

Pegaso Project
People for Ecosystem based Governance
in Assessing Sustainable development of
Ocean and coast

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Geonode Interconnection Guidelines

WP3

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Introduction

The Pegaso Spatial Data Infrastructure (PegasoSDI) is designed to create a distributed infrastructure of Geonodes that can be accessed either independently or all together from a central Geonode. This infrastructure is being built by integrating existing Geonodes from Pegaso partners and also by creating new Geonodes by partners that were lacking this service. The added value of PegasoSDI is based on the selection of relevant data for Pegaso project and the availability of those data from a central, coherent service.

Each Pegaso partner can potentially build their own Geonode, which will be interconnected with the central Geonode. In order to successfully interconnect those services, the partner's Geonode should be set up following these guidelines, ensuring the compatibility and providing an homogenous set of services.

In order to successfully implement this infrastructure, the proper architecture has to be chosen, matching the following requirements:

- Include only relevant information
- Make this information easily accessible for partners and users
- Take into consideration existing Geonodes, trying to integrate them in the most efficient way
- Offer different levels of access if some datasets are protected and should only be accessible for partners or some user profiles

Data services (WMS, WCS, WFS and direct download)

The purpose of the SDI is to feed the map viewer but also to provide access to cartographic datasets for analysis. In order to fulfill that purpose and to maximize the options available for users, **each data set should be delivered using the following services:**

- Visualization service: **WMS**
- Data access service: **WFS** (for vector data), **WCS** (for raster data) and **direct download**

Offering just an WMS services is not enough, as that service is only suitable for visualization purposes, so partners and general public can't perform analysis task using those services. This is the reason to complement WMS with WFS, WCS and direct download services.

Recommendations for WMS, WCS and WFS services

WMS, WCS and WFS services can be configured to offer a set of coordinate reference systems for accessing the layers. The exact set of available reference systems is defined in the service configuration. When accessing a layer, the client is able to choose which reference system will be use (within the set of available reference systems, defined by the server).

Offering several coordinate reference systems makes published layers easier to integrate in Map Viewers and to combine with regional cartography on desktop GIS tools (such as QuantumGIS, gvSIG or ArcGIS).

Therefore, at least the following coordinate reference systems should be available:

Brief Name	Description	Code on EPSG reference database
ETRS89-LAEA	European Terrestrial Reference System 1989 (ETRS89) datum on GRS80 ellipsoid using Lambert Azimuthal Equal Area projection	EPSG:3035
ETRS89-LCC	European Terrestrial Reference System 1989 (ETRS89) datum on	EPSG:3034



	GRS80 ellipsoid using Lambert Conical Conformal projection	
ETRS89-Geographic	European Terrestrial Reference System 1989 (ETRS89) datum on GRS80 ellipsoid using geographic (latitude-longitude) coordinates	EPSG:4258
WGS84	World Geodetic System 1984 (WGS84) using geographic (latitude-longitude) coordinates	EPSG:4326
Web-Mercator	Spherical Mercator projection, used in popular map services such as Google Maps, Bing, OpenStreetMap, etc.	EPSG:3857
ETRS89-UTM-zoneXX (zones 30 to 37)	European Terrestrial Reference System 1989 (ETRS89) datum on GRS80 ellipsoid using Universal Transverse Mercator for zones 30 to 37	EPSG:25830 EPSG:25831 EPSG:25832 EPSG:25833 EPSG:25834 EPSG:25835 EPSG:25836 EPSG:25837

It is strongly recommended that the metadata record is linked in the layer metadata section of WMS, WCS and WFS services. See Annex III for details on how to properly encode the link to the metadata record.

Recommendations for direct download service

The files offered as direct download should use well-documented, popular data formats that can be opened with (virtually) any GIS tool available in the market. The following formats have been selected:

- Shapefile for vector layers.
- TIFF (GeoTIFF) for raster layers.

Shapefiles are known to have several limitations, but have been anyway selected as there is a wide support on almost every existing GIS tool.

The files will be delivered in ZIPPED format (.zip) to reduce connection bandwidth and to include the datasets, the metadata and the documentation in a single file.

Metadata catalog

In order to make layers searchable from the central Geonode catalog, partners are encouraged to set up a metadata catalog. Metadata contains the description of the data (title, description, spatial and temporal coverage, distribution services, etc), which makes data more useful both for your organization and for other organizations not familiar with your datasets. In this sense, metadata clearly increases the value of your data.

Protocols for metadata access

The metadata catalog can be accessed using the catalog webpage, but it should also offer standardized access using **Catalog Service for the Web (CSW) protocol from OGC**.

Additional protocols can be also set up to offer maximum interoperability. The Pegaso catalog software (which is a customized version of GeoNetwork software) can be configured to offer the following protocols: CSW, GeoNetwork and OAI-PMH.

Metadata codification

Metadata records have to be codified on XML files following ISO19139 standard. The records can be generated with any 19139-compatible tool, such as GeoNetwork software. See Annex I for a description of the most relevant metadata fields on ISO19139.



In order to achieve a good integration with the Pegaso Map Viewer and Catalog, the metadata record should have a link to the WMS, WCS, WFS and download services, under the subsection “Online Resource” of the “Distribution info” section. Using GeoNetwork software, this link can be created within the section Distribution, creating an Online Resource sub-section for each available service, as shown in the snapshot:

The screenshot displays the 'Distribution Information' section of a metadata record in GeoNetwork. It features a sidebar on the left with navigation options: Constraints, Spat. Info, Ref. system, **Distribution**, Data quality, App. schema, Catalog, Content Info, Ext. Info, and XML view. The main area is titled 'Distribution Information' and contains a 'Distribution' section with expandable fields for 'Distribution format' and 'Distributor'. Below this is the 'Transfer options' section, which includes 'Digital transfer options' with expandable fields for 'Units of distribution' and 'Transfer size'. The core of the interface consists of four 'OnLine resource' entries, each with a 'Linkage' sub-section containing a 'URL' field (marked with an asterisk), a 'Protocol' dropdown, an 'Application profile' field, a 'Name of the resource' field, a 'Description' text area, and a 'Function' dropdown. The first entry has a URL of <http://pegasosdi.uab.es/data/public/eea/clc>, Protocol 'Web address (URL)', Name of the resource 'Raster 100m (GeoTiff)', and Function 'Download'. The second entry has a URL of <http://pegasosdi.uab.es/ogc/wms>, Protocol 'OGC-WMS Web Map Service', Name of the resource 'CLC2006v15_100m', and Function '+'. The third entry has a URL of <http://pegasosdi.uab.es/ogc/wcs>, Protocol 'OGC-WCS Web Coverage Service', Name of the resource 'CLC2006v15_100m', Description 'WCS Server: http://pegasosdi.uab.es /ogc/wcs (requires a WCS client to connect)', and Function '+'. The fourth entry has a URL of <http://www.eea.europa.eu/data-and-maps/>, Protocol 'Web address (URL)', and Function '+'. A 'del' button is visible next to the second entry.

- For Download Services, the URL must point to the downloadable file, protocol should be set to “Web Address (URL)”, “Name of the resource” should not be empty, and “Function” must be “download”.



- For WMS services, the URL must point to the WMS server address (e.g. 'http://pegasosdi.uab.es/ogc/wms'), protocol should be set to "OGC-WMS Web Map Service" and the "Name of the resource" should be the "name" of the layer on the WMS service.
- For WCS services, the URL must point to the WCS server address (e.g. 'http://pegasosdi.uab.es/ogc/wcs'), protocol should be set to "OGC-WCS Web Coverage Service", the "Name of the resource" should be the "name" of the layer on the WCS service, and a description should be also including specifying that a WCS client is required to access this service (e.g. 'WCS Server: http://pegasosdi.uab.es/ogc/wcs (requires a WCS client to connect)').
- For WFS services, the URL must point to the WFS server address (e.g. 'http://pegasosdi.uab.es/ogc/wfs'), protocol should be set to "OGC-WFS Web Feature Service", the "Name of the resource" should be the "name" of the layer on the WFS service, and a description should be also including specifying that a WCS client is required to access this service (e.g. 'WFS Server: http://pegasosdi.uab.es/ogc/wfs (requires a WFS client to connect)').

See Annex II for details on the expected contents on the Distribution Information section of the XML 19139 metadata.

Metadata filtering

Some partners already have working GeoNodes, including a metadata catalog. However, not all the metadata available on those catalogs is relevant for Pegaso. Therefore, relevant metadata has to be selected by the partner, in order to only include those metadata records on Pegaso SDI.

The selected metadata should be 'marked' or 'tagged' in some special way, so that a filter can be applied on the central catalog to exclusively show datasets relevant for Pegaso project.

Several options are possible to 'tag' the metadata, depending on the protocol offered by the partner:

For protocol...	Metadata should be tagged using...
GeoNetwork (option A, preferred)	'pegaso' keyword (using ISO19139 keywords field)
GeoNetwork (option B)	'pegaso' category (using Geonetwork categories)
CSW	'pegaso' keyword (using ISO19139 keywords field), the keyword should be come available on the CSW 'subject' field
OAI-PMH	'pegaso' category (using Geonetwork categories)

Geonode interconnection

If you have successfully implemented the services and protocols described in your previous sections, your geonode is ready to be connected to Pegaso Spatial Data Infrastructure. Congratulations!

In order to perform this connection, you need to provide:

- The URL address of your metadata catalog (if possible, CSW URL)
- The URL addresses of your map services: WMS, WCS and WFS. (Note: these addresses may not be necessary if your metadata catalog already contains links to WMS, WCS and WFS services, as described on "Metadata Codification" section).
- The web address of your institution, your geoportal web site or your catalog (as you prefer). At some point, we will create a section on Pegaso SDI pointing to the web address of the partners that are providing data to the SDI.



Annex I. Relevant metadata records (extracted from ISO19139).

Producing a good metadata record is very important to correctly document the layer and making it valuable for partners and potential 3rd party users. A metadata record should be detailed enough to let a previously uninformed user to be able to understand the contents of the layer and decide whether it can be useful for him.

The ISO 19139 standard proposes a huge set of metadata fields. In order to make easier the process of metadata filling, a subset of fields is proposed and explained here:

Title: Should be precise and descriptive. Example: "Pegaso Land Cover Map 2000"

Abstract: A descriptive summary of the contents of the dataset. This summary should be understandable even for people not previously knowing the dataset

Creation, publication or revision date: This field is especially relevant if several revisions of the layer are expected to be produced, as it will help identifying which revision is documented on this metadata record.

Edition: This field can be used to specify the version of the dataset, in case a versioning system is in use (example: "v16", meaning version 16 of Corine Land Cover 2000 dataset).

Point of contact section: This section should make clear who should be contacted in order to get more information about the dataset. At least an email, a person name and/or an organization name should be filled.

Descriptive keywords: A list of keywords, separated by commas. At least one (or more) of the INSPIRE GEMET themes should be included as keyword (see Annex IV for available INSPIRE GEMET themes), but other relevant keywords can be included. Example: "Land Cover, Land Use, Pegaso, MODIS", keyword type: "Theme").

Resource constraints (legal constraints, security constraints): Make use of "Use limitation", "Access constraints", "Use constraints" and "Other constraints" fields to clearly describe the usage and distribution terms for the dataset. These fields are really relevant, as they state whether the user can legally make a specific use of this dataset in the context of the project. Examples: "Free to use, modify and redistribute for any purpose", "Free to use, modify and redistribute for academic and non-commercial uses", "Requires a License from ESA", "It can be freely used, but it can not be redistributed without written permission from XX", "It can be freely used for any purpose as far as the source is credited using the following statement: '© 2013 Pegaso Projects, YOU ARE THE BEST'", etc.

Equivalent scale (vector data): The level of detail expressed as a scale factor, i.e. 10000 for a 1:10000 map.

Extent:

- **Temporal extent (reference date):** the date or period of time covered by the contents of the dataset (example: "2000-1-1 to 2001-12-31" for Corine Land Cover year 2000).
- **Geographic extent:** Geographic area that is covered by the dataset, usually specified as the coordinates of a rectangle containing this area. Examples:
 - o NASA Bluemarble satellite photo has a world-wide coverage, thus its extent is (-90, 90, -180, 180) (south latitude, north latitude, west longitude, east longitude).
 - o Corine Land Cover 2000 covers the area of the following countries: Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia the former Yugoslavian Republic of, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom which translates to (26, 72, -26, 45).

Distribution information: In this section, the subsections "Transfer Options" and "Online resource" should be used to link the metadata to the dataset on the WMS, WFS, WCS and download services. See "Annex II. Expected codification for "Distribution Information" section on ISO19139 metadata records." for details on how to encode this links on the metadata.

Spatial representation, resolution (for raster data): Ground sample distance, i.e. the centre-to-centre distance between adjacent spatial samples on the earth's surface. Example: 250 metres, 100 metres.

Reference system: The coordinate reference system (CRS) of the dataset (examples: WGS1984, ETRS89 LAEA). The preferred way to specify the CRS is by means of the EPSG¹ code, as it is an unambiguous, standardized way to specify all the parameters of the coordinate reference system in use. Examples: EPSG:4326 for WGS1984; EPSG:3035 for ETRS89 LAEA.

Data quality info, report and lineage: These fields should be used to describe the expected accuracy, uncertainty or computed error for the dataset. The lineage section should be used to describe the data sources (e.g. other layers, satellite sensors, etc) used to create the layer and the methodology or GIS steps performed on these datasources to produce the dataset.

We encourage you to fill other fields besides the ones explained here, if you feel they are useful for describing your layer.

¹ The EPSG Geodetic Parameter Dataset is a structured dataset of Coordinate Reference Systems and Coordinate Transformations, accessible through a data registry (<http://www.epsg-registry.org>). It is maintained by Geodesy Subcommittee of OGP (International Association of Oil & Gas producers), formerly European Petroleum Survey Group.



Annex II. Expected codification for “Distribution Information” section on ISO19139 metadata records.

Download links

The download links should be documented on the CI_OnlineResource section of the metadata record.

- The URL of the downloadable resource should be placed of the 'linkage/url' subsections.
- The 'protocol' should start with the string “WWW:LINK-” and the 'function' section should contain 'download' on the codeListValue attribute.
- Alternatively, the 'protocol' should start with the string “WWW:DOWNLOAD-”. In this case the 'function' section is optional.

Sample XML metadata fragment to document download links

```

<gmd:distributionInfo>
  <gmd:MD_Distribution>
    <gmd:transferOptions>
      <gmd:MD_DigitalTransferOptions>
        <gmd:onLine>
          <gmd:CI_OnlineResource>
            <gmd:linkage>

<gmd:URL>http://pegasosdi.uab.es/data/public/eea/clcv15/clc90/g100_90.zip</gmd:URL
>

            </gmd:linkage>
            <gmd:protocol>
              <gco:CharacterString>WWW:LINK-1.0-http--link</gco:CharacterString>
            </gmd:protocol>
            <gmd:name>
              <gco:CharacterString>Raster 100m (GeoTiff)</gco:CharacterString>
            </gmd:name>
            <gmd:description gco:nilReason="missing">
              <gco:CharacterString/>
            </gmd:description>
            <gmd:function>
              <gmd:CI_OnLineFunctionCode
codeList="http://www.isotc211.org/2005/resources/codeList.xml#CI_OnLineFunctionCod
e" codeListValue="download"/>
              </gmd:function>
            </gmd:CI_OnlineResource>
          </gmd:onLine>
        </gmd:MD_DigitalTransferOptions>
      </gmd:transferOptions>
    </gmd:MD_Distribution>
  </gmd:distributionInfo>

```

WMS layer links

The links to the layer on WMS service should be documented on the CI_OnlineResource section of the metadata record.

- The URL of the WMS server should be placed of the 'linkage/url' subsections.



- The 'protocol' should be 'OGC:WMS'
- The 'name' section should contain the name of the layer in the WMS service.

Sample XML metadata fragment to document WMS links

```
<gmd:distributionInfo>
  <gmd:MD_Distribution>
    <gmd:transferOptions>
      <gmd:MD_DigitalTransferOptions>
        <gmd:onLine>
          <gmd:CI_OnlineResource>
            <gmd:linkage>
              <gmd:URL>http://pegasosdi.uab.es/ogc/wms</gmd:URL>
            </gmd:linkage>
            <gmd:protocol>
              <gco:CharacterString>OGC:WMS</gco:CharacterString>
            </gmd:protocol>
            <gmd:name>
              <gco:CharacterString>CLC1990v15_100m</gco:CharacterString>
            </gmd:name>
            <gmd:description gco:nilReason="missing">
              <gco:CharacterString/>
            </gmd:description>
          </gmd:CI_OnlineResource>
        </gmd:onLine>
      </gmd:MD_DigitalTransferOptions>
    </gmd:transferOptions>
  </gmd:MD_Distribution>
</gmd:distributionInfo>
```

WCS layer links

The links to the layer on WCS service should be documented on the CI_OnlineResource section of the metadata record.

- The URL of the WCS server should be placed of the 'linkage/url' subsections.
- The 'protocol' should be 'OGC:WCS'
- The 'name' section should contain the name of the layer in the WCS service.
- The 'description' section should include the following text: 'WCS Server: http://your-wcs-server-address (requires a WCS client to connect)'

Sample XML metadata fragment to document WCS links

```
<gmd:distributionInfo>
  <gmd:MD_Distribution>
    <gmd:transferOptions>
      <gmd:MD_DigitalTransferOptions>
        <gmd:onLine>
          <gmd:CI_OnlineResource>
            <gmd:linkage>
              <gmd:URL>http://pegasosdi.uab.es/ogc/wcs</gmd:URL>
            </gmd:linkage>
            <gmd:protocol>
              <gco:CharacterString>OGC:WCS</gco:CharacterString>
```



```
</gmd:protocol>
  <gmd:name>
    <gco:CharacterString>CLC1990v15_100m</gco:CharacterString>
  </gmd:name>
  <gmd:description>
    <gco:CharacterString>WCS Server: http://pegasosdi.uab.es/ogc/wcs
(requires a WCS client to connect)</gco:CharacterString>
  </gmd:description>
</gmd:CI_OnlineResource>
</gmd:onLine>
  <gmd:MD_DigitalTransferOptions>
</gmd:transferOptions>
</gmd:MD_Distribution>
</gmd:distributionInfo>
```

WFS layer links

The links to the layer on WFS service should be documented on the CI_OnlineResource section of the metadata record.

- The URL of the WFS server should be placed of the 'linkage/url' subsections.
- The 'protocol' should be 'OGC:WFS'
- The 'name' section should contain the name of the layer in the WFS service.
- The 'description' section should include the following text: 'WFS Server: http://your-wfs-server-address (requires a WFS client to connect)'

Sample XML metadata fragment to document WMS links

```
<gmd:distributionInfo>
  <gmd:MD_Distribution>
    <gmd:transferOptions>
      <gmd:MD_DigitalTransferOptions>
        <gmd:onLine>
          <gmd:CI_OnlineResource>
            <gmd:linkage>
              <gmd:URL>http://pegasosdi.uab.es/ogc/wfs</gmd:URL>
            </gmd:linkage>
            <gmd:protocol>
              <gco:CharacterString>OGC:WFS</gco:CharacterString>
            </gmd:protocol>
            <gmd:name>
              <gco:CharacterString>CLC1990v15_100m</gco:CharacterString>
            </gmd:name>
            <gmd:description>
              <gco:CharacterString>WFS Server: http://pegasosdi.uab.es/ogc/wfs
(requires a WFS client to connect)</gco:CharacterString>
            </gmd:description>
          </gmd:CI_OnlineResource>
        </gmd:onLine>
      </gmd:MD_DigitalTransferOptions>
    </gmd:transferOptions>
  </gmd:MD_Distribution>
</gmd:distributionInfo>
```



Creating this codification on Geonetwork

Geonetwork catalog software provides a web interface to create metadata records following ISO19139 standard. The codification describing in the previous sections can be achieved by filling the appropriate fields on Geonetwork interface, as show in the following snapshot:

Distribution Information [x]

Distribution

Distribution format [+]
Distributor [+]

Transfer options [x] [v]

Digital transfer options

Units of distribution [+]
Transfer size [+]

OnLine resource [x] [v]

OnLine resource

Linkage

URL *

Protocol

Application profile [+]
Name of the resource

Description [x]

Function [+]

OnLine resource [x] [v] [x] [v]

OnLine resource

Linkage

URL *

Protocol

Application profile [+]
Name of the resource

Description [x]

Function [+]

OnLine resource [x] [v] [x] [v]

OnLine resource

Linkage

URL *

Protocol

Application profile [+]
Name of the resource

Description [x]



Annex III. Metadata record linkage from WMS, WCS and WFS layer metadata.

For each layer published on WMS, WCS or WFS (WxS) services, it is possible to create a link to the layer metadata on Pegaso catalog. It is strongly recommended to set up this link, which provides extended information for each layer.

Linkage from WMS service

The 'getCapabilities' request should include a MetadataURL section for each available layer, pointing to the metadata record of the layer on the metadata Catalog.

Sample XML fragment for a WMS 1.3.0 getCapabilities response

```
<MetadataURL type="TC211">
  <Format>text/html</Format>
  <OnlineResource xlink:type="simple"
xlink:href="http://pegasosdi.uab.es/catalog/srv/en/metadata.show?uuid=5d621310-
df0d-4e2f-aa4a-6f4f3e389ca1"/>
</MetadataURL>
```

Linkage from WCS service

The 'describeCoverage' request should include a Metadata section for each available layer, pointing to the metadata record of the layer on the metadata Catalog.

Sample XML fragment for a WCS 1.1 describeCoverage response

```
<CoverageSummary>
  <ows:Metadata
xlink:href="http://pegasosdi.uab.es/catalog/srv/en/metadata.show?uuid=5d621310-
df0d-4e2f-aa4a-6f4f3e389ca1"/>
  [ . . . ]
</CoverageSummary>
```

Sample XML fragment for a WCS 1.0 describeCoverage response

```
<CoverageOffering>
  <metadataLink metadataType="TC211" xlink:type="simple"
xlink:href="http://pegasosdi.uab.es/catalog/srv/en/metadata.show?uuid=5d621310-
df0d-4e2f-aa4a-6f4f3e389ca1"/>
  [ . . . ]
</CoverageOffering>
```

Linkage from WFS service

The 'getCapabilities' request should include a MetadataURL section for each available layer, pointing to the metadata record of the layer on the metadata Catalog.

Sample XML fragment for a WFS 1.1 getCapabilities response



```
<FeatureType>
  [ . . . ]
  <MetadataURL format="text/html" type="TC211">
    http://pegasosdi.uab.es/catalog/srv/en/metadata.show?uuid={EE82258F-97AC-4B36-
    BB70-12348632AF1F}
  </MetadataURL>
  [ . . . ]
</FeatureType>
```

Sample XML fragment for a WFS 2.0 getCapabilities response

```
<FeatureType xmlns:bo="http://www.BlueOx.org/BlueOx">
  [ . . . ]
  <MetadataURL
xlink:href="http://pegasosdi.uab.es/catalog/srv/en/metadata.show?uuid={EE82258F-
97AC-4B36-BB70-12348632AF1F}"/>
  [ . . . ]
</FeatureType>
```



Annex IV. Inspire GEMET themes

List Inspire Spatial Data Themes (34 themes) and their definition:

Addresses: Location of properties based on address identifiers, usually by road name, house number, postal code.

Administrative units: Units of administration, dividing areas where Member States have and/or exercise jurisdictional rights, for local, regional and national governance, separated by administrative boundaries.

Agricultural and aquaculture facilities: Farming equipment and production facilities (including irrigation systems, greenhouses and stables).

Area management/restriction/regulation zones and reporting units: Areas managed, regulated or used for reporting at international, European, national, regional and local levels. Includes dumping sites, restricted areas around drinking water sources, nitrate-vulnerable zones, regulated fairways at sea or large inland waters, areas for the dumping of waste, noise restriction zones, prospecting and mining permit areas, river basin districts, relevant reporting units and coastal zone management areas.

Atmospheric conditions: Physical conditions in the atmosphere. Includes spatial data based on measurements, on models or on a combination thereof and includes measurement locations.

Bio-geographical regions: Areas of relatively homogeneous ecological conditions with common characteristics.

Buildings: Geographical location of buildings.

Cadastral parcels: Areas defined by cadastral registers or equivalent.

Coordinate reference systems: Systems for uniquely referencing spatial information in space as a set of coordinates (x, y, z) and/or latitude and longitude and height, based on a geodetic horizontal and vertical datum.

Elevation: Digital elevation models for land, ice and ocean surface. Includes terrestrial elevation, bathymetry and shoreline.

Energy resources: Energy resources including hydrocarbons, hydropower, bio-energy, solar, wind, etc., where relevant including depth/height information on the extent of the resource.

Environmental monitoring facilities: Location and operation of environmental monitoring facilities includes observation and measurement of emissions, of the state of environmental media and of other ecosystem parameters (biodiversity, ecological conditions of vegetation, etc.) by or on behalf of public authorities.

Geographical grid systems: Harmonised multi-resolution grid with a common point of origin and standardised location and size of grid cells.

Geographical names: Names of areas, regions, localities, cities, suburbs, towns or settlements, or any geographical or topographical feature of public or historical interest.

Geology: Geology characterised according to composition and structure. Includes bedrock, aquifers and geomorphology.

Habitats and biotopes: Geographical areas characterised by specific ecological conditions, processes, structure, and (life support) functions that physically support the organisms that live there. Includes terrestrial and aquatic areas distinguished by geographical, abiotic and biotic features, whether entirely natural or semi-natural.

Human health and safety: Geographical distribution of dominance of pathologies (allergies, cancers, respiratory diseases, etc.), information indicating the effect on health (biomarkers, decline of fertility, epidemics) or well-being of humans (fatigue, stress, etc.) linked directly (air pollution, chemicals, depletion of the ozone layer, noise, etc.) or indirectly (food, genetically modified organisms, etc.) to the quality of the environment.

Hydrography: Hydrographic elements, including marine areas and all other water bodies and items related to them, including river basins and sub-basins. Where appropriate, according to the definitions set out in Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (2) and in the form of networks.

Land cover: Physical and biological cover of the earth's surface including artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands, water bodies.

Land use: Territory characterised according to its current and future planned functional dimension or socio-economic purpose (e.g. residential, industrial, commercial, agricultural, forestry, recreational).

Meteorological geographical features: Weather conditions and their measurements; precipitation, temperature, evapotranspiration, wind speed and direction.



Mineral resources: Mineral resources including metal ores, industrial minerals, etc., where relevant including depth/height information on the extent of the resource.

Natural risk zones: Vulnerable areas characterised according to natural hazards (all atmospheric, hydrologic, seismic, volcanic and wildfire phenomena that, because of their location, severity, and frequency, have the potential to seriously affect society), e.g. floods, landslides and subsidence, avalanches, forest fires, earthquakes, volcanic eruptions.

Oceanographic geographical features: Physical conditions of oceans (currents, salinity, wave heights, etc.).

Orthoimagery: Geo-referenced image data of the Earth's surface, from either satellite or airborne sensors.

Population distribution — demography: Geographical distribution of people, including population characteristics and activity levels, aggregated by grid, region, administrative unit or other analytical unit.

Production and industrial facilities: Industrial production sites, including installations covered by Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (1) and water abstraction facilities, mining, storage sites.

Protected sites: Area designated or managed within a framework of international, Community and Member States' legislation to achieve specific conservation objectives.

Sea regions: Physical conditions of seas and saline water bodies divided into regions and sub-regions with common characteristics.

Soil: Soils and subsoil characterised according to depth, texture, structure and content of particles and organic material, stoniness, erosion, where appropriate mean slope and anticipated water storage capacity.

Species distribution: Geographical distribution of occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit.

Statistical units: Units for dissemination or use of statistical information.

Transport networks: Road, rail, air and water transport networks and related infrastructure. Includes links between different networks. Also includes the trans-European transport network as defined in Decision No 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community Guidelines for the development of the trans-European transport network (1) and future revisions of that Decision.

Utility and governmental services: Includes utility facilities such as sewage, waste management, energy supply and water supply, administrative and social governmental services such as public administrations, civil protection sites, schools and hospitals.

Source: GEMET - INSPIRE themes, version 1.0, 2008-06-01

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