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D.5.3: Design and Development of a common meta-data model for interoperability in the field of drought

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These are Dublin Core metadata elements. See for more details and examples http://www.dublincore.org/

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ACRONYMS AND ABBREVIATIONS

Abbreviation	Name
EDO	European Drought Observatory
fAPAR	Fraction of Absorbed Photosynthetically Active Radiation
INSPIRE	Infrastructure for Spatial Information in the European Community
INSPIRE MIR	Infrastructure for Spatial Information in the European Community – Metadata Implementation Rules
ISO	International Organization for Standardization
NDWI	Normalized Difference Water Index
SPI	Standardized Precipitation Index
WMS	Web Map Service
WFS	Web Feature Service
WCS	Web Coverage Service
XML	Extensible Mark-up Language
XSD	XML Schema

GLOSSARY

Term	Definition
Drought indicator	A drought indicator provides quantitative information relating to the severity of drought conditions. A range of indicators are available that provide measures of drought at various stages of the water cycle from the meteorological rainfall input through to soil moisture availability, hydrological groundwater availability and vegetation related indices.
SPI	The Standardize precipitation index calculation is based on the distribution of precipitation over long time periods. The long term precipitation record is fit to a probability distribution, which is then normalized so that the mean (average) SPI for any place and time period is zero.
Precipitation percentiles	A percentile is the value of a variable below which a certain percent of observations falls.
Meteorological parameter	The indicator is based on precipitation data and their spatial interpolation based on geographical latitude, altitude, nearby stations and width of the grid cell.
NDWI	The Normalized Difference Water Index (NDWI) is a satellite-derived index from the Near Infrared (NIR) and Short Wave Infrared (SWIR) channels. It assesses the water content of vegetation.
fAPAR	The Fraction of Absorbed Photosynthetically Active Radiation (fAPAR) represents the fraction of the solar energy which is absorbed by the vegetation. fAPAR is a biophysical variable directly correlated with the primary productivity of the vegetation.
Daily Soil Moisture Anomaly	Daily soil moisture anomaly data provide an image of the current situation of the water content in the top soil layer compared to long-term daily average of soil moisture at each location. This comparison leads to a normalized soil moisture product that allows the evaluation of the current situation as compared to a climatological average.
Composite Drought Indicator	The product is a prototype of a composite drought indicator. It combines four drought indices: SPI, fAPAR anomaly, NDWI and soil moisture anomaly.
Piezometric levels in aquifers	The groundwater level is the height of the free surface of water on the sea level in unconfined aquifers. The observation of changes in groundwater level at some point

Term	Definition
	provides information on trends in storage.
Soil moisture	Soil moisture is the water that is held in the spaces between soil particles.
Rainfall	The indicator is the ratio of rainfall the previous month to the average inter-annual rainfall regarding the same month reference period.
Efficient rainfall	Effective precipitation is that fraction of total precipitation that is exploited by plants. It depends on many factors such as the intensity of rainfall or arid climate, as well as others such as land slope, moisture content or soil infiltration rate.
Hydrological status index	The index of drought monitoring is based on indicators of water resources state, which include volumes stored in reservoirs, piezometric levels in aquifers, circulating flows in rivers and rainfall data. Depending on the values of these variables, different levels of risk of drought conditions are set.

1 SCOPE

The purpose of this document is to describe the activities and documents generated for the task 5.3., in the framework of WP5 activities for EuroGEOSS project.

2 INTRODUCTION

The initial objective of the task 5.3 “Design and development of a common data model for interoperability” was to design, develop and implement a common data model for the drought thematic area, following INSPIRE specifications. Partners with existing monitoring systems would have to perform a cost-benefit analysis before adapting their systems or even designing them in a new way.

After analyzing the drought information systems and respective drought datasets existing at WP5 partners, it was realized and agreed that proposing a common data model would not be possible at the present time due to different stages of development among the partners, and lack of agreement on the scope and content of such a model. It was therefore decided in the first place to support the Initial Operating Capacity (IOC) of EuroGEOSS by publishing in the Summer of 2010 the drought indicators available either as images (WMS) or data accessible for use (WCS), and in the second place to document in greater detail the different indicators used by each partner (this report). These detailed descriptions follow a standardized template. Detailed descriptions of drought indicators are required for search, discovery, and analysis when a drought expert wants to make use of the drought indicators available through the drought component of EuroGEOSS. They are therefore essential for data access and use.

Once we had defined and agreed upon a structured and detailed description of our drought indicators, we wanted to make use of them - e.g. search for data following specific requirements in the metadata catalogue. Therefore, we had to find a way to integrate the additional descriptions into the catalogue.

The metadata elements currently provided in the metadata catalogue correspond to INSPIRE metadata elements. INSPIRE metadata are suitable for the discovery of resources, but extended descriptions and metadata elements considerably increase the usefulness of search capabilities of the metadata catalogue for a drought expert. In this document we present an analysis of ISO 19115 metadata elements as extension to INSPIRE metadata elements for integrating detailed descriptions of drought indicators into the metadata catalogue.

This document presents the steps performed for describing drought indicators with extended metadata elements and for integrating this additional information into the metadata catalogue. This document and the descriptions it contains are therefore essential steps in the process of defining whether a common data model is needed for drought applications in Europe, and how it can be defined.

3 ACTIVITIES

The activities developed during task 5.3 are described below (the documents generated are marked in blue color).

3.1 Template for structured description of drought indices

Generation of a form **(EuroGEOSS_Template_Drought_Indices.doc)** to be filled in by each partner with the relevant information to identify properly all characteristics of drought indicators important for their further use.

This template was developed in order to facilitate a description of drought indicators of WP5 partners, as well as to offer a guideline for potential future partners. It describes the fields that must be filled to allow a clear understanding of each indicator.

For the choice of fields that make up the form, common technical features were considered that may be necessary to define an indicator of drought (e.g. origin, type of information, data model, geographic information). The elements identified were discussed among all partners, and contributed to the definition of the final template.

This form requests information about the following items:

- Organization: The name of the organization responsible for the indicator (e.g.: JRC, SIA, CHE...)
- Indicator name: What is the drought indicator?
- Indicator description: Describe the drought indicator. If possible, please provide a hyperlink or reference to associated documentation on the indicator.
- Type of drought: Which is the type of drought that the indicator assesses? (Example: Meteorological, Hydrological, Agricultural...)
- Availability of information: Is the information available to the public? If yes, provide the references/Hyperlinks
  Is the information published through a standard? (WMS, WFS, XML, Web System…)
  If yes, provide the standard
- Frequency of updating information: What is the frequency of updating information? (e.g., daily, monthly, annually...)
  If the frequency of updating is different from the frequency of publication, indicate both frequencies.
- Data Range Available: Indicate the range of data from which information is available

- General Structure:
    - Geographic information:
        - Vector/raster
        - Spatial data (layers)
        - Coordinate reference system (ETRS89, ED50...)
        - Reference map scale at which the indicator was calculated. (1:25000, 1:5000…) Provide brief explanation if necessary
        - Information volume: [ ] MB/GB
    - Alphanumeric information:
        - Choose one: Database / Other systems (Provide the Database Management System DBMS or other system used) e.g.: Oracle, SQLServer, MySQL...)
        - Information volume: [ ] MB/GB
- Data structure
    - Vector
        - Indicate the meaning of the value (or values) associated with each management unit.
    - Raster
        - Indicate the meaning of the value (or values) associated with each point or cell.
    - Database
        - Brief description about main tables, attributes and relations.
- Information on the components of the drought indicator
    - Data model (Provide brief explanation of the data model. If possible, please provide a hyperlink or reference to associated documentation, e.g. UML diagrams):
    - Components (e.g. Precipitation, Soil moisture, Flow, Reservoir Volume Piezometric level…)
        - For each component that is used to elaborate the indicators, please give the following information:
            - Produced by (organization)
            - Format

- Periodicity (early, monthly, daily...)
- Availability (if it is available to general public, how it is done (personal requirement? Download on web? Web service as WMS, WFS....?)
- Please indicate how the component was assessed: Monitored, Calculated, Estimated
- Indicate the range of data from which information is available
- Weighting coefficient or relevance of the component (about the calculation of the drought indicator) In paragraph “Indicator description” this will be explained in more detail

▪ Tools

- How is the indicator created? By the application of a software? Which? Manually? Automatically through a spatial model or GIS analysis? ...

- Representation: any suggested colors? Any defined classes? What is the correspondent qualitative classification?
- Other comments

3.2 Compilation of information for each drought indicator

We have compiled the information of each partner´s data model in a unique document called **Eurogeoss_datamodel_01102010.doc**

The following table summarizes the information received:

ORGANIZATION	INDICATOR
FGUA-OSE/SIA-MARM	Hydrological state indicator
CHE	Hydrological status index which is derived from several indicators (water flow, water storage, snow package, piezometric levels)
	Partial Indicators (water flow, water storage, snow package, piezometric levels)
National agency for Environment (of Republic of Slovenia)	Meteorological parameter
DMCSEE (Drought Management Center for South Eastern Europe)	SPI
	Precipitation percentiles
JRC	NDWI

ORGANIZATION	INDICATOR
	SPI
	fAPAR
	Daily Soil Moisture Anomaly
	Composite Drought Indicator
BRGM	Piezometric levels in aquifers
	Soil moisture
	Rainfall
	Efficient rainfall

Table 1: Information about indicators and organizations

There are other indicators from the different partners of WP5 that supports analysis related to drought, but which are not specifically drought indicators, such as sustainability, climatic, socioeconomic, etc. These indicators are not compiled on this report, even though they are available on EDO Viewer and can be an important support for drought analysis.

3.3 Identification of common elements and divergences between the drought indicators

We have compared all the models and we have identified the common elements and the divergences, compiled in the file "**CommonDenominators_Divergences.xls".**

There are some common denominators between the different indicators:

- The access is public for most indicators.
- Same standard for WMS in majority of cases.
- The predominant temporal resolution is monthly.
- Usually similar legends are used (but not divided into the same categories).
- Precipitation is the predominant single input parameter for drought indicators.

But the conclusion is that each of the countries is working with different data models and systems:

- Focus on different types of drought.
- Reference and/or observation period is not homogeneous.
- Geographic information is mostly in raster rather than in vector format.
- Different coordinate reference systems.
- Different tools for creating indicators.
- Different internal data holding and databases.
- Different spatial scales and resolutions.

Common elements are summarized in the table below:

			OSE-SIA MARM	CHE		DMCSEE		National Agency for Environment of Republic of Slovenia	JRC					BRGM			
			Hydrological state indicator	Hydrological status index which is derived from several indicators	Partial Indicators (water flow, water storage, snow package, piezometric levels)	SPI	Precipitation percentiles	Meteorological parameter	NDWI	SPI	fAPAR – fraction of absorbed photosynthetically active radiation	Daily Soil Moisture Anomaly	Composite Drought Indicator	Piezometric levels in aquifers	Soil moisture	Rainfall	Efficient rainfall
Common denominators	The access is public in most indicators.	Public access	Yes	Yes	These indicators are described in paragraph 2.9. of document about Hydrological status index	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes, but owner is MeteoFrance	Yes, but owner is MeteoFrance	Yes, but owner is MeteoFrance
	Same standard in some cases	Standard	WMS	No		WMS	No	WMS	WMS	WMS	WMS	WMS	No	WMS	WMS to be confirmed	WMS to be confirmed	WMS to be confirmed
	The mainly frequency is monthly	Frequency of updating information	Monthly	Monthly		Monthly, 3-months, 6-months and annual	Monthly	Unknown, no frequency is predicted. It is not updated in time.	Ten-daily	Per month, for three, six, nine and twelve months.	10-day periods	Daily	It´s produced every ten days	Monthly	Monthly	Monthly	Monthly
	Usually similar legends (but not divided in the same categories)	Representation	4 classes. Similar legend.	4 classes. Similar legend.		3 classes. Similar legend.	5 classes.	11 classes	3 classes. Similar legend.	3 classes. Similar legend.	2 classes (dry: yellow)	3 classes. Similar legend.	5 classes. Similar legend.	5 classes. Similar legend	20 classes. Similar legend	11 classes. Similar legend	11 classes. Similar legend
	Indicators have common components to one another	Common components	Precipitation Piezometric levels Reservoir volume	Precipitation Piezometric levels Water storage		Precipitation	Precipitation	Precipitation	Vegetation	Precipitation	Vegetation	Soil moisture Meteorological data	Soil moisture Meteorological data Vegetation	Piezometric levels	Soil moisture	Precipitation	Precipitation

Divergences are summarized in the table below:

			OSE-SIA MARM	CHE		DMCSEE		National Agency for Environment of Republic of Slovenia	JRC					BRGM			
			Hydrological state indicator	Hydrological status index which is derived from several indicators	Partial Indicators (water flow, water storage, snow package, piezometric levels)	SPI	Precipitation percentiles	Meteorological parameter	NDWI	SPI	fAPAR – fraction of absorbed photosynthetically active radiation	Daily Soil Moisture Anomaly	Composite Drought Indicator	Piezometric levels in aquifers	Soil moisture	Rainfall	Efficient rainfall
Divergences	Different types of drought	Type of drought	Hydrological	Hydrological	These indicators are described in paragraph 2.9. of document about Hydrological status index	Meteorological	Meteorological	Meteorological	Leaf-water content of vegetation	Meteorological	Indicator referring to vegetation	Anomaly of soil moisture in the top soil layer.	Drought risk, which is determined based on four different indicators (SPI, fAPAR anomaly, NDWI and soil moisture anomaly).	Hydrological	Agronomy	Meteorological	Meteorological
	Data range isn´t homogeneous (The indicator "Meteorological parameter" isn't updated)	Data range available	February 2006-May 2010	1980-2010 (everyone but snow package: 2004-2010)		January 1986-May 2009	January 1986-May 2010	January 1961-December 1990	2008-01-01 ten-daily (for 2006 and 2007 April to October)-Production ongoing	1990-01-01 Production ongoing	from 1997-09-01 every 10 days Production ongoing	2005-01-01 daily Production ongoing	from 2006-01-01 ten-daily Production ongoing	September 1998-August 2010	September 1998-August 2010	September 1998-August 2010	September 1998-August 2010
	Geographic information is raster or vector	Geographic information	Vector	Vector		Raster	Raster	Vector	Raster	Raster (although not specified on the document)	Raster	Raster	Raster	Raster	Raster	Raster	Raster

			OSE-SIA MARM	CHE		DMCSEE		National Agency for Environment of Republic of Slovenia	JRC					BRGM			
			Hydrological state indicator	Hydrological status index which is derived from several indicators	Partial Indicators (water flow, water storage, snow package, piezometric levels)	SPI	Precipitation percentiles	Meteorological parameter	NDWI	SPI	fAPAR – fraction of absorbed photosynthetically active radiation	Daily Soil Moisture Anomaly	Composite Drought Indicator	Piezometric levels in aquifers	Soil moisture	Rainfall	Efficient rainfall
	Different coordinate reference systems	Coordinate reference system	ED_1950_UTM_Zone_30N	ED_1950_UTM_Zone_30N		EUR50 (Lambert Conformal Conic Projection)	EUR50 (Lambert Conformal Conic Projection)	Transverse Mercator	EPSG:3035 (LAEA)	EPSG:4326 (WGS84)	EPSG:4326 (WGS84)	GISCO reference system	EPSG:3035 (LAEA)	WGS 84 or Lambert 2	To be checked	To be checked	To be checked
	Different tools for creating indicators	How is the indicator created?	Manually	Manually		Automatically through a spatial model or GIS analysis with GRASS operating system	Automatically through a spatial model or GIS analysis with GRASS operating system	Manually	Software application	Software application	Software application	Software application	Software application	Automatically through a spatial model or GIS analysis	Automatically through a spatial model or GIS analysis	Automatically through a spatial model or GIS analysis	Automatically through a spatial model or GIS analysis
	Different alphanumeric systems	Alphanumeric system	Oracle version 10	Spread sheet data sets		Apache, GRASS.	Apache, GRASS.	Oracle version 10	Not reported (an ongoing process to migrate the data into a database)	OracleSpatial	Not reported (an ongoing process to migrate the data into a database)	Not reported (an ongoing process to migrate the data into a database)	Not reported (an ongoing process to migrate the data into a database)	Oracle, PostGRE	To be checked	To be checked	To be checked

			OSE-SIA MARM	CHE		DMCSEE		National Agency for Environment of Republic of Slovenia	JRC					BRGM			
			Hydrological state indicator	Hydrological status index which is derived from several indicators	Partial Indicators (water flow, water storage, snow package, piezometric levels)	SPI	Precipitation percentiles	Meteorological parameter	NDWI	SPI	fAPAR – fraction of absorbed photosynthetically active radiation	Daily Soil Moisture Anomaly	Composite Drought Indicator	Piezometric levels in aquifers	Soil moisture	Rainfall	Efficient rainfall
	Different scales but there are operating systems at: -OSE-SIA MARM indicator -CHE indicator -Precipitation percentiles (DMCSEE) - Meteorological parameter (Slovenia)	Map scale	1:25000	Which one?		Calculation: WGS 84 coordinate system, resolution approx.30 sec. Images displayed on the Internet are transformed in Lambert Conform Projection of EUR50 date	Calculation: WGS 84 coordinate system, resolution approx.30 sec. Images displayed on the Internet are transformed in Lambert Conform Projection of EUR50 date	100 x 100 m grid cells (Slovenia)	Spatial resolution 1000m The indicator is calculated for all of Europe.	Spatial resolution 5000m The indicator is calculated for all of Europe.	Spatial resolution 1200m The indicator is calculated for all of Europe.	Spatial resolution 5000m The indicator is calculated for all of Europe.	Spatial resolution 5000m The indicator is calculated for all of Europe.	National	Grid cells (size to be checked with MeteoFrance)	Grid cells (size to be checked with MeteoFrance)	Grid cells (size to be checked with MeteoFrance)
	No reported information	Description about main tables, attributes and relations of data base	Yes	Not reported		Not reported	Not reported	Yes (only about process). A table of attribute sis reported.	Not reported (an ongoing process to migrate the data into a database)	Yes	Not reported (an ongoing process to migrate the data into a database)	Not reported (an ongoing process to migrate the data into a database)	Not reported (an ongoing process to migrate the data into a database)	Yes	Yes	Yes	Yes
		Data Model	Yes	Not reported		Yes (only about process).	Yes (only about process).	Not reported.	Yes (only about process)	Yes	Yes	Yes	Yes	Yes	To be checked	To be checked	To be checked

3.4 Development of XSD templates

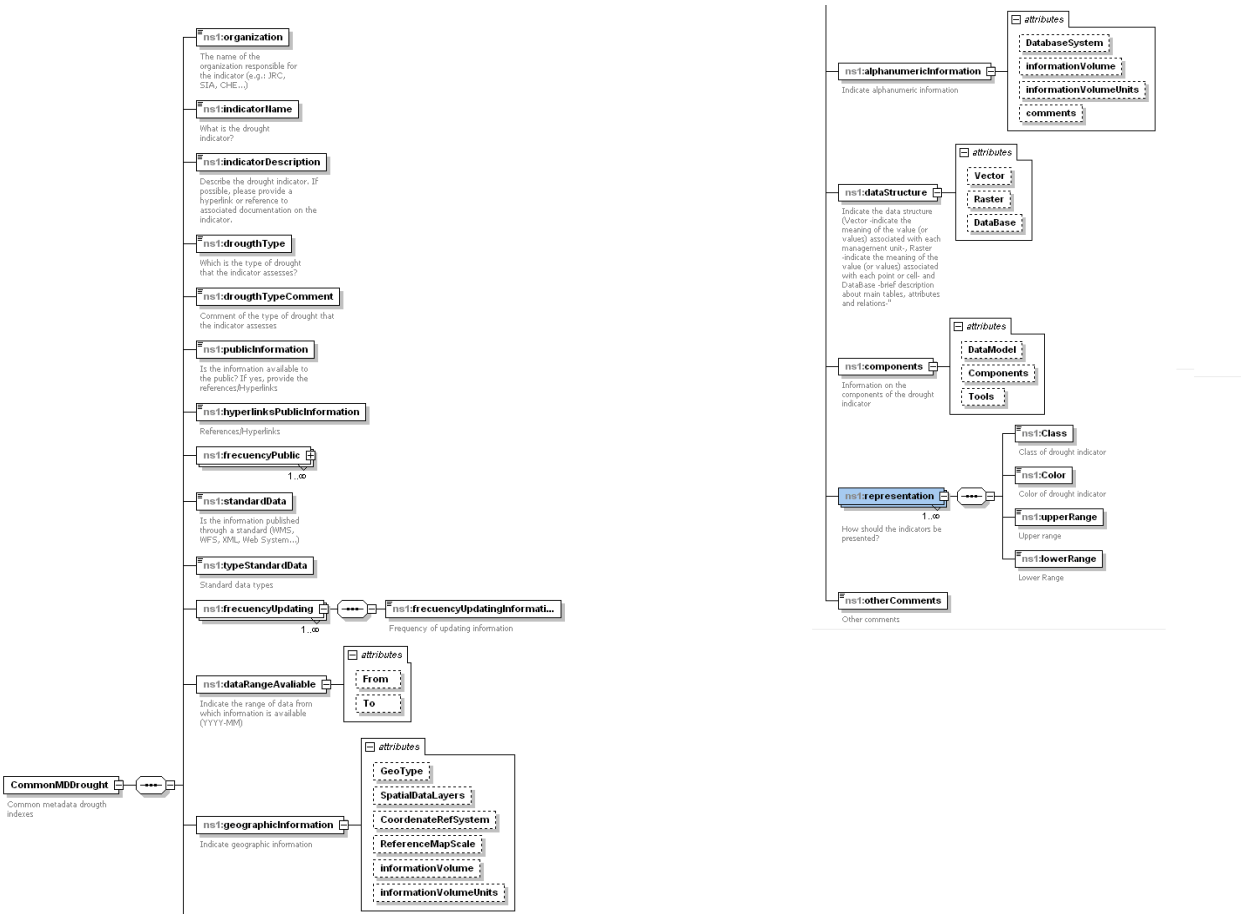
As mentioned above, the first step was the development of a common questionnaire which reflects relevant information about each indicator. After the compilation exercise, and also after checking the heterogeneity of data, it was decided to standardize the results of the questionnaire through a series of XSD templates.

A XSD schema is a vocabulary to express the rules of the data that we use and that serves as a reference to validate the data that appear in the associated XML. This file specifies both the structure of the XML document instance (the element is composed of elements and these in turn by other elements, etc.) and the data type of the element or attribute (e.g. an integer between 0 and 4).

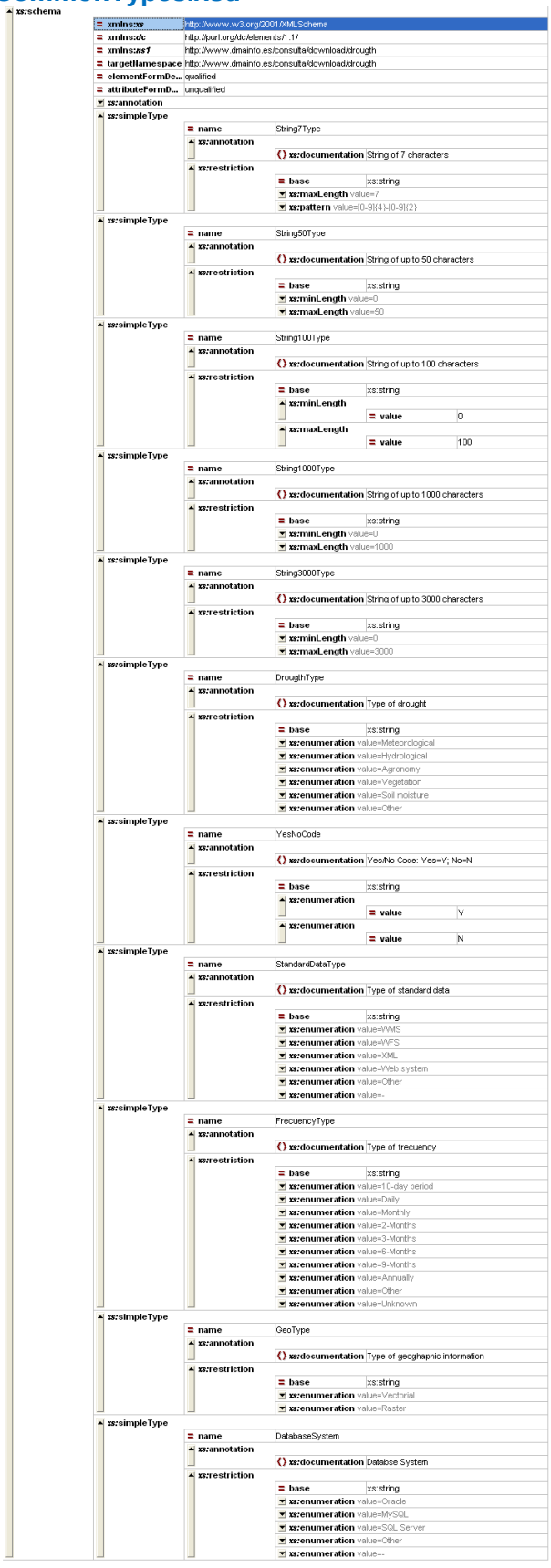
Once developed these templates, the series of questionnaires collected (MS Word) is transformed to a set of XML files with XSD common rules in which you can find information in a standardized way.

In this case, we have developed two templates XSD. The first, *CommonMDDrought.xsd*, contains information about the fields and the structure of the XML standard to be generated. The second template, *CommonTypes.xsd*, is associated with the first, and contains the types of each data that is stored in XML.

It then displays the contents of these templates XSD (**CommonMDDrought.xsd**):



CommonTypes.xsd



3.5 Generation of XML files

The generation of XML files with the information of the forms, and properly formatted (including the graphical representation of classes of each drought indicator), is an essential step towards the standardization of each of the indicators metadata. In this way, you can search and find common elements of each indicator. The technical tool used to generate it was *Altova XML Spy*. The XML files created for all drought indicators are:

Metadata_Drought_SPI_JRC.xml
Metadata_Drought_CompositeDroughtIndicator _JRC.xml
Metadata_Drought_DailySoilMoistureAnomaly_JRC.xml
Metadata_Drought_FAPAR_JRC.xml
Metadata_Drought_NDWI_JRC.xml
Metadata_Drought_Hidro_State_SIA-MARM.xml
Metadata_Drought_Hydrological_Status_Index _CHE.xml
Metadata_Drought_MeteorParam_Slovenia.xml
Metadata_Drought_PrecipcPercent_DMCSEE.xml
Metadata_Drought_SPI_DMCSEE.xml
Metadata_Drought_Rainfall_BRGM.xml
Metadata_Drought_RainfallEfficient_BRGM.xml
Metadata_Drought_SoilMoisture_BRGM.xml
Metadata_Drought_PiezometricLevels_BRGM.xml

As an example shows the schema of the indicator SPI (JRC):

ns1:organization	EC-JRC
ns1:indicatorNa...	SPI – Standardized Precipitation Index
ns1:indicatorDe...	SPI-3 Grid 5km: the three monthly Standardized Precipitation Index (SPI-3) for Europe of the last month in the original 5 km resolution. In addition to the SPI for three months, the SPI for one month, six months, nine months and 12 months can be provided. The SPI is provided for all of Europe. http://edo.jrc.ec.europa.eu/php/index.php?action=view&id=18
ns1:drougthType	Meteorological
ns1:drougthTyp...	A meteorological index based on precipitation data.
ns1:publicInfor...	Y
ns1:hyperlinksP...	A map server based on the WMS standard is publicly available: http://edo.jrc.ec.europa.eu/php/index.php?action=view&id=201
ns1:frecuencyPublic (5)	

	ns1:frecuencyPublicInformation
1	Monthly
2	3-Months
3	6-Months
4	9-Months
5	Annually

ns1:standardData	Y
ns1:typeStandar...	WMS
ns1:frecuencyUpdating (5)	

	ns1:frecuencyUpdatingInformation
1	Monthly
2	3-Months
3	6-Months
4	9-Months
5	Annually

ns1:dataRangeAvaliable		
	From	1990-01
	To	2010-10
ns1:geographicInformation		
	CoordenateRefSystem	EPSG:4326 (WGS84)
	GeoType	Raster
	SpatialDataLayers	-
	informationVolume	40
	informationVolumeUnits	Megabytes
	ReferenceMapScale	Spatial resolution 5000m
ns1:alphanumericInformation		
	DatabaseSystem	Oracle
	informationVolume	0
	informationVolumeUnits	Kilobytes
	comments	-
ns1:dataStructure		
	Vector	-
	Raster	-
	DataBase	The SPI is calculated on the fly by processing two tables of the OracleSpatial database: precipitation data and grid data.
ns1:components		
	DataModel	Meteorological input information at a daily time step is derived from point measurements of around 1800 meteorological stations throughout Europe, and communicated via the Global Telecommunication System (GTS) of WMO. http://www.dmainfo.es/consulta/download/drougth/JRC/SPI_DataModel.JPG
	Components	Component 1: Precipitation data Data produced by the World Meteorological Organisation Format: - Periodicity: daily Availability: communicated via the Global Telecommunications System Assessment: - Time period of availability: - Weighting: - Component 2: Grid Spatial grid used for the intersection of the data collected at weather stations with space (Europe). Data produced by IES-JRC Format: - Periodicity: not periodic Availability: not available to public Assessment: - Time period of availability: - Weighting: -
	Tools	Software application: regular production schema implemented.
ns1:representation (7)		

	ns1:Class	ns1:Color	ns1:upperRange	ns1:lowerRange
1	Extremely wet	39640B	3	2
2	Very wet	64AD12	2	1.50
3	Moderately wet	9EEC48	1.50	1
4	Near normal	F7C93E	1	-1
5	Moderately dry	F88C3D	-1	-1.50
6	Severe dry	FF0000	-1.50	-2
7	Extremely dry	DF0000	-2	-3

ns1:otherComm...	-

3.6 Integration of the information received of drought indicators in the ISO19115 metadata profile

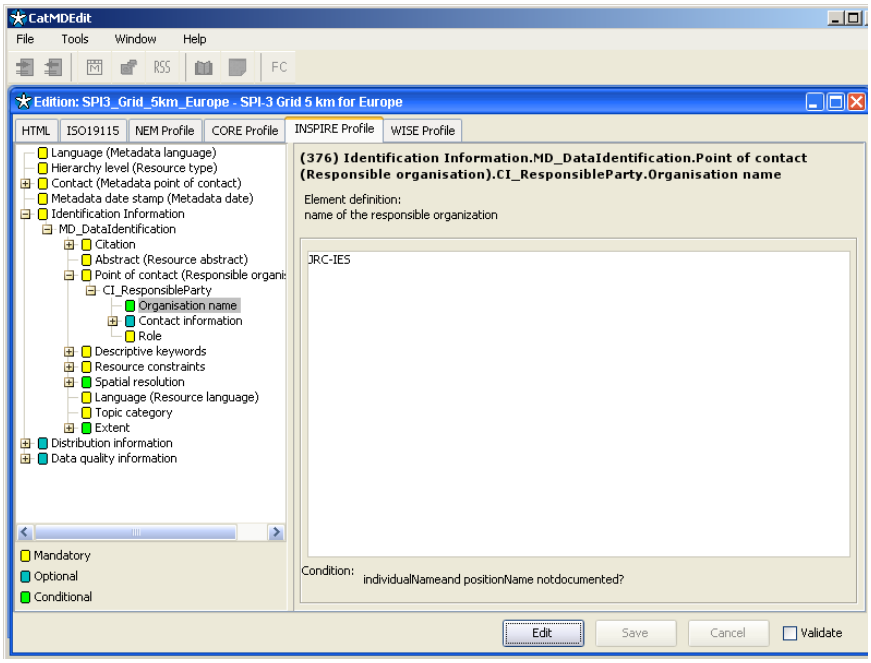
To standardize metadata of drought indicators of the various partners, we have chosen ISO metadata profile in which to include the information that characterizes each indicator (ISO 19115 metadata profile and INSPIRE metadata implementation rules (MIR)). Thus, it may be incorporated into the ISO 19115 metadata profile indicators defined by other countries and agencies in Europe. The purpose of this activity is to allow searching on the metadata in the metadata catalogue for each drought indicator.

The information on the matching of metadata profiles is available in the following document: "**EuroGEOSS_Template_Drought_Indices_with_ISO19115_Mappings.doc**".

Then, the mappings with ISO 19115 and the INSPIRE Metadata Implementing Rules (for each field of the form "**EuroGEOSS_Template_Drought_Indices.doc"**) are listed:

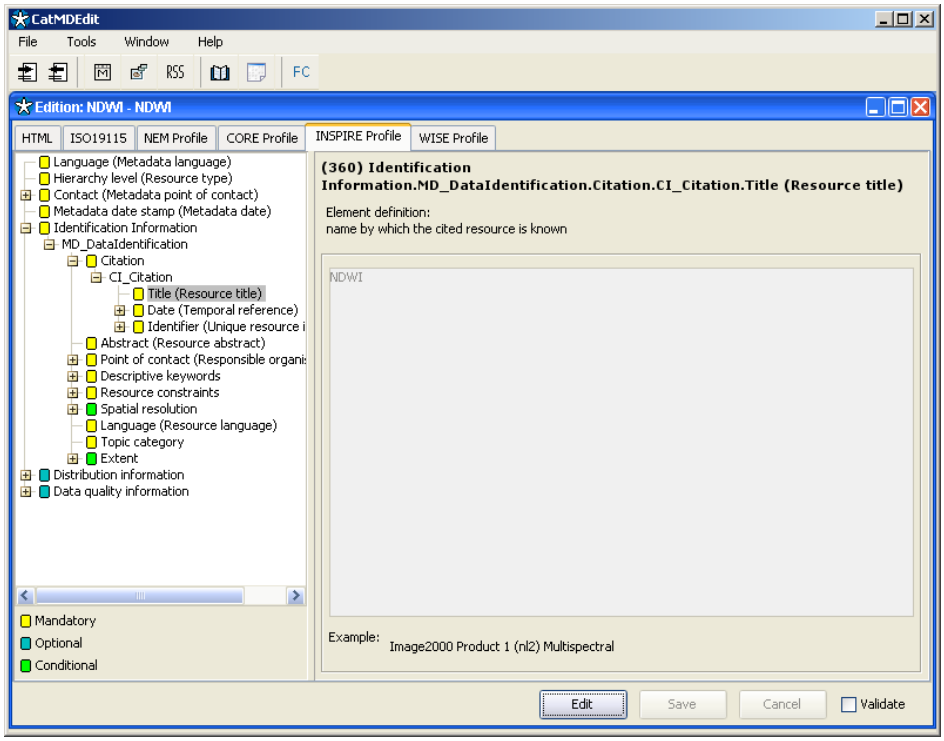
- Organization:

  Element in ISO 19115: Identification Information.MD_DataIdentification.Point of contact.CI_ResponsibleParty.Organisation name
  Corresponding element in INSPIRE MIR: Responsible organization

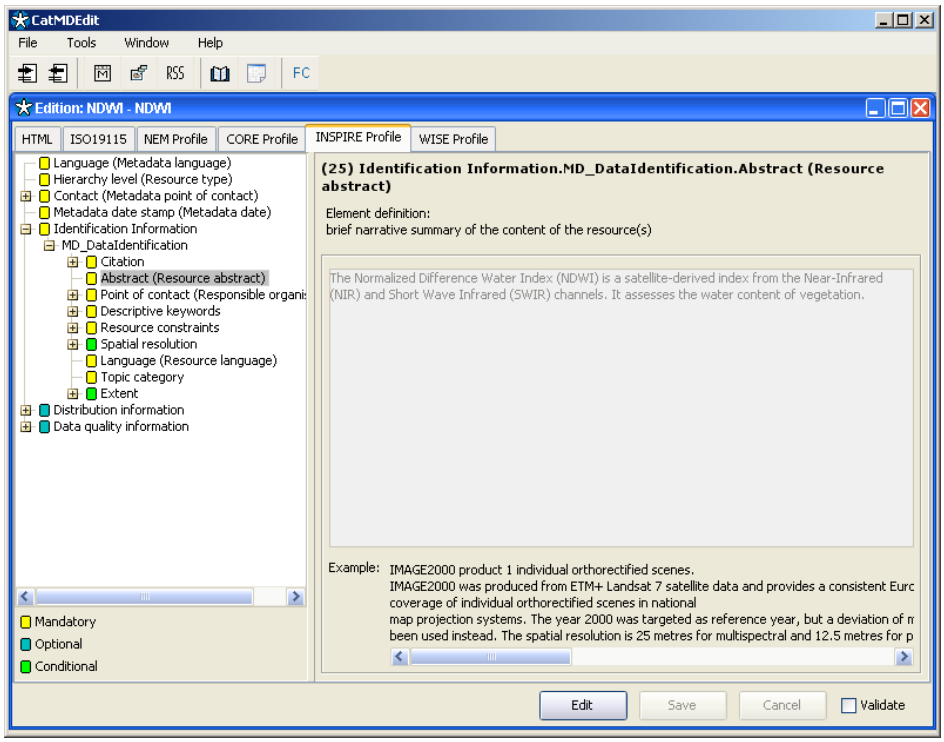


- Indicator name:

  Element in ISO 19115:
  Identification Information.MD_DataIdentification.Citation.CI_Citation.Title
  Corresponding element in INSPIRE MIR: Resource title



- Indicator description: Describe the drought indicator. If possible, please provide a hyperlink or reference to associated documentation on the indicator.
  Element in ISO 19115: Identification Information.MD_DataIdentification.Abstract
  Corresponding element in INSPIRE MIR: Resource abstract

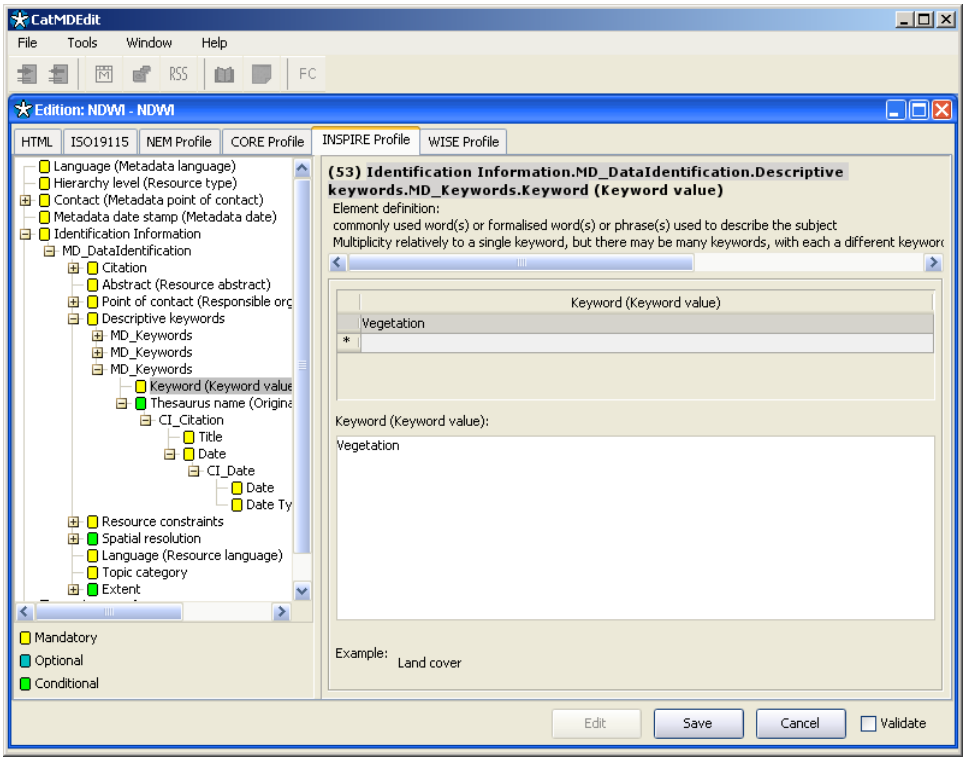


- Type of drought:

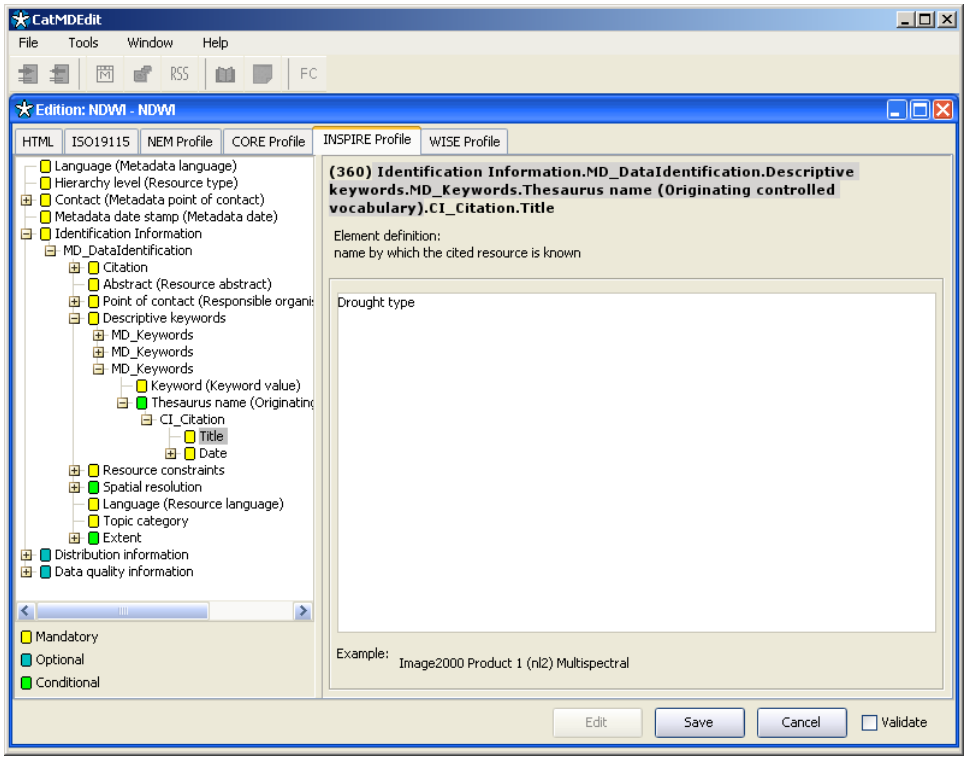
  The drought type should be described as ISO 19115 metadata by means of a keyword belonging to a specialized thesaurus focused on drought types.

  Note: It is desirable to match these drought types with the specialized vocabulary focused on droughts, which has been proposed by WP5 partners.

  Element in ISO 19115: Identification Information.MD_DataIdentification.Descriptive keywords.MD_Keywords.Keyword
  Corresponding element in INSPIRE MIR: Keyword value

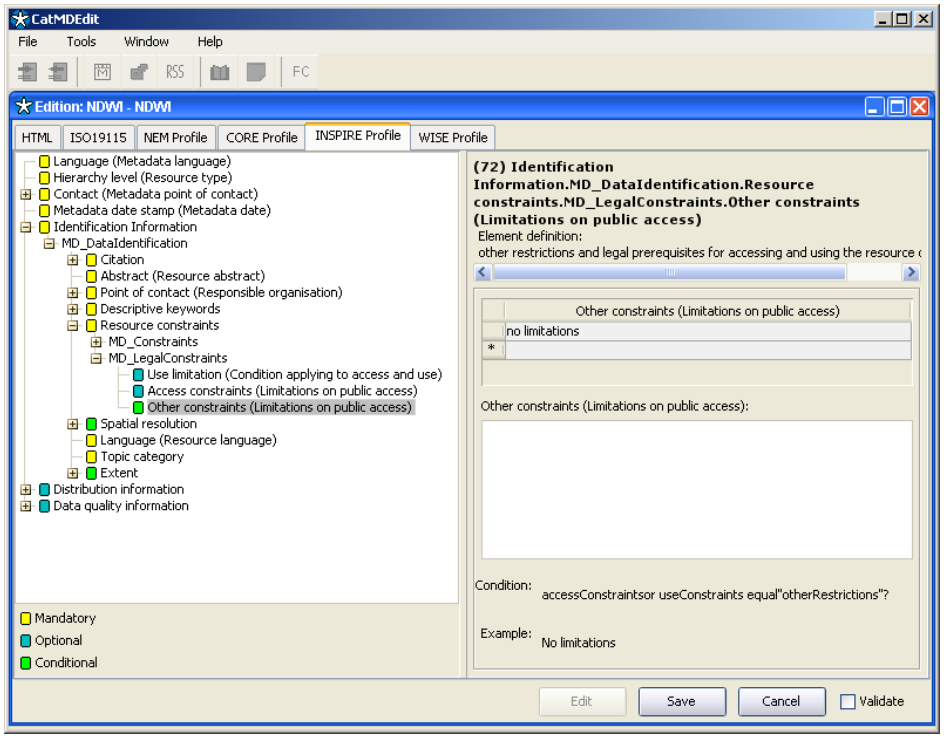


Element in ISO 19115: Identification Information.MD_DataIdentification.Descriptive keywords.MD_Keywords.Thesaurus name
Corresponding element in INSPIRE MIR: Originating controlled vocabulary

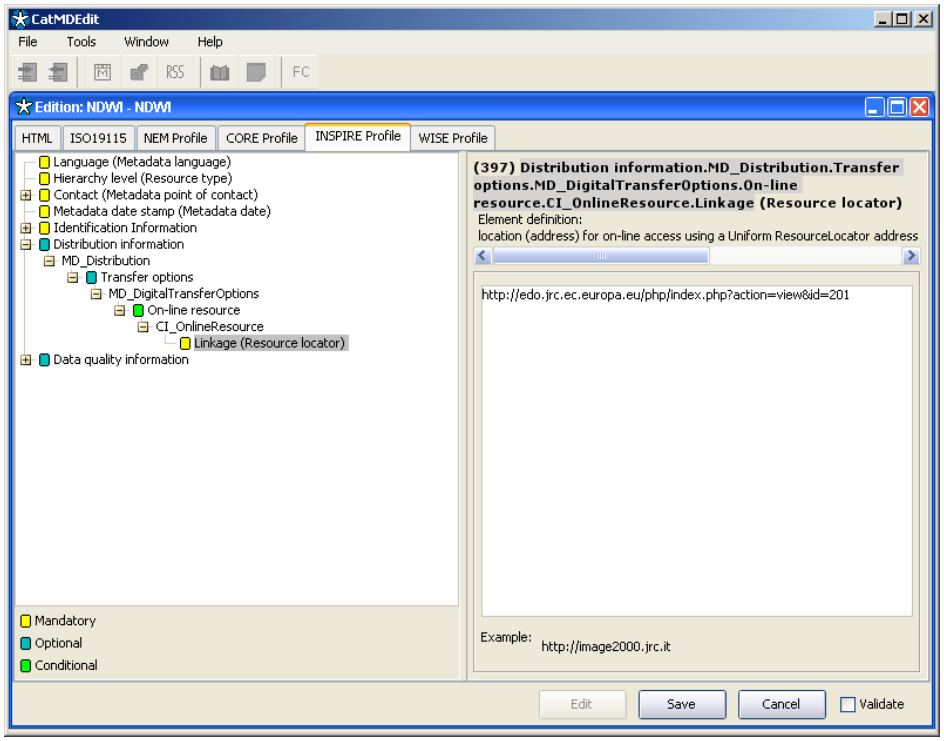


- Availability of information:

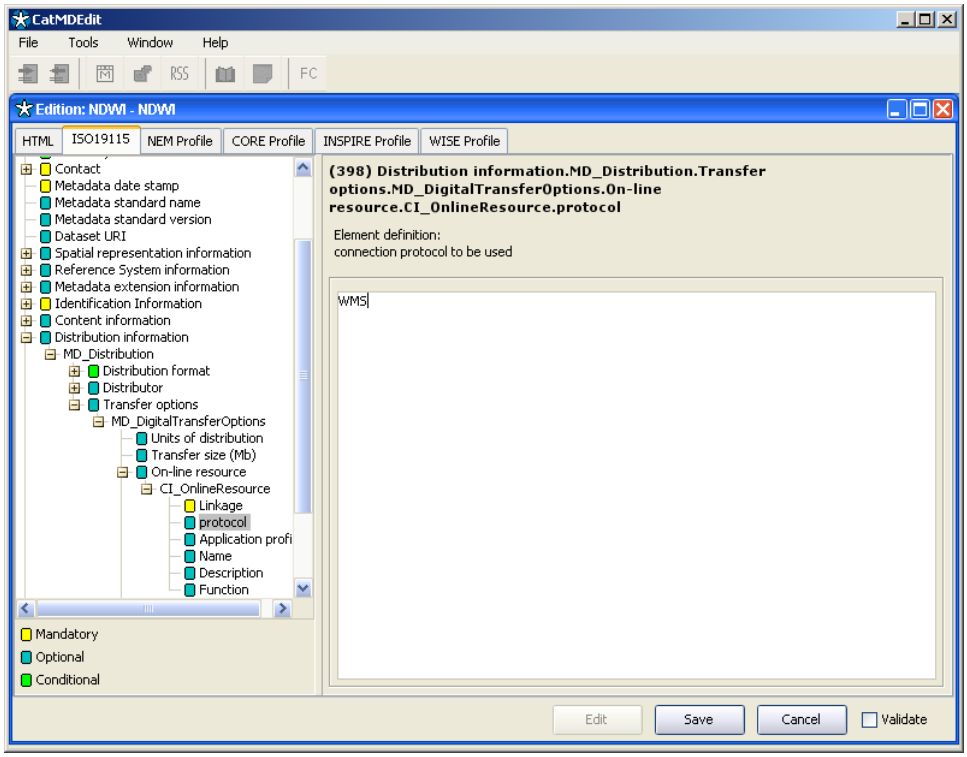
Is the information available to the public?
Element in ISO 19115: Identification Information.MD_DataIdentification.Resource constraints.MD_LegalConstraints.Other constraints
Corresponding element in INSPIRE MIR: Limitations on public access



If yes, provide the references/Hyperlinks
Element in ISO 19115: Distribution information.MD_Distribution.Transfer options.MD_DigitalTransferOptions.On-line resource.CI_OnlineResource.Linkage
Corresponding element in INSPIRE MIR: Resource locator



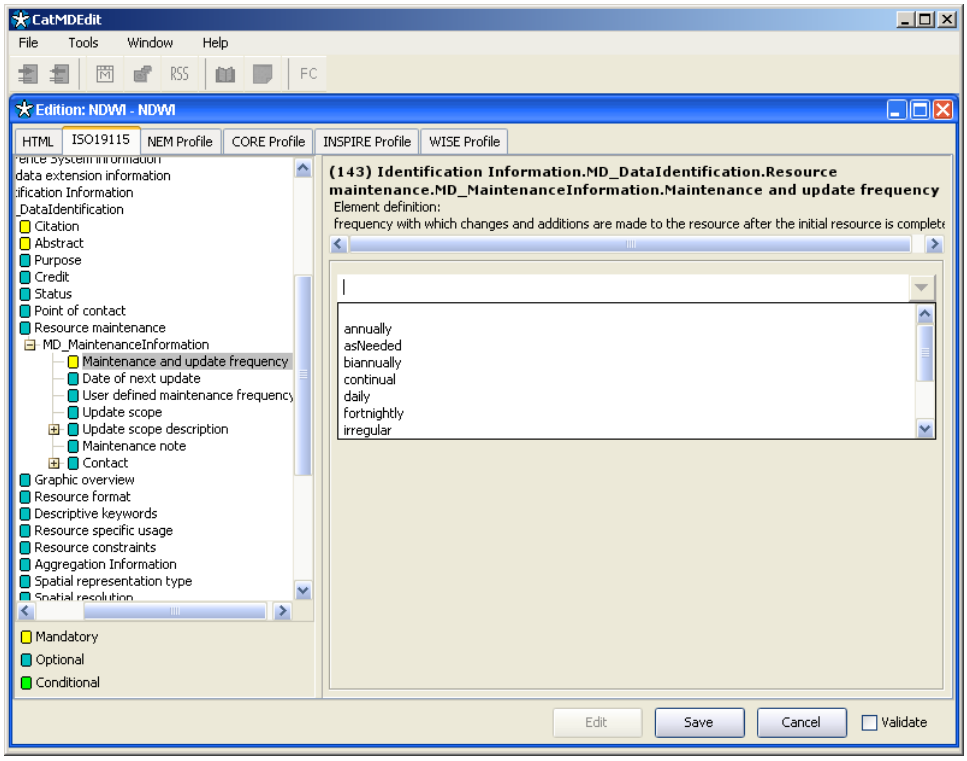
Is the information published through a standard? (WMS, WFS, XML, Web System…)
Element in ISO 19115: Distribution information.MD_Distribution.Transfer options.MD_DigitalTransferOptions.On-line resource.CI_OnlineResource.protocol
Corresponding element in INSPIRE MIR: Not available



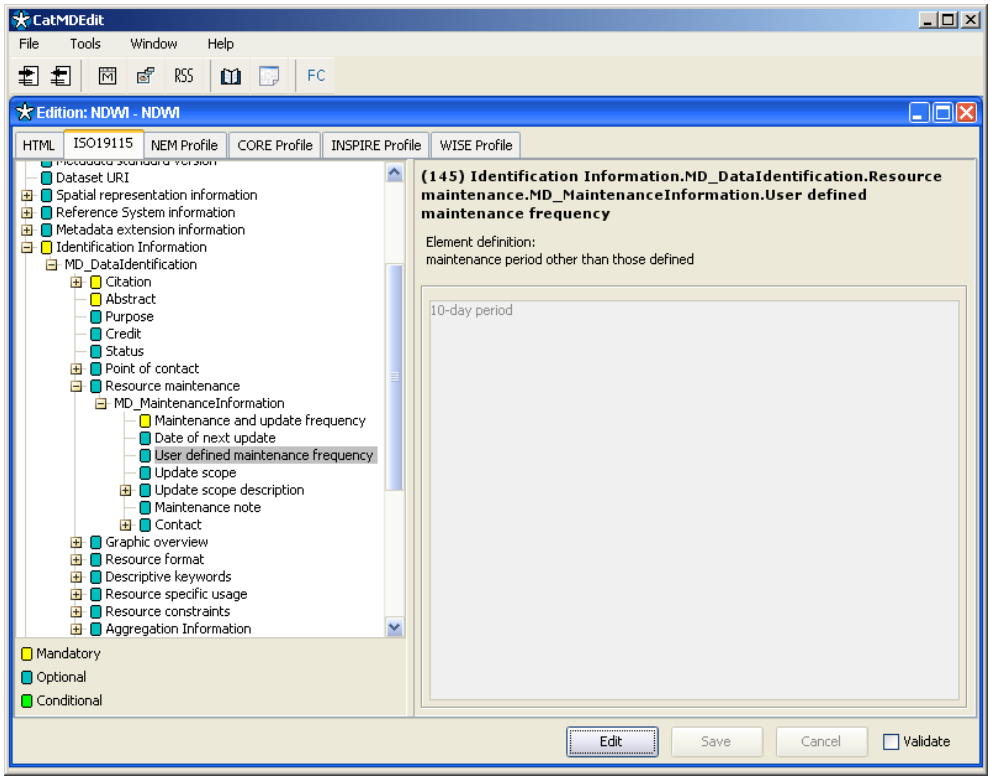
- Frequency of updating information:

Element in ISO 19115: Identification Information.MD_DataIdentification.Resource maintenance
Corresponding element in INSPIRE MIR: Not available
*If the frequency fits the proposed values, use *Identification Information.MD_DataIdentification.Resource maintenance.MD_MaintenanceInformation.Maintenance and update frequency*

  - Annually
  - As needed
  - Biannually
  - Continual
  - Daily
  - Fortnightly
  - Irregular
  - Monthly
  - Not planned
  - Quarterly
  - Unknown
  - Weekly

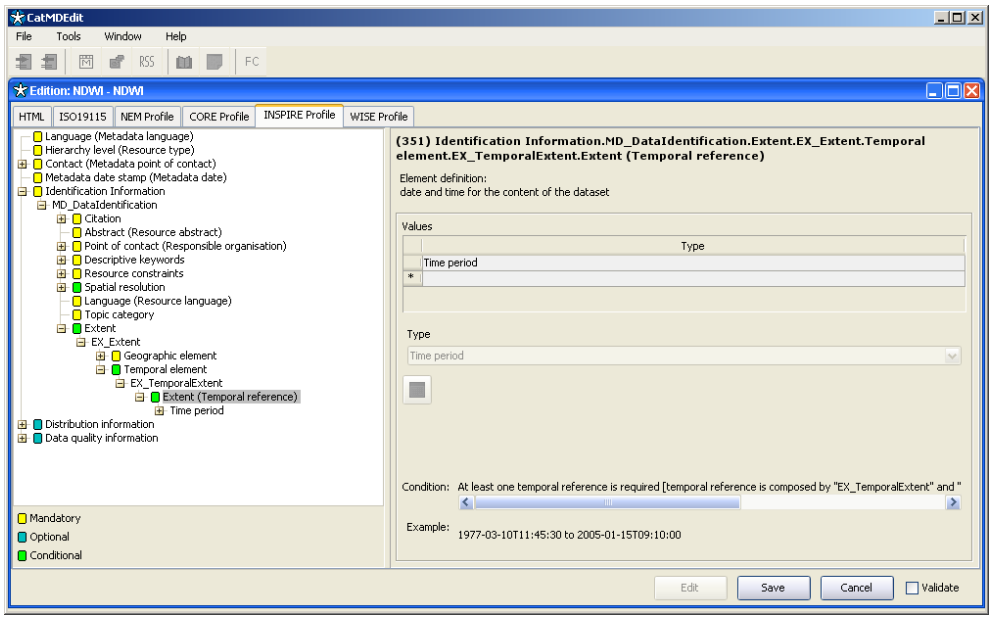


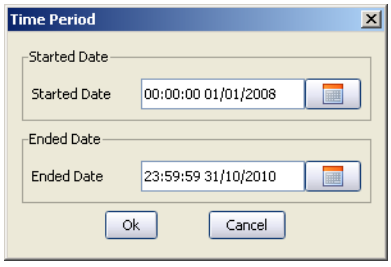
*If the frequency does not fit the proposed values, use *Identification Information.MD_DataIdentification.Resource maintenance.MD_MaintenanceInformation.User defined maintenance frequency*)



- Data Range Available:

Element in ISO 19115:
Identification Information.MD_DataIdentification.Extent.EX_Extent.Temporal element.EX_TemporalExtent.Extent
Corresponding element in INSPIRE MIR: Temporal reference



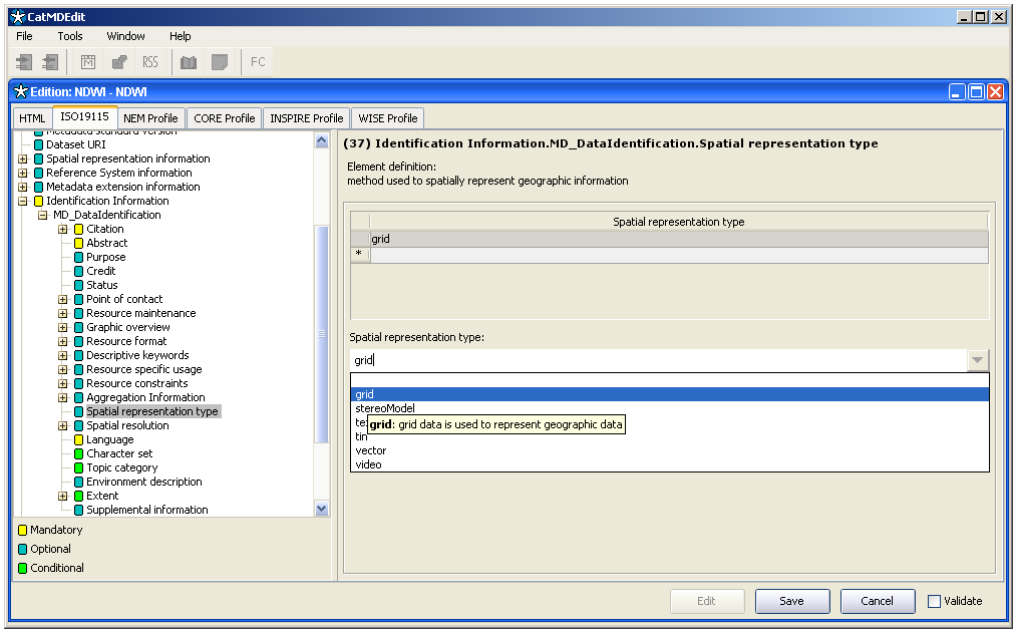


- General Structure:
  - Geographic information:
    - Vector/raster

      Element in ISO 19115: Identification Information.MD_DataIdentification.Spatial representation type

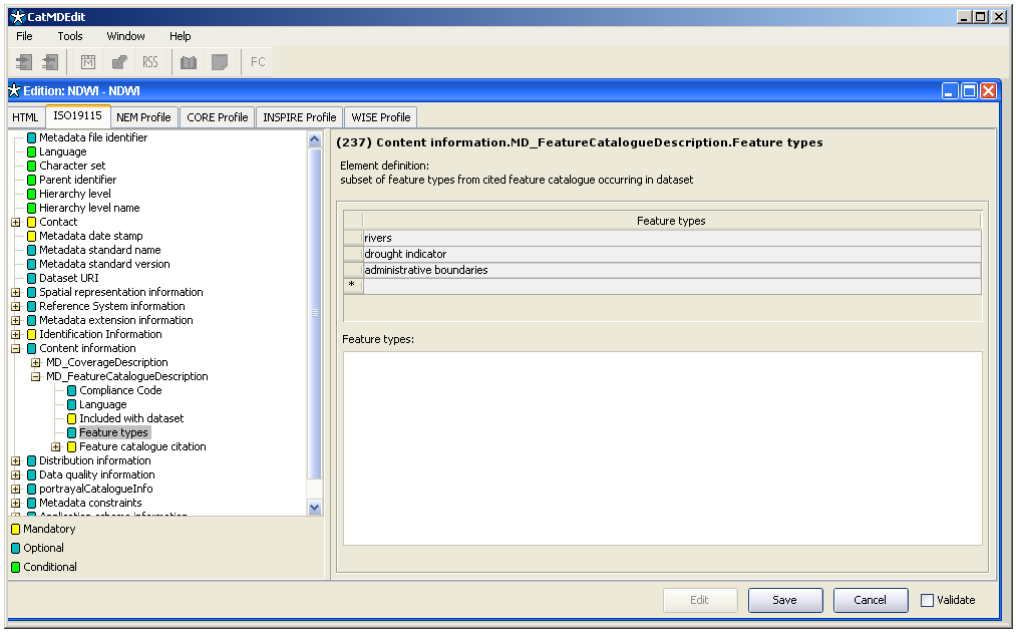
      - Vector
      - Grid

      Corresponding element in INSPIRE MIR: Not available

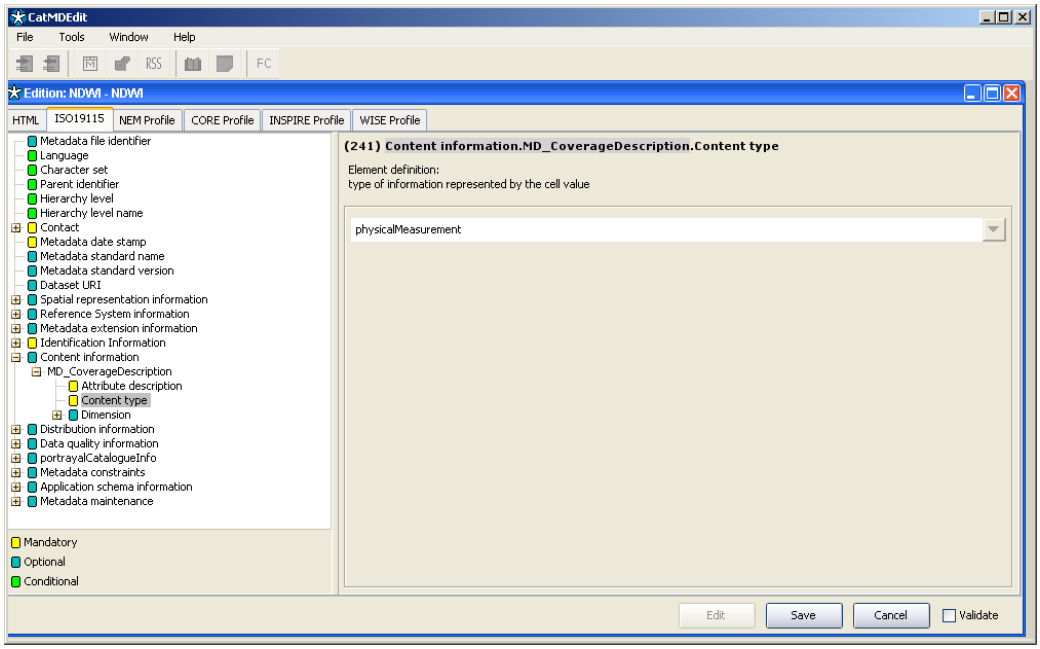


- Spatial data (layers)

Element in ISO 19115: Content information
Corresponding element in INSPIRE MIR: Not available
*In case of vector data, use *Content information.MD_FeatureCatalogueDescription.Feature types*

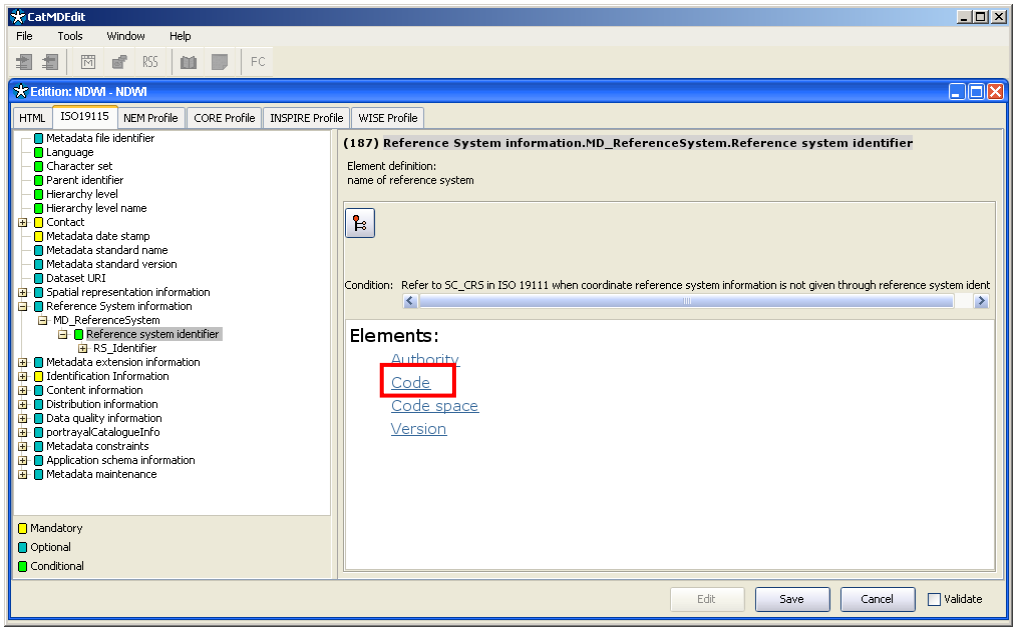


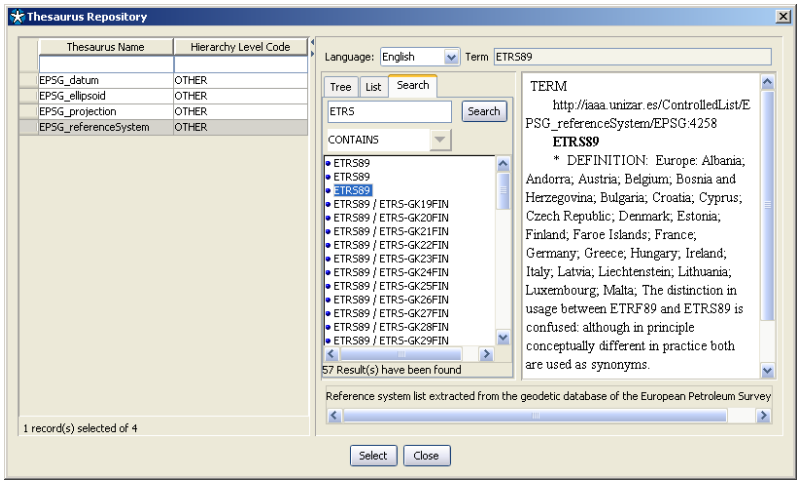
*In case of raster/image data, use *Content information.MD_CoverageDescription*



- Coordinate reference system (ETRS89, ED50...)

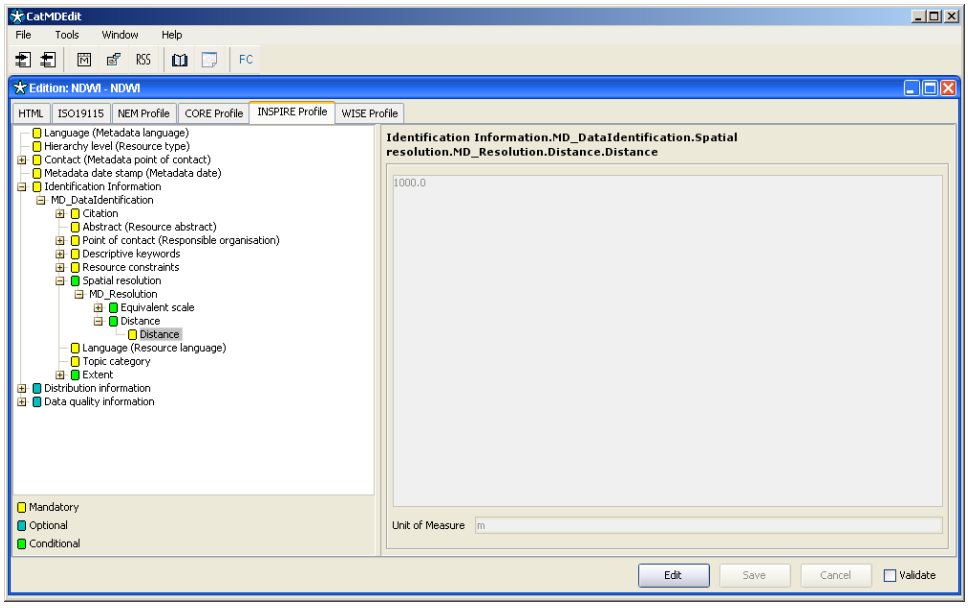
Element in ISO 19115: Reference System information.MD_ReferenceSystem.Reference system identifier
Corresponding element in INSPIRE MIR: Not available





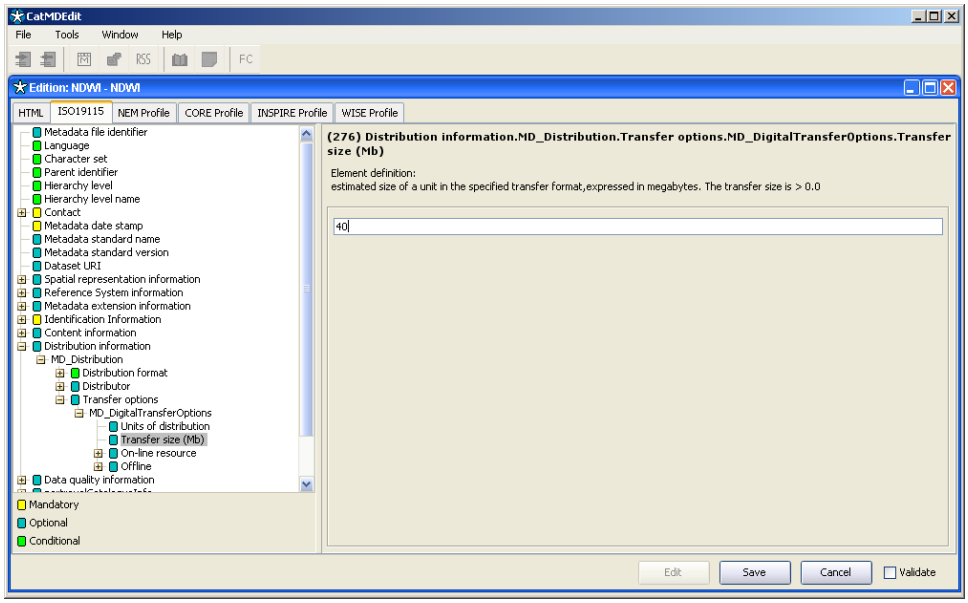
- Reference map scale at which the indicator was calculated. (1:25000, 1:5000…)

Element in ISO 19115: Identification Information.MD_DataIdentification.Spatial resolution.MD_Resolution.Distance.Distance
Corresponding element in INSPIRE MIR: Spatial resolution



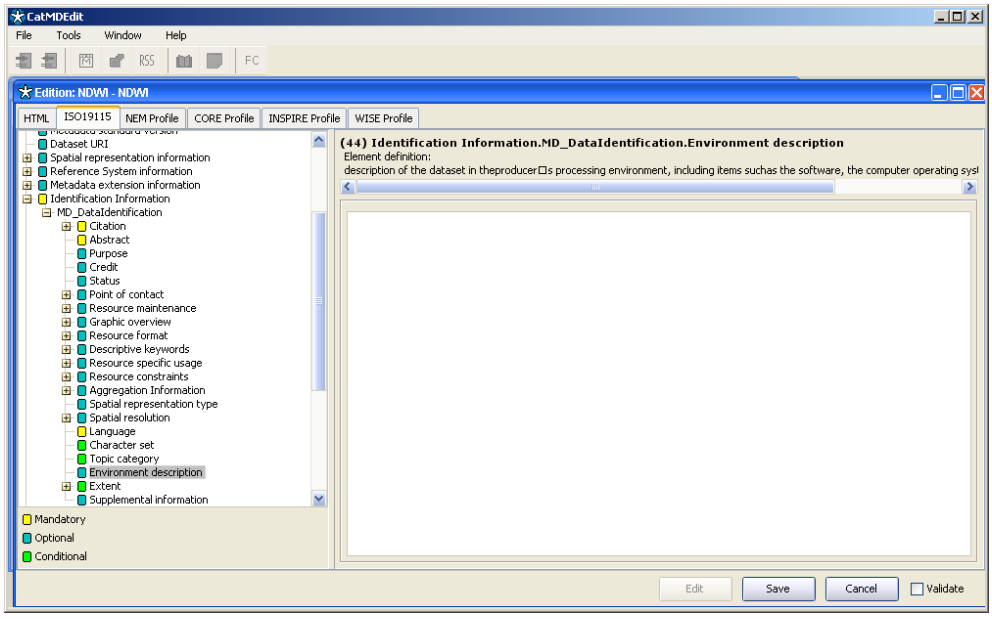
- Information volume: [ ] MB/GB

Element in ISO 19115: Distribution information.MD_Distribution.Transfer options.MD_DigitalTransferOptions.Transfer size (Mb)
Corresponding element in INSPIRE MIR: Not available



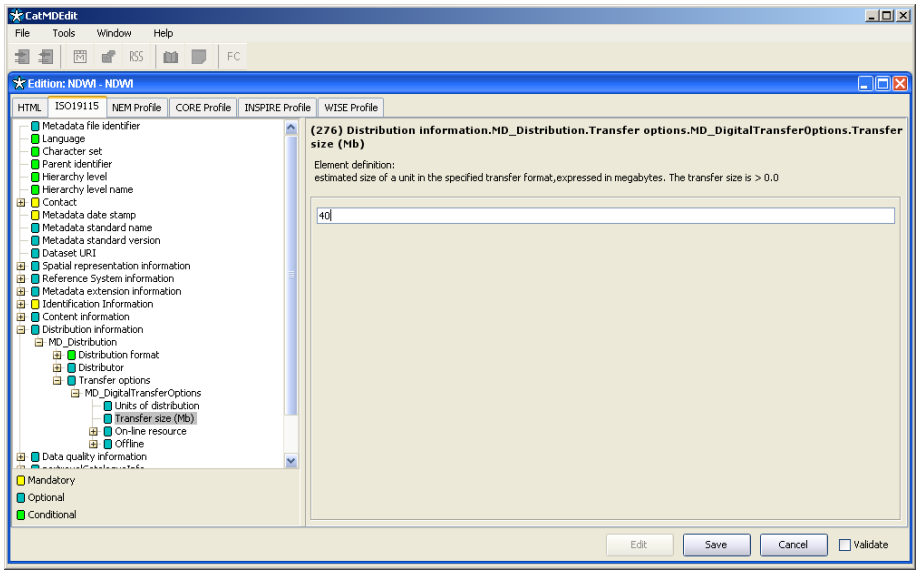
- Alphanumeric information:
- Choose one: Database / Other systems (Provide the Database Management System DBMS or other system used) e.g.: Oracle, SQLServer, MySQL, ...)

Element in ISO 19115: Identification Information.MD_DataIdentification.Environment description
Corresponding element in INSPIRE MIR: Not available



- Information volume: [ ] MB/GB

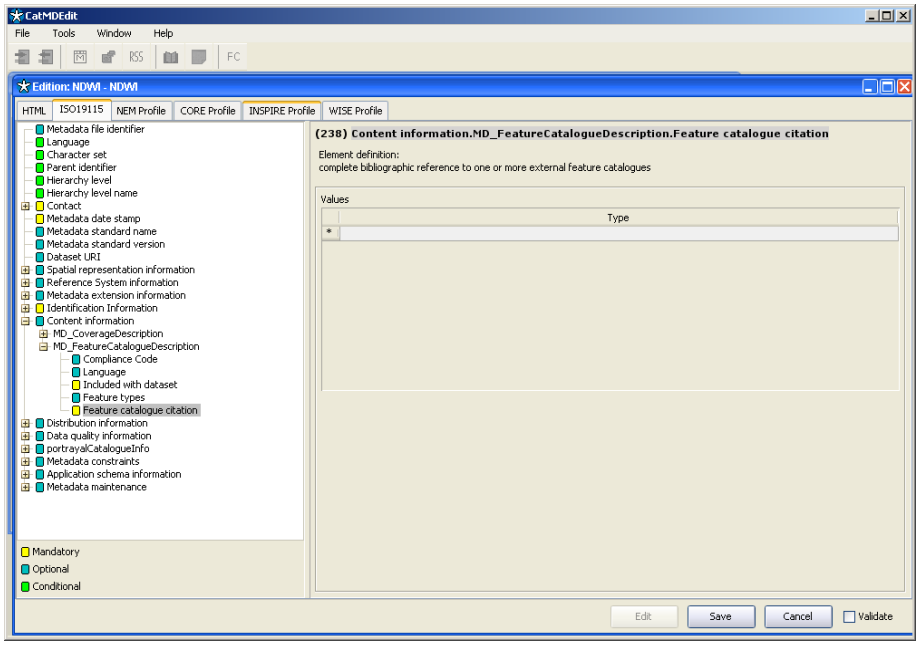
Element in ISO 19115: Distribution information.MD_Distribution.Transfer options.MD_DigitalTransferOptions.Transfer size (Mb)
Corresponding element in INSPIRE MIR: Not available



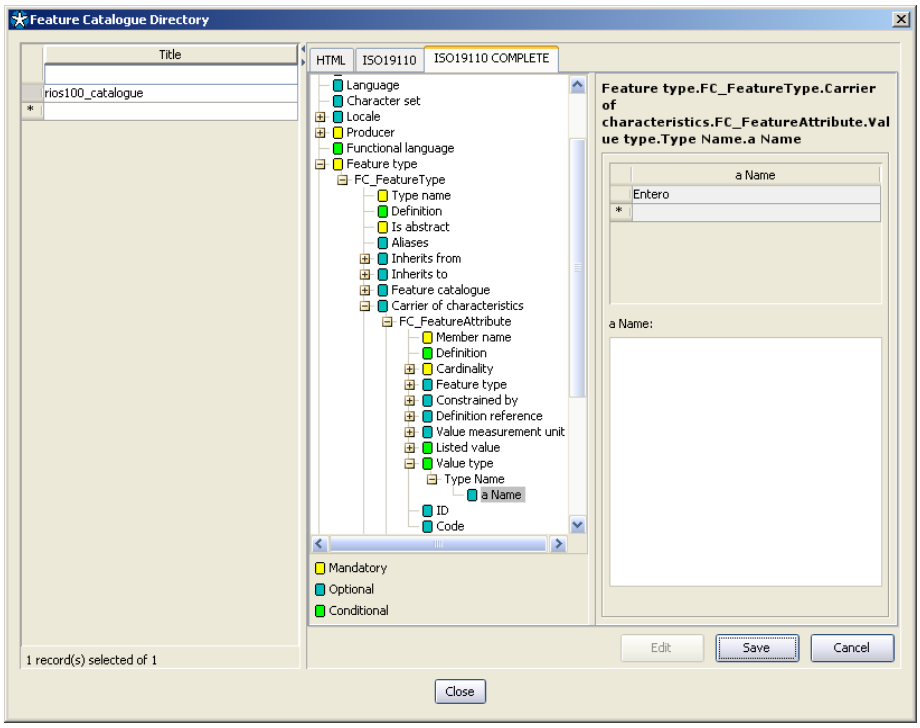
- Data structure
  - Vector
- Indicate the meaning of the value (or values) associated with each management unit.

A data model can be described at a conceptual level (through a conceptual schema) and at a logical level (through an application schema, see later the mapping for database description). For the conceptual level, ISO 19115 proposes to refer to an external feature catalogue, which must be compliant with ISO 19110 standard. A feature catalogue describes with full detail the features of a model, the attributes and relations of these features, and the meaning of values for these attributes.

Element in ISO 19115: Content information.MD_FeatureCatalogueDescription.Feature catalogue citation (this element is used to refer to an external source describing the conceptual schema, e.g. an UML schema or an ER schema. Following ISO TC 211 recommendations such a conceptual schema should be described according to ISO 19110)
Corresponding element in INSPIRE MIR: Not available

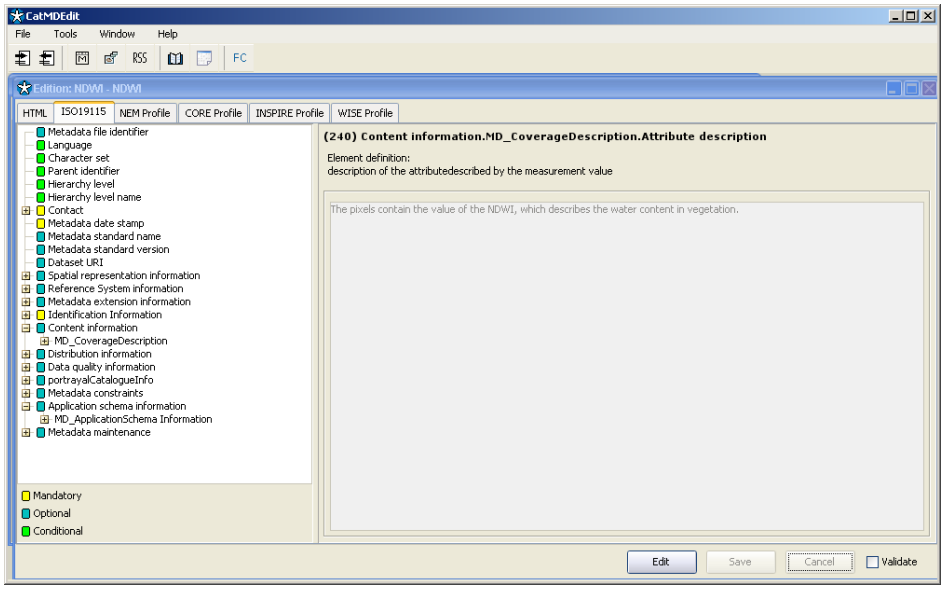


Element in ISO 19110: Feature type.FC_FeatureType.Carrier of characteristics.FC_FeatureAttribute (this entity allows the description of attributes by means of definition, type, value units…)



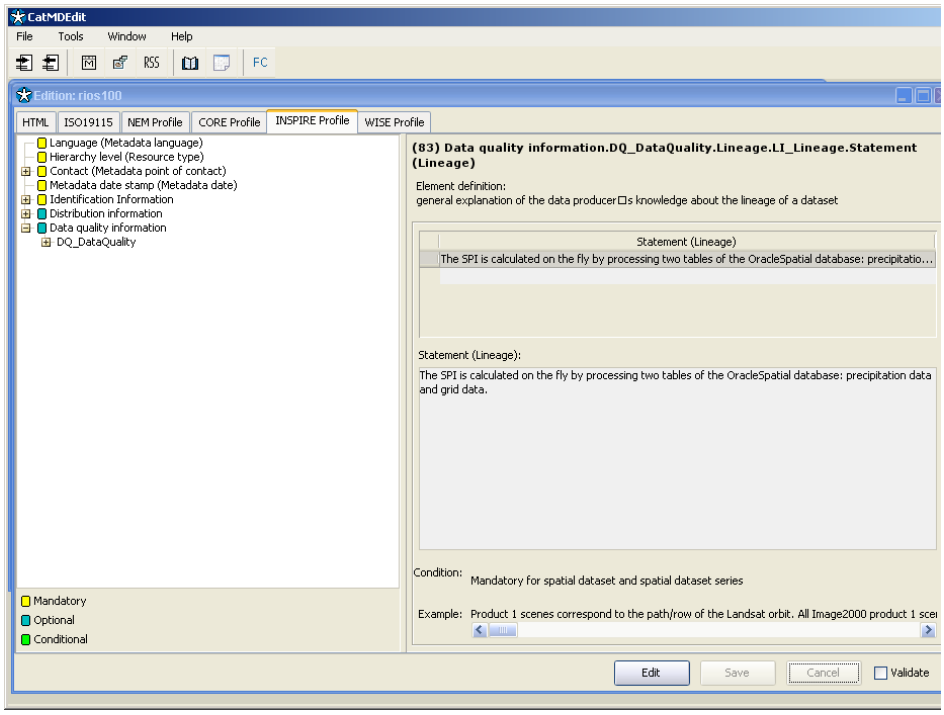
- Raster
  - Indicate the meaning of the value (or values) associated with each point or cell.

Element in ISO 19115: Content information.MD_CoverageDescription.Attribute description
Corresponding element in INSPIRE MIR: Not available



- Database
  - Brief description about main tables, attributes and relations.

Element in ISO 19115: Data quality information.DQ_DataQuality.Lineage.LI_Lineage.Statement (the following value has been extracted from the description of the database provided for the JRC SPI index)
Corresponding element in INSPIRE MIR: Lineage



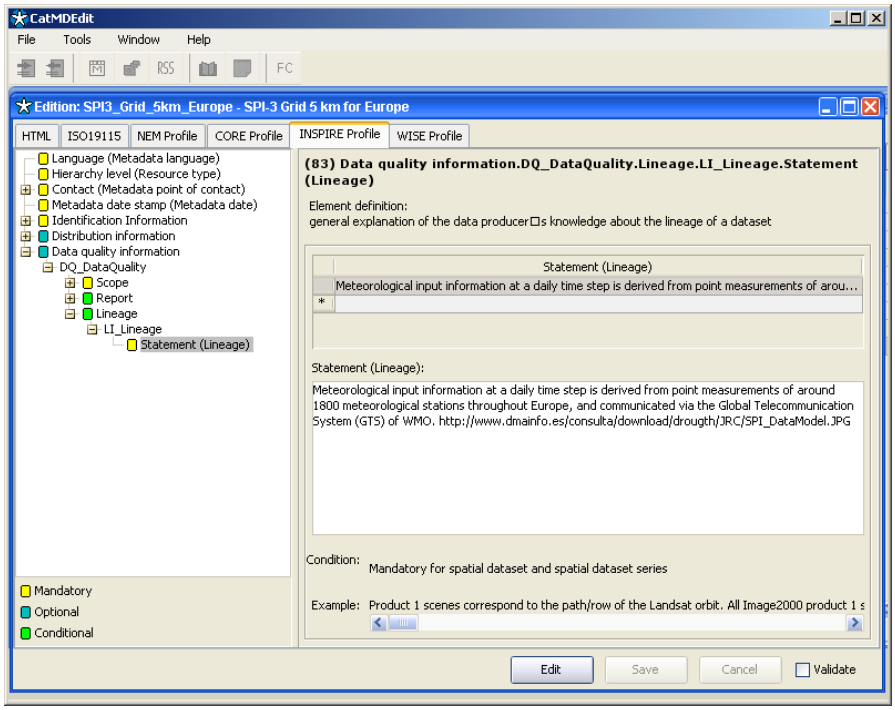
- Information on the components of the drought indicator
  - Data model (Provide brief explanation of the data model. If possible, please provide a hyperlink or reference to associated documentation, e.g. UML diagrams):

*In the case of vector data, and as mentioned before, ISO 19115 proposes to describe the conceptual schema of a data model by means of a reference to an external feature catalogue, which must be compliant with ISO 19110 standard. The reference to this external feature catalogue may include as well some hyperlinks to additional sources (i.e. a feature catalogue citation includes elements for other citation details such as *Content information.MD_FeatureCatalogueDescription.Feature catalogue citation.CI_Citation.Other citation details).* However, most indicators are represented as raster data.

*For raster data there is no reference to an external feature catalogue. On the other hand, looking at the content of the explanations provided for indicators, it can be seen that partners' explanation focus more on the procedure followed to obtain the indicators than on the model itself. Therefore, we propose to describe this data model as part of the lineage statement. With respect to the hyperlink to the associated documentation, the Application schema information element of ISO 19115 could be used as well.

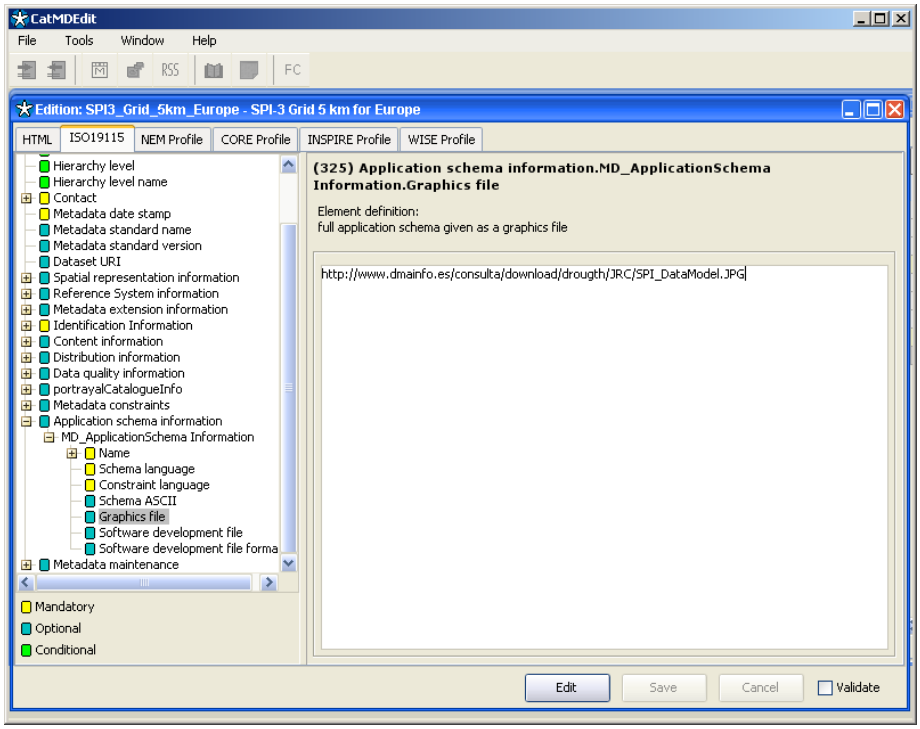
Description

Element in ISO 19115: Data quality information.DQ_DataQuality.Lineage.LI_Lineage.Statement
Corresponding element in INSPIRE MIR: Lineage



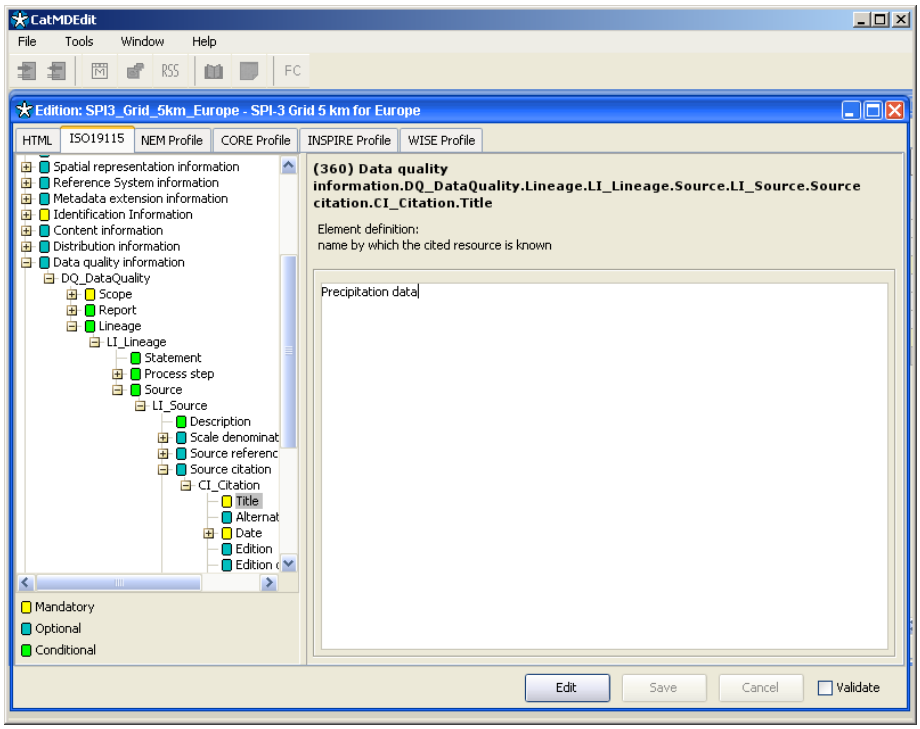
Separate hyperlink

Element in ISO 19115: Application schema information.MD_ApplicationSchema Information.Graphics file
Corresponding element in INSPIRE MIR: Not available



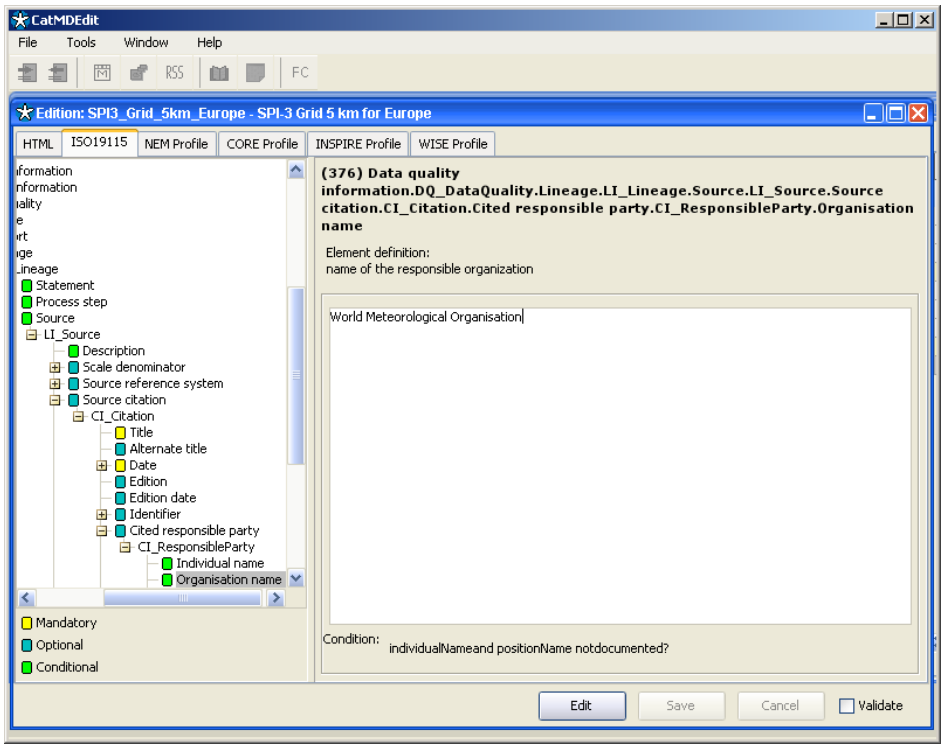
- Components (e.g. Precipitation, Soil moisture, Flow, Reservoir Volume Piezometric level…)

The data quality information proposed by ISO 19115 enables the description of each separate source (See also screenshots below for each description item).
Element in ISO 19115: Data quality information.DQ_DataQuality.Lineage.LI_Lineage.Source
Corresponding element in INSPIRE MIR: Not available



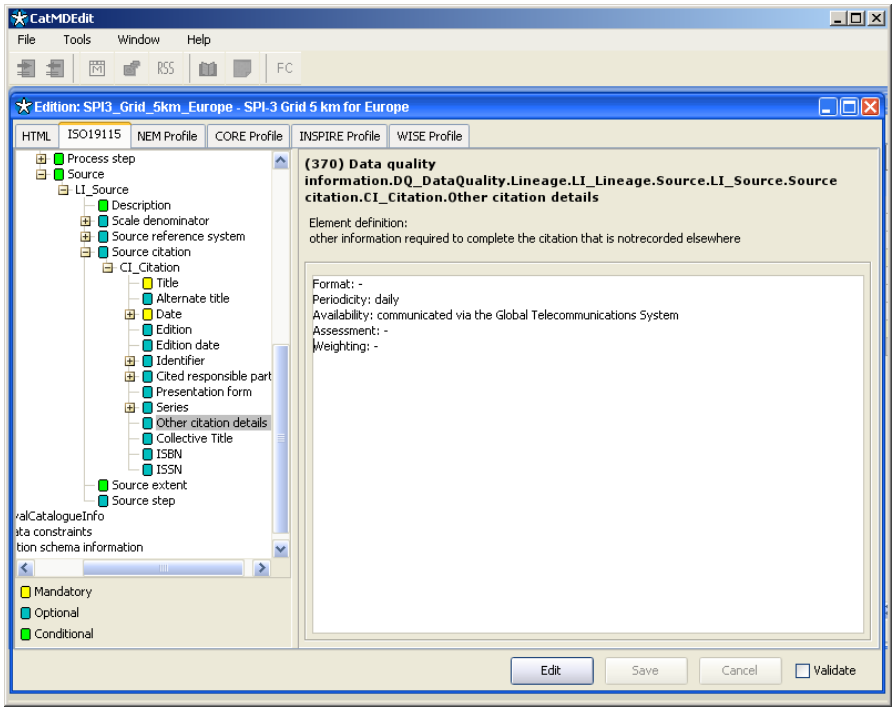
- For each component that is used to elaborate the indicators, please give the following information:
- Produced by (organization)

Element in ISO 19115: Data quality information.DQ_DataQuality.Lineage.LI_Lineage.Source.LI_Source.Source citation.CI_Citation.Cited responsible party.CI_ResponsibleParty.Organisation name
Corresponding element in INSPIRE MIR: Not available



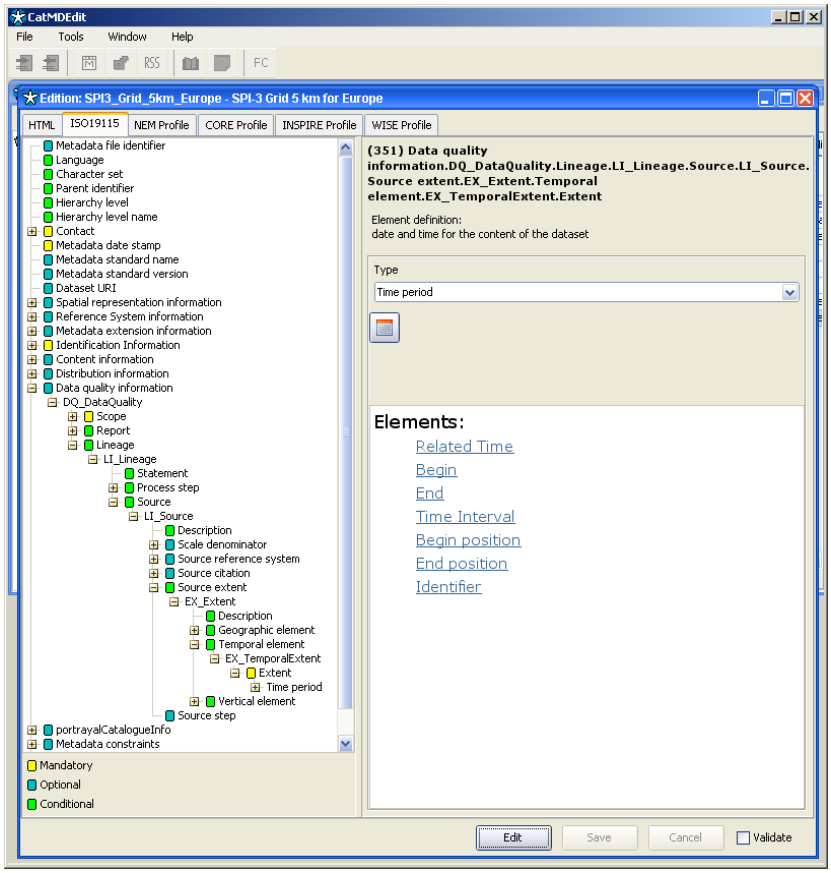
- Format
- Periodicity (early, monthly, daily...)
- Availability (if it is available to general public, how it is done (personal requirement? Download on web? Web service as WMS, WFS....?)
- Please indicate how the component was assessed: Monitored, Calculated, Estimated
- Weighting coefficient or relevance of the component (about the calculation of the drought indicator) In paragraph “Indicator description” this is explained in more detail

Element in ISO 19115: Data quality information.DQ_DataQuality.Lineage.LI_Lineage.Source.LI_Source.Source citation.CI_Citation.Other citation details
Corresponding element in INSPIRE MIR: Not available



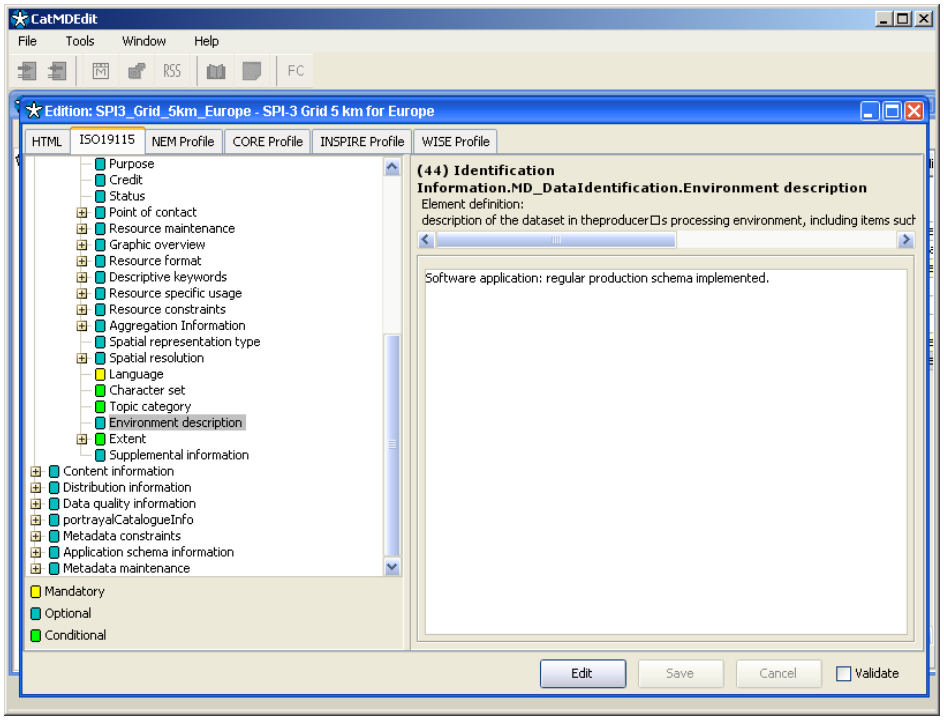
- Indicate the range of data from which information is available

Element in ISO 19115: Data quality information.DQ_DataQuality.Lineage.LI_Lineage.Source.LI_Source.Source extent.EX_Extent.Temporal element.EX_TemporalExtent.Extent
Corresponding element in INSPIRE MIR: Not available



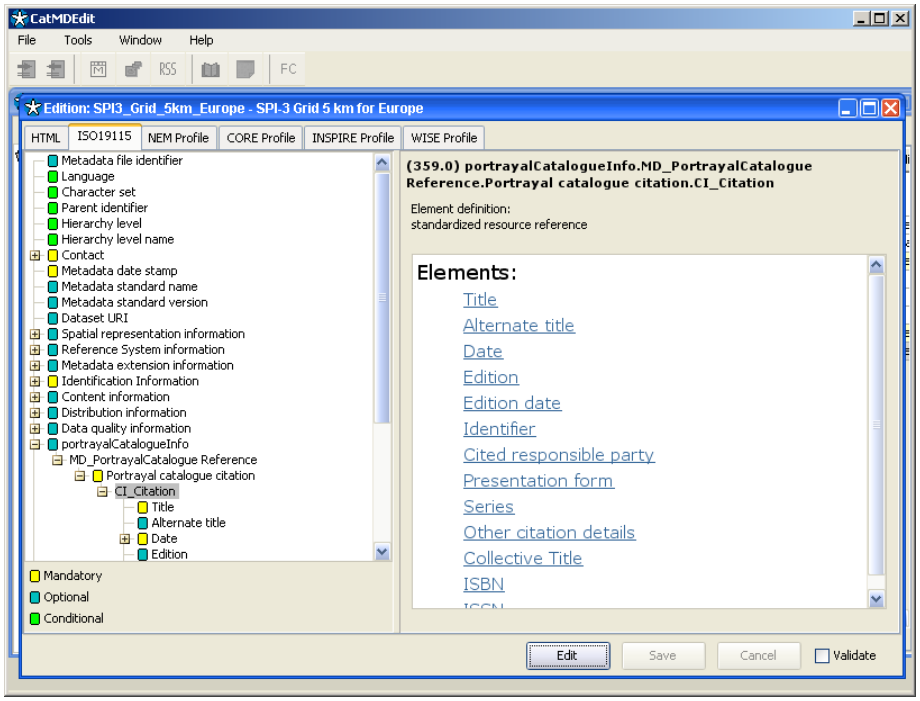
- Tools
- How is the indicator created? by the application of a software? Which? Manually? Automatically through a spatial model or GIS analysis? ...

Element in ISO 19115: Identification Information.MD_DataIdentification.Environment description
Corresponding element in INSPIRE MIR: Not available



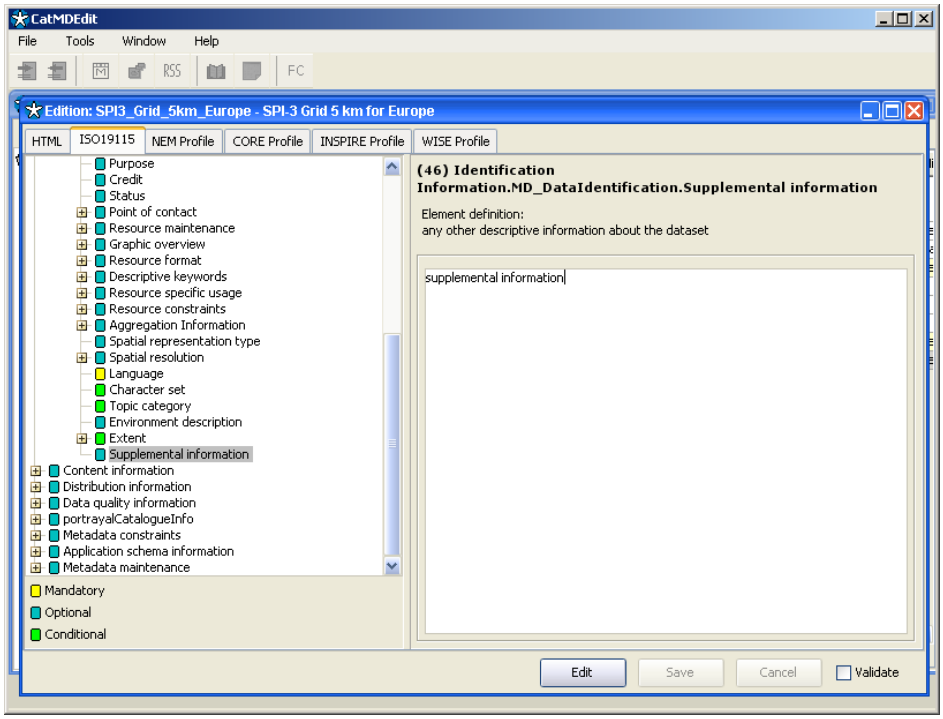
- Representation: any suggested colors? Any defined classes? What is the correspondent qualitative classification?

The rules for the portrayal of a resource are described in ISO 19115 by means of a reference to a portrayal catalogue. The citation details of this catalogue could include a hyperlink to a Style Layer Descriptor document.
Element in ISO 19115: Portrayal Catalogue Information.MD_PortrayalCatalogue Reference.Portrayal catalogue citation
Corresponding element in INSPIRE MIR: Not available



- Other comments

Element in ISO 19115: Identification Information.MD_DataIdentification.Supplemental information
Corresponding element in INSPIRE MIR: Not available



4 SUMMARY

The original purpose of task 5.3 was the development of a common data model for all partners of WP5. After an initial analysis and a major effort in publishing the available indicators through the EuroGEOSS broker, it was agreed that the most urgent and useful task was to develop an extensive description of the drought indicators used by each partner so that they can be more easily used by others. The comparative analysis of these indicators developed in this report contributes also to the process of agreeing on the scope and content of a common data model. Here, we present a series of steps taken from the development of the project WP5.3 task:

- First, the task was to select a set of common attributes that define and characterize drought indicators of the different partners. A document was created with the different attributes and put together with partners (see Section 3.1). Also, a template was made available as an example of how complete the information through the drought indicator published by the SIA (Spanish system of water information).

- Second, the forms received by the different partners were analyzed and placed in a common format via XML and XSD files. With this work, we noted the possibility of standardizing the metadata that was associated with different drought indicators.

- Third, and as the final development of this task, it has been accomplished to standardize metadata of drought indicators of the various partners. To this end, we have chosen ISO metadata profile in which to complete the information that characterizes each indicator. This work will enable the uniform search for the information that characterizes the indicators.

5 CONCLUSIONS

The objective of this task has been re-focused to account for the necessity to manage many different datasets, from different sources, at different scale units, and with many other differences.

The first step to compile and analyse existing drought indicators was completed satisfactory. Most of the differences in drought datasets were highlighted, as the different format of data (raster x vector), different types of drought generated by each partner, etc. In spite of some differences, the task also allowed to identify commonalities that allowed for a structured description of drought datasets.

The development of this document, the compilation and the results obtained were essential in order to give an overview of the drought information we are dealing with, and to give hints on how to propose the next step in respect to interoperability, capabilities, etc.

One step forward was given when proposing the integration of the information generated in this task into the metadata catalog developed in previous tasks of WP5. The importance of getting all the fundamental information together, easily accessible, well coordinated and structured is enormous when treating geographical data.

So, key documents were generated in order to help the integration of the standard information that defines drought indicators. In the case other partners wish to incorporate their data into EDO, they will find an organized system to have their drought information well represented, and found through our metadata catalog.

In general means, the product of this task increases the usefulness of the services offered by EDO, facilitating the interoperability and exploitation of drought data from different sources, with different scales and all other differences that it must have. By this way, any user can access meaningful and useful drought data, making is possible to be used on development of politics, on research projects, on diffusion of knowledge about droughts or any other purpose.

The standardization of drought indicators descriptions within the metadata catalog is also an important achievement. This required the adaptation and extension of the core INSPIRE metadata elements, which were designed for discovery purposes only. These extensions will help the drought community as they allow for a better understanding of what data is accessible that relates to drought, and how it can be used for different purposes via EDO.

The tasks performed in this report (definition of agreed metadata elements, and formalization through XSD into ISO compliant syntax) represent therefore a repeatable methodology for other partners to perform to document their data holdings, and contribute to a shared understanding within and across disciplines.