand INSPIRE Metadata Editor is easy to use, moreover it is fully compliant with INSPIRE directive, but it has low number of groups for metadata (keywords). However due to simplicity *INSPIRE Metadata Editor is recommended*.

Example how to prepare metadata with INSPIRE Metadata Editor can be found in the Appendix B.

5.2 EDO MapViewer

Raster maps can be added to EDO MapViewer under new section IDMP (example on Figure 2 for DMCSEE). Maps can be real-time or near real-time (daily, weekly, monthly or yearly). Data must be provided using WMS protocol. Raster data are preferred, however also vector data can be added.
This task is not obligatory however it is highly desirable.

5.2.1 WMS

WMS (Web Map Service) is one of standard protocols defined by OGC which serves georeferenced map images over the Internet (Fig. 13).

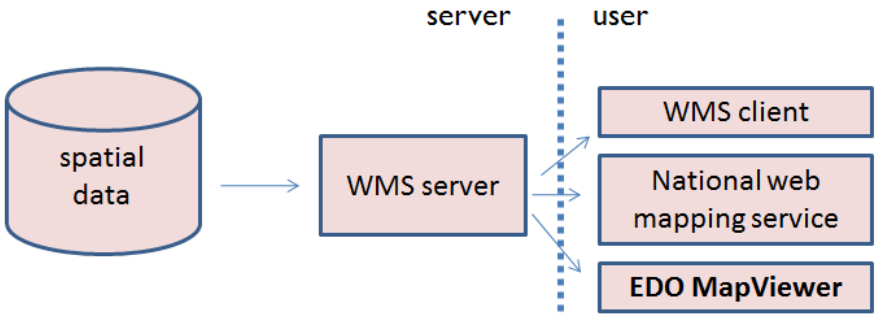


Figure 13: Schematic idea behind WMS.

There are a lot of WMS servers available on the market, for example:

- GeoServer - http://geoserver.org/,
- OSGeo MapServer - http://mapserver.org/,
- QGIS Server (previously Quantum GIS) - http://qgis.org/,
- ArcGIS Server - http://www.esri.com/software/arcgis/arcgisserver/ (non-free).

One of the first and well known WMS servers is OSGeo Mapserver, which was launched in the mid-1990s. It is lightweight, runs on different platforms and supports many file formats. It is easy to install however more difficult to configure.

Maps can be added to existing WMS server. Because of the INSPIRE directive these service should be available at national level. Partners can also check availability of WMS service in IT departments of their institutions. If partners would like to establish their own WMS server, help can be only offered for OSGeo MapServer.

Appendix A

EDO MapViewer functionalities

EDO MapViewer contains all the basic functionalities typical for web mapping service (Fig. 14). It provides view on continental and regional scale with data from external sources (Fig. 15). Additional it is also possible to compare up to four different indicators at the same date (Fig. 16) or compare the same indicator at up to four different dates (Fig. 17).

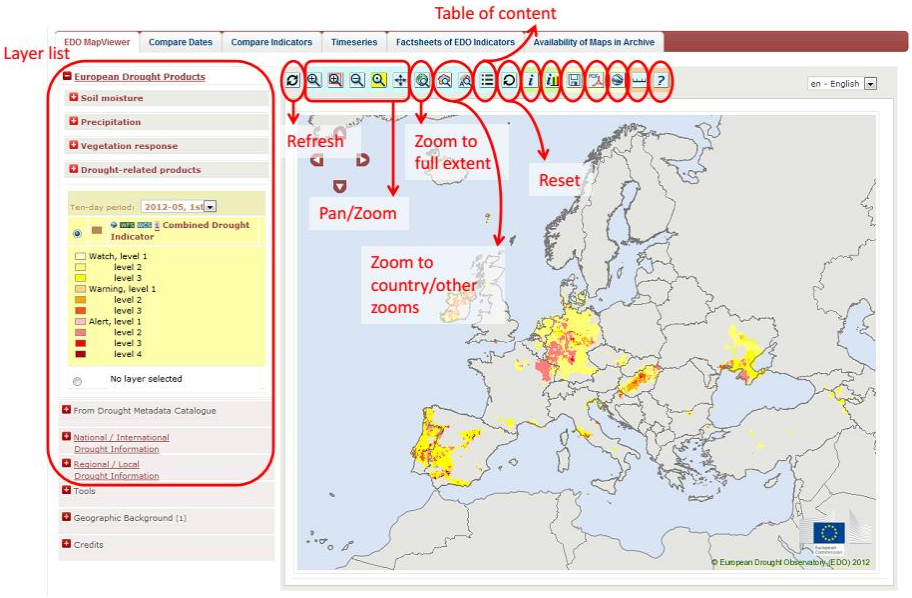


Figure 14: EDO MapViewer - basic functionalities.

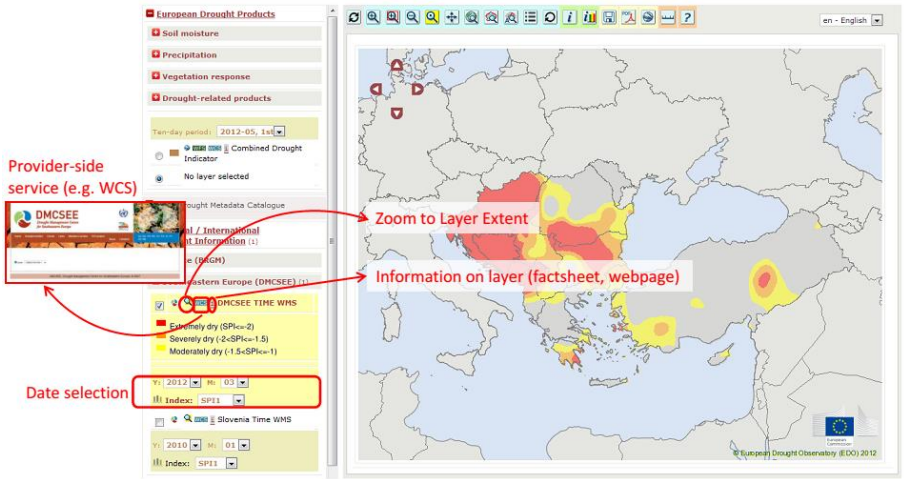


Figure 15: EDO MapViewer - multiscale approach example for external DMCSEE.

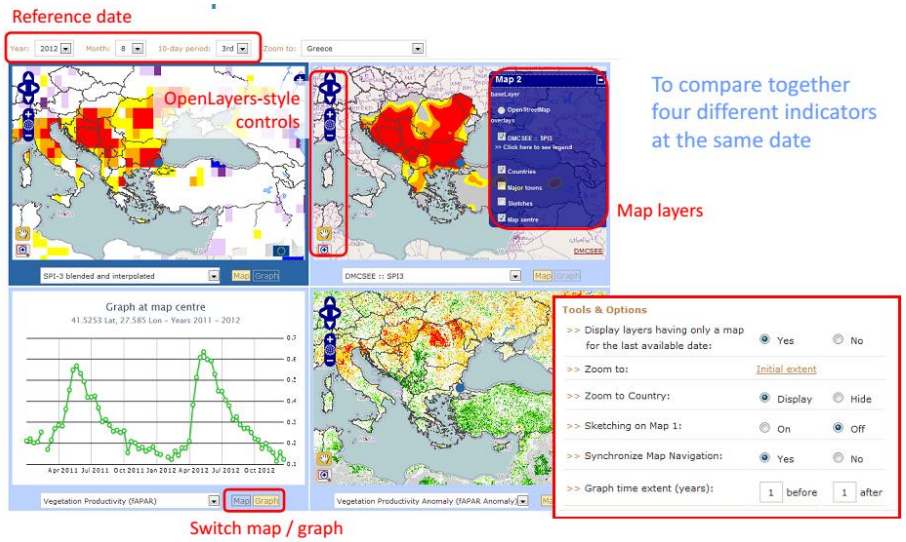


Figure 16: EDO MapViewer – compare four different indicators together at the same date.

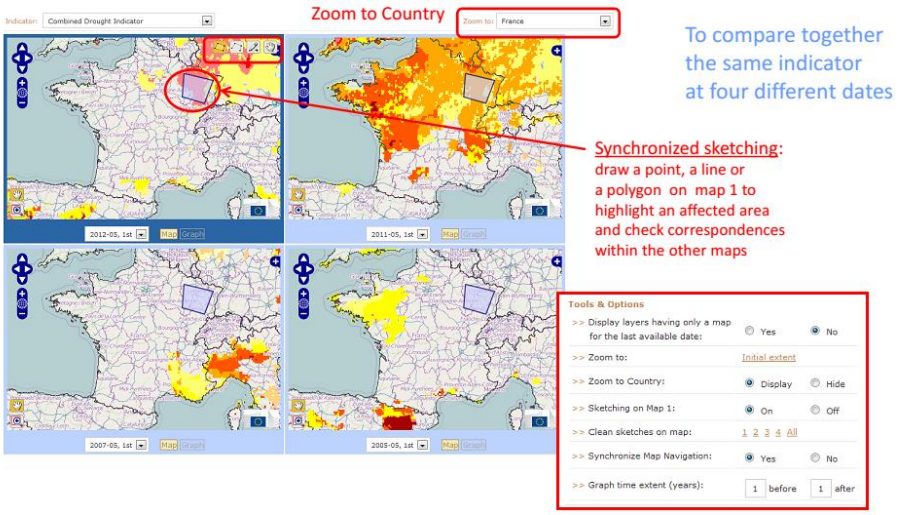


Figure 17: EDO MapViewer – compare the same indicator at four different dates.

Drought Metadata Catalogue search functionalities[44]

Drought Metadata Catalogue can be searched by:

- location (with bounding box) (Fig. 18),
- keywords or text (Fig. 19),
- Societal Benefit Area (SBA) (Fig. 20),
- SBA sub-categories (Fig. 20),
- temporal parameters (Fig. 21).

[44] Based on http://www.eurogeoss.eu/Documents/EuroGEOSS_D_5_2.pdf.

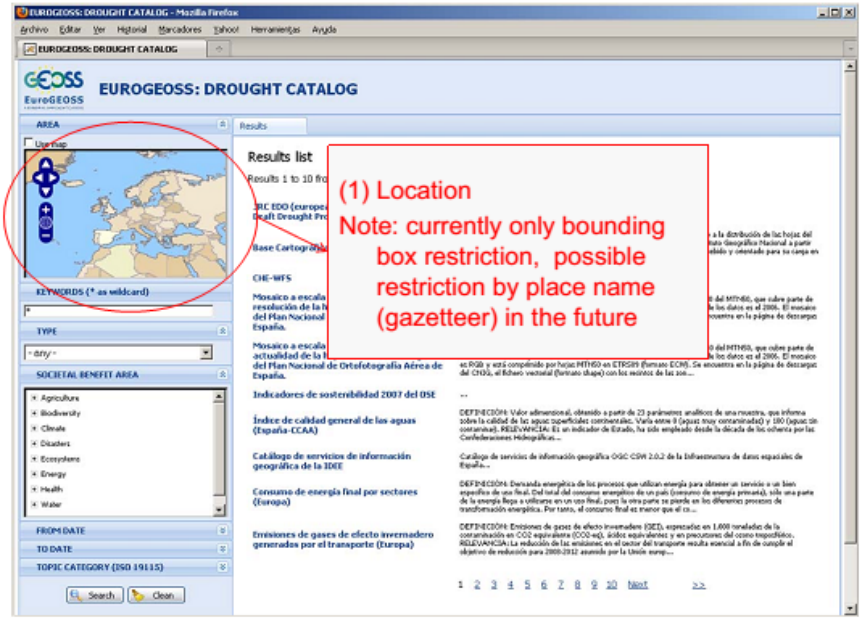


Figure 18. Drought Metadata Catalogue – search criteria: location.

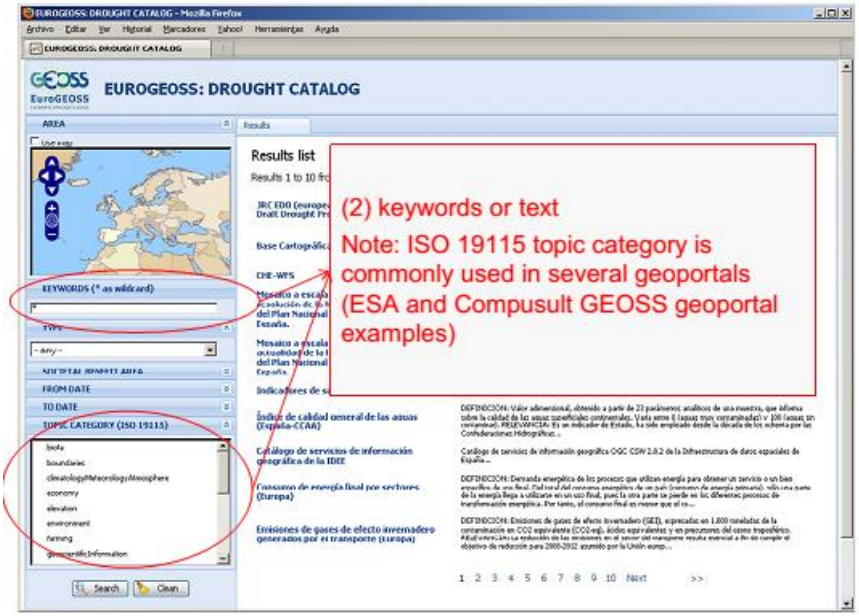


Figure 19. Drought Metadata Catalogue – search criteria: keywords or text.

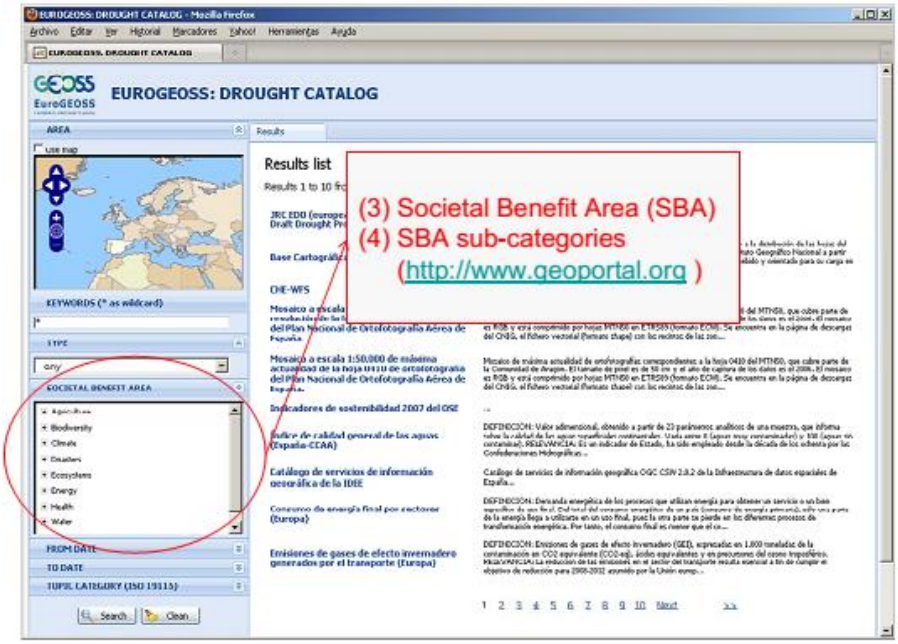


Figure 20. Drought Metadata Catalogue – search criteria: Societal Benefit Area (SBA) categories and sub-categories.

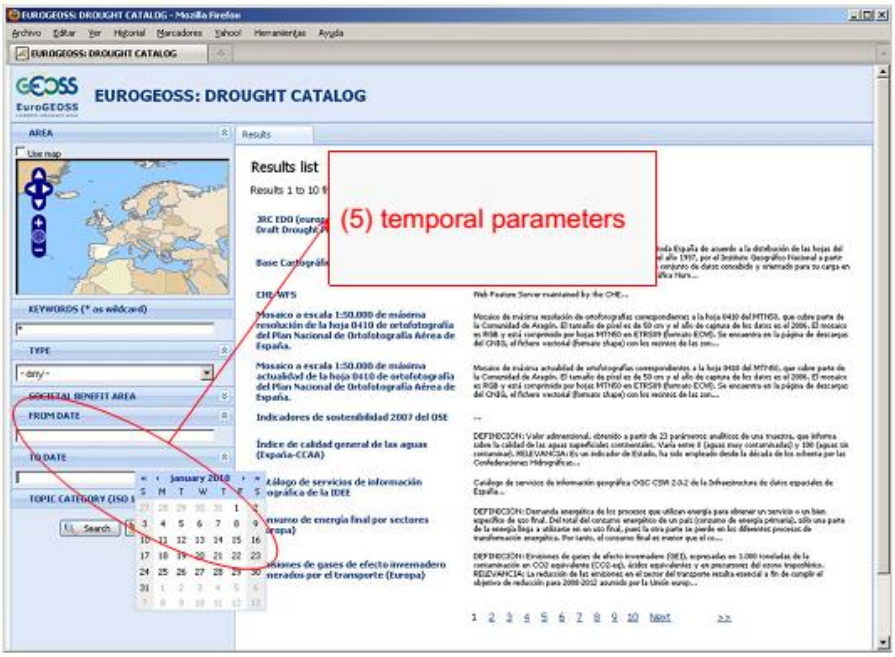


Figure 21. Drought Metadata Catalogue – search criteria: temporal parameters.

Appendix B

TheDrought Vocabulary[45]

The Drought Vocabulary was developed within EuroGEOSS project. It contains 103 keywords related to drought which have been translated into 15 languages, among them also in English, French, German, Spanish and Italian. Keywords in English are listed in next subsection.

Keywords

agricultural drought
alert
anomaly
arid climate
arid zone
climate
climate change
climate variability
composite drought indicator
cumulative departure from normal or climatologically expected precipitation
cumulative precipitation deficit
desertification
discharge
DMCSEE
Drought
drought control
drought duration
drought early warning
drought end
drought forecast
drought frequency
drought hazard
drought impact
drought indicator
drought intensity
drought management
drought map
drought mitigation
drought monitoring
drought monitoring system
drought onset
drought overview
drought plan
drought product
drought region
drought resilience
drought risk
drought severity
drought spatial extent
drought status
drought stress
drought threshold
dry season
EDO
emergency
European drought product
evaporation
evapotranspiration
fAPAR
GPCC data
groundwater
heat stress
hydrological drought
hydrological drought index
hydrological status
Hydrology
low flow
meteorological drought
meteorological drought index
meteorological state
Meteorology
National/multinational drought product
Natural hazard
NDWI
normality
PDSI
piezometric level

[45] Based on http://www.eurogeoss.eu/Documents/D%205%202b_final.pdf.

potential evapotranspiration
pre-alert
precipitation
precipitation anomaly
precipitation deficiency (amount, intensity, timing)
precipitation deficit
precipitation percentile
rainfall
rainfall anomaly
Regional/local drought product
Remote sensing
remote sensing product
reservoir
reservoir volume
semiarid climate
semiarid zone
snow
snow pack
Soil
soil moisture
soil moisture deficit
spatial assessment of drought
SPI
Statistics
timeseries
trend
type of drought
vegetation productivity
vegetation state index
vulnerability to drought
water deficit
water runoff
water scarcity
water stored in reservoir
water stress
weather extremes

Example of preparing metadata with INSPIRE Metadata Editor

INSPIRE Metadata Editor is online metadata editor (http://inspire-geoportal.ec.europa.eu/editor/). Main page is shown on Figure 22. Editor has menu and tabs with different topics. Under each topic there are several forms which need to be completed. Instructions which forms to complete inside each topic and what to write/select are in next subsection. More information is available under Help in the menu or by pushing the information button (shown as Help on Fig. 22) next to each form.

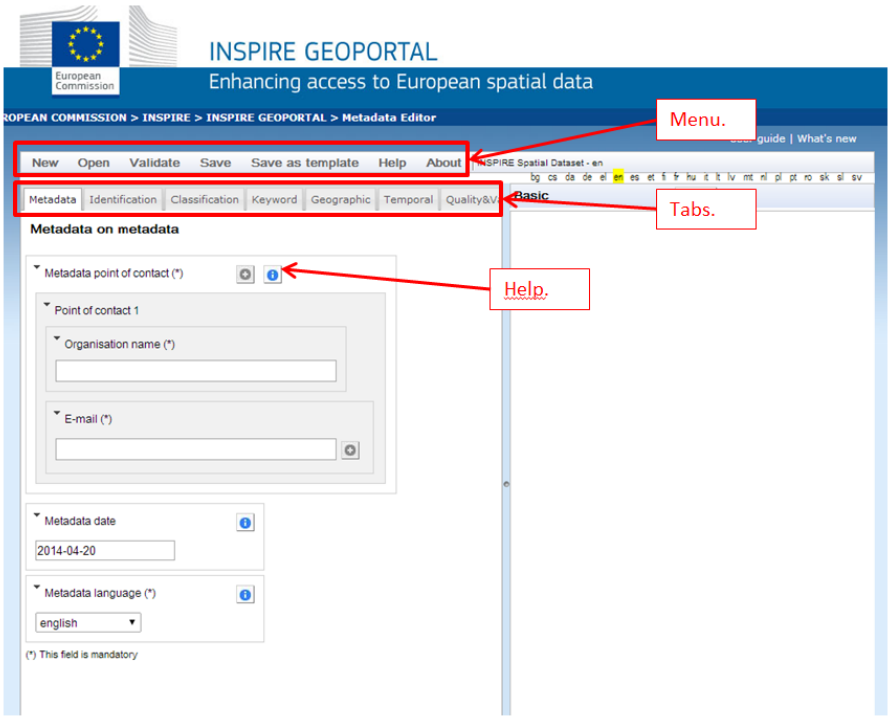


Figure 22. Drought Metadata Catalogue – main page.

Instructions

The whole process can be summarized in 13 steps:

STEP 1: Navigate to online metadata editor (http://inspire-geoportal.ec.europa.eu/editor/). Under tab *Metadata* insert organization name and e-mail address. Please leave language set to English (see Fig. 23).

STEP 2: Switch to *Identification* tab. Insert full name of your data or product under Resource title and short unique code (see Fig. 24 for suggestion). According to Fig. 24, write short description, insert link to data resource (or to institution that provides it) and indicate language in which the resource is available.

STEP 3: Switch to *Classification* tab. Select one or more topics (see Fig. 25 for suggestions).

STEP 4: Switch to *Keyword* tab. Ignore first two insert fields (Keyword from INSPIRE Data Themes and Keywords from repositories) and move to Free keyword entry. Choose keyword from Appendix 6.3 and insert it as Keyword value. Insert the rest of the entries as it is shown in Fig. 26. Press Apply button. You are encouraged to insert as many keywords as you find relevant.

STEP 5: Switch to *Geographic* tab and select your country (rest is filled in automatically; see Fig. 27).

STEP 6: Switch to *Temporal* tag. Under Starting date, insert the date from which the data is available (see Fig. 28 for suggestions).

STEP 7: Switch to *Quality&Validity* tab. Under Lineage entry, insert information about the data (see Fig. 29 for suggestions).

STEP 8: Switch to *Conformity* tab. Click to Specifications entry and press ENTER. Choose first option (as suggested in Fig. 30), rest is filled in automatically.

STEP 9: Switch to *Constraints* tab. Here you can set limitation to use your data (you can get suggestions by clicking on an entry and pressing ENTER). Most desirable is that you allow free use of the data (see Fig. 31 for suggestions).

STEP 10: Switch *to Responsible party* tab (depending on screen resolution, it might be hidden; in that case, rescale the right window). Insert name of responsible institution (probably same as in Identification tab), contact address and role (see Fig. 32 for suggestions).

STEP 11: Click *Validate* in the navigation bar. If everything is OK, you should get only two error messages, shown in Fig. 33.

STEP 12: Click *Save* in the navigation bar. Save the file to your computer.[46]

STEP 13: Rename file to Country-Name_of_the_indicator.xml (e.g. SI-Drought_bulletin.xml) and send it to luka@bo-mo.si.

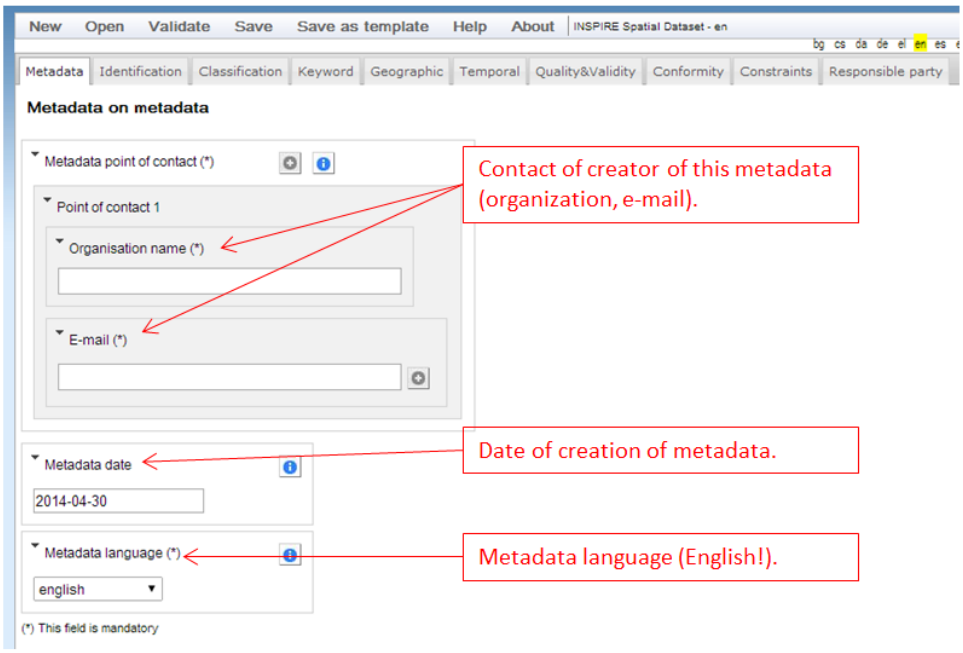


Figure 23. INSPIRE Metadata Editor – Tab Metadata.

[46] File can be reedited using Open button in the menu and selecting saved file from computer.

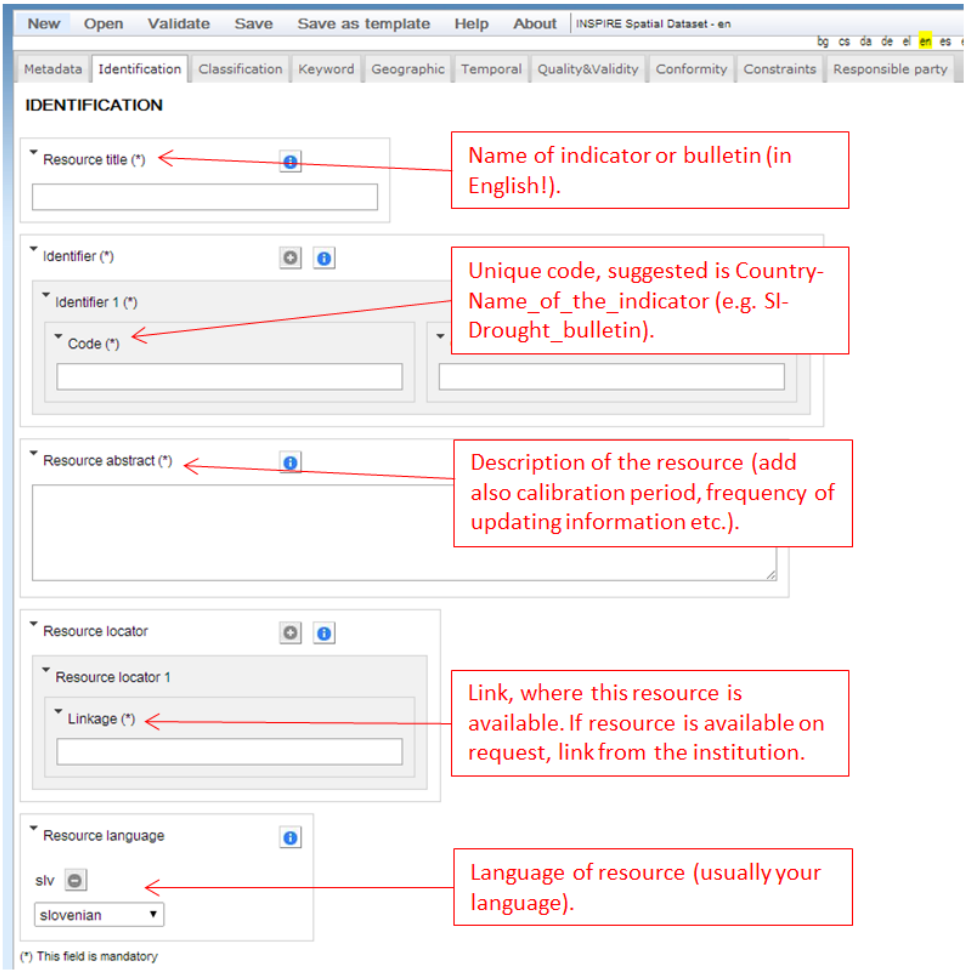


Figure 24. INSPIRE Metadata Editor – Tab Identification.

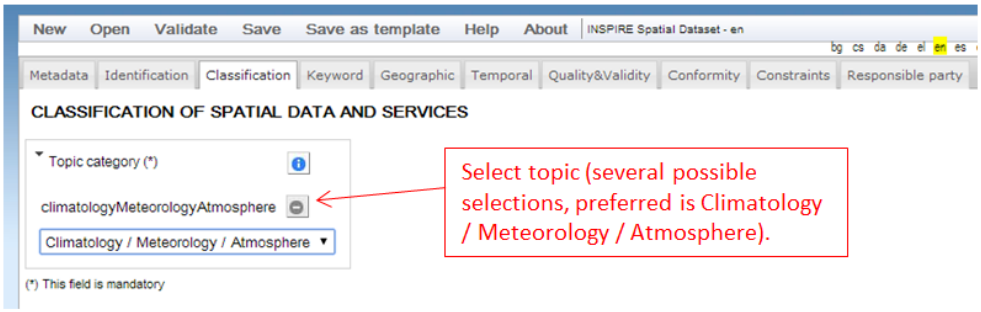


Figure 25. INSPIRE Metadata Editor – Tab Classification.

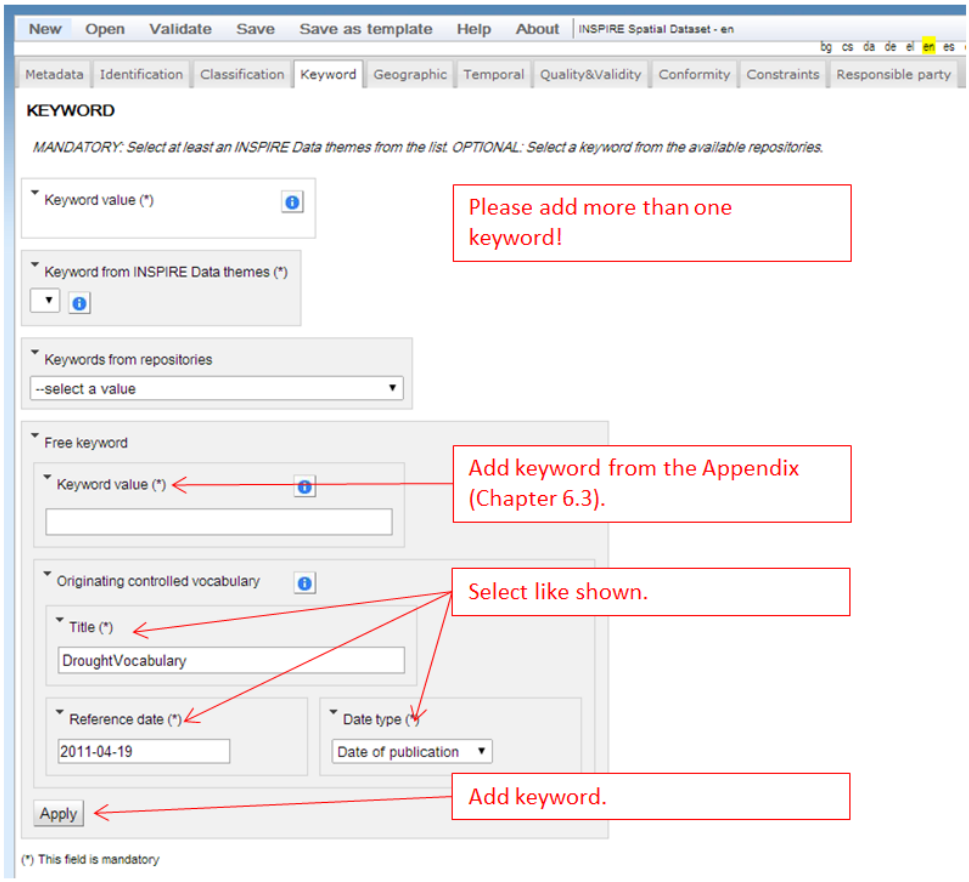


Figure 26. INSPIRE Metadata Editor – Tab Keyword.

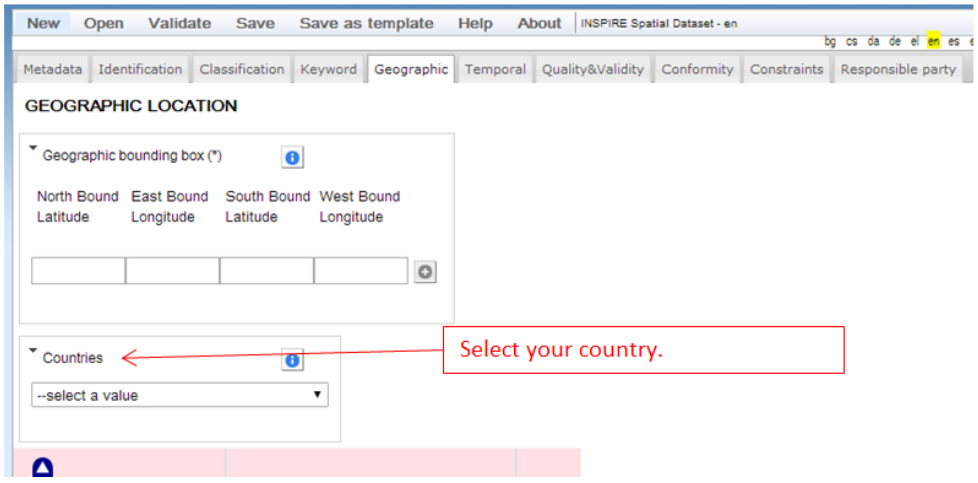


Figure 27. INSPIRE Metadata Editor – Tab Geographic.

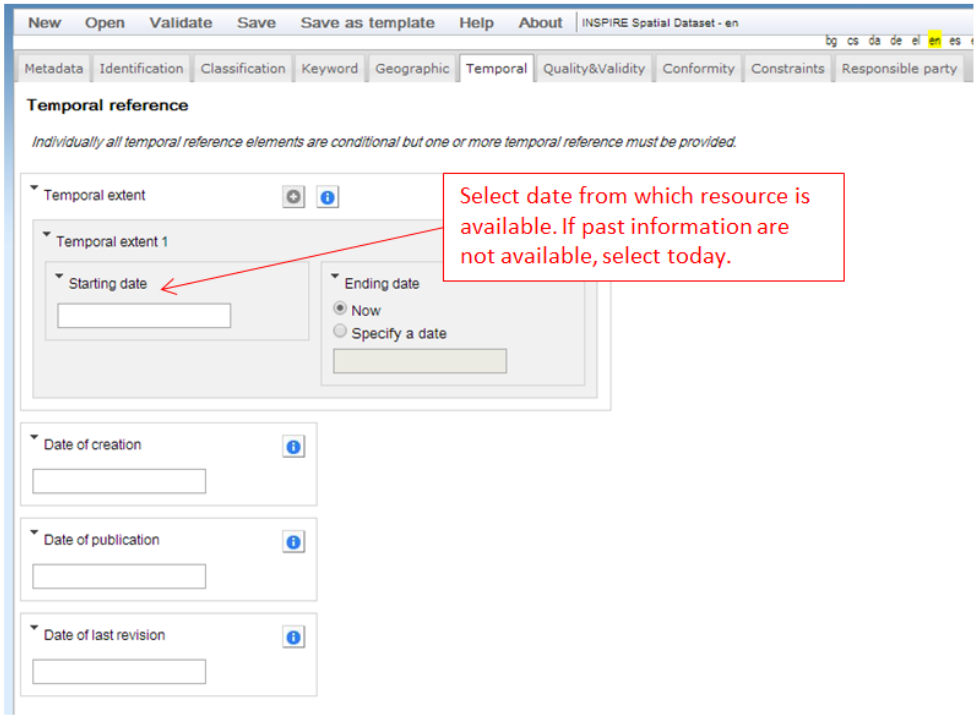


Figure 28. INSPIRE Metadata Editor – Tab Temporal.

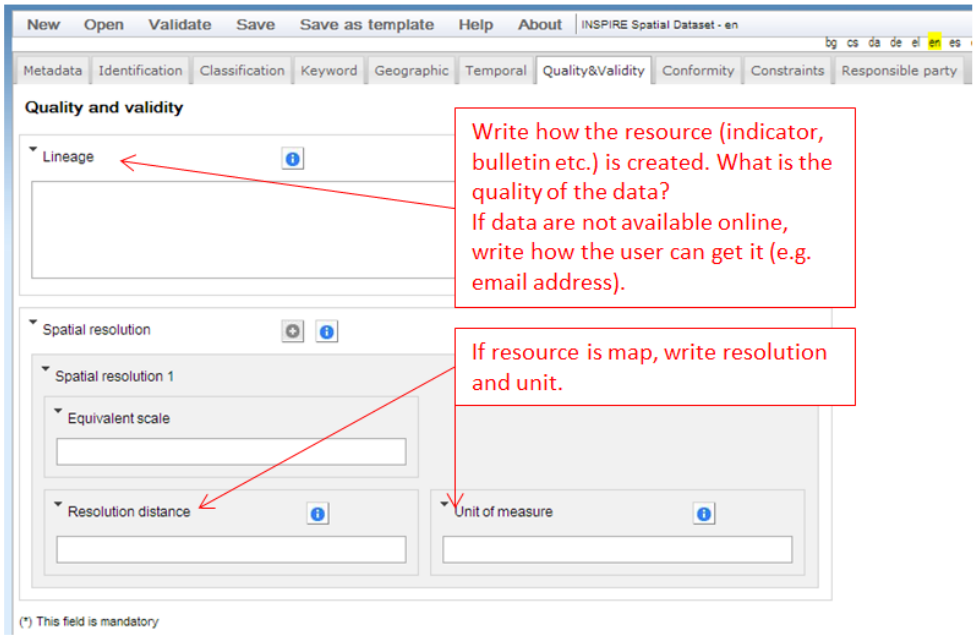


Figure 29. INSPIRE Metadata Editor – Tab Quality&Validity.

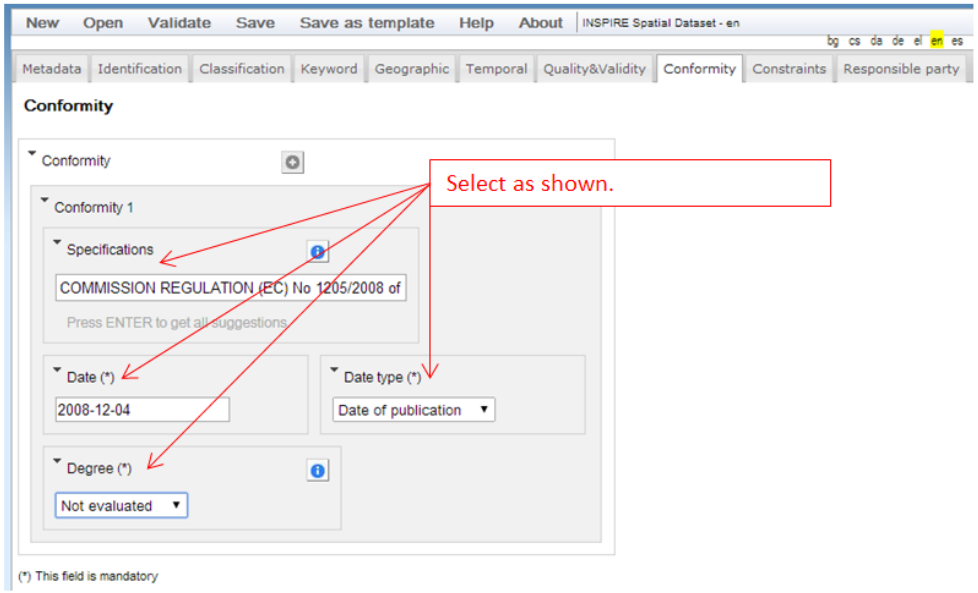


Figure 30. INSPIRE Metadata Editor – Tab Conformity.

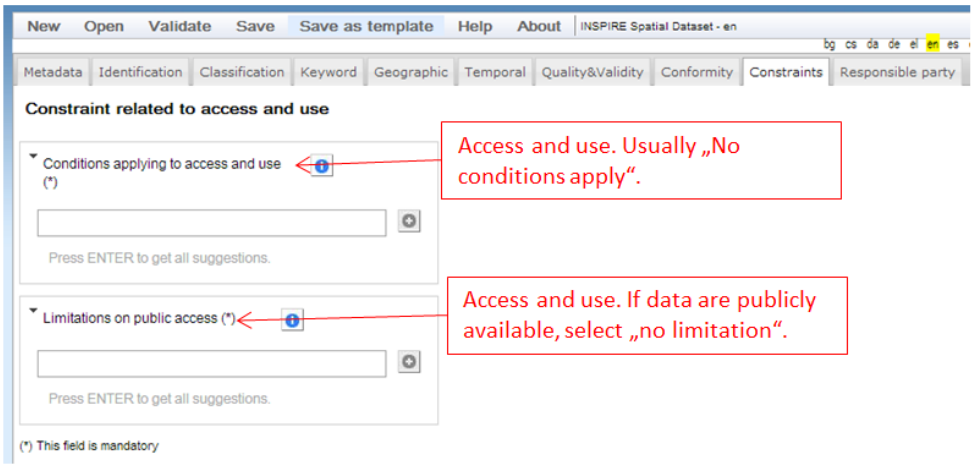


Figure 31. INSPIRE Metadata Editor – Tab Constraints.

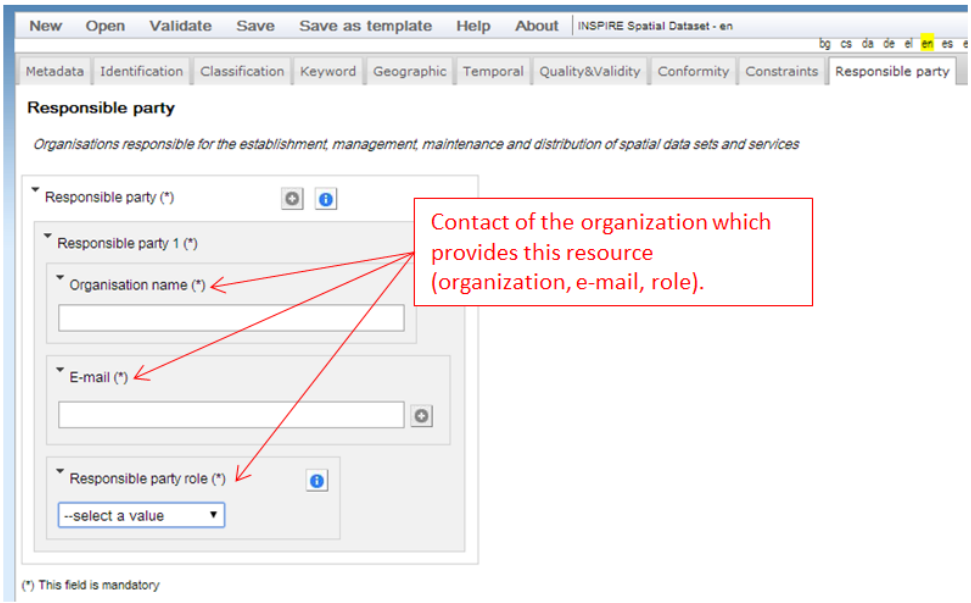


Figure 32. INSPIRE Metadata Editor – Tab Responsible party.

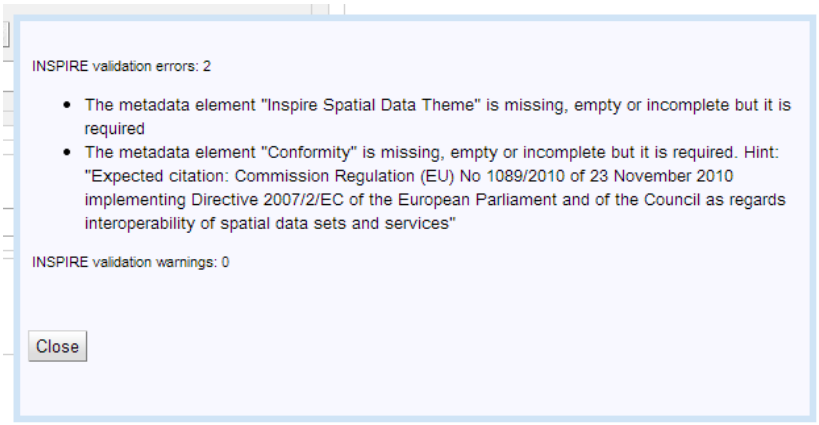


Figure 33. Drought Metadata Catalogue – expected errors after validation.