



Report on the Open Access Database

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Version 0.4

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CNR

Work package 2

December, 2016

Website: <http://www.gemex-h2020.eu>



The GEMex project is supported by the European Union's Horizon 2020 programme for Research and Innovation under grant agreement No 727550

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Acronyms and Abbreviations

OADB - Open Access Database

CMS - Content Management System

SDI - Spatial Data Infrastructure

XML - eXtensible Markup Language

FGDC - Federal Geographic Data Committee

PDF - Portable Document Format

OGC – Open Geospatial Consortium

WMS – Web Map Service

WFS - Web Feature Service

WCS - Web Coverage Service

CSW – Catalogue Service for Web

TMS - Tile Mapping Service

KML - Keyhole Markup Language

CSV – Comma Separated Values

API – Application Programming Interface

PNG - Portable Network Graphics

JPEG – Joint Photographic Experts Group (which is the committee who created the standard

WPs – Workpackages

MT - MagnetoTelluric

TEM – Tomography electro Magnetic

DEM – Digital Elevation Model

SGY – Seismic data format

EDI – Electrical Data Interchange

DDF – Data Description Files

URL – Uniform Resource Locator

DIF – Directory Interchange Files

ebRIM – electronic business Registry Information Model

Executive summary

This report includes the description of the GEMex Open Access Database implementation and the collection of data. Geothermal data, in the form of maps, datasets and models will be organized and stored in an Open Access Database and will be made available in a Spatial Data Infrastructure according to international standards and protocols.

Part of this report is in the form of a handbook to help user to access the available information. The database is available by a dedicated link in the project website and will be updated by the end of the project.

1 Introduction

GEMex project will carry out many tasks in order to perform a resources assessment at two Mexican unconventional geothermal sites, a reservoir characterization of the two geothermal systems and eventually a definition of the concepts for the sites development. To such aims the consortium will collect new data during the life time of the project as well as will elaborate and produce new information.

The objective of the task 2.3 is to provide an easy to use and open access tool to store and manage the project data, which can be exploited firstly by the project partner's and secondly by any interested users on geothermal.

The task 2.3 makes available an Open Access Database (OADB) to collect, describe and display the GEMex geothermal data, in the form of maps, datasets and information on models. All these data will be catalogued and possibly provided as interactive maps in a WebGIS.

The Open Access Database rely on GeoNode software, which allow to organize and display data in agreement with the main international standards and protocols.

This report describes GeoNode implementation as OADB for GEMex project in the section 2, then drafts the data categories and data typology will be collected in section 3 whereas section 4 incorporates the main hints and tips to use GeoNode in the form a slim manual.

2 Description of the database

2.1 GeoNode

GeoNode is a geospatial Content Management System (CMS). It is a web-based platform for the management and publication of geospatial data, so called Spatial Data Infrastructure (SDI). GeoNode is an open source platform built by using other open source components, which allows non-specialized users to share data and create interactive maps visualizations. The data stored in the GeoNode can be shared publicly or restricted to allow access to only specific users.

Spatial data in the form of vector and raster data in their original reference systems can be uploaded in GeoNode by using a web form. Vector data are uploaded in ESRI shapefile format and different kinds of raster data are uploaded as GeoTIFFs. All the loaded data have to be described according to standard metadata formats like ISO 19139:2007. Metadata related to a dataset can be uploaded as XML document (in ISO, FGDC or Dublin Core format) to fill in key GeoNode metadata elements automatically.

The data collected in GeoNode can be searched geographically or via keywords. In addition, the stored datasets can be combined to create thematic maps.

All the layers are re-projected by the system to web Mercator for maps display, making it possible to use different popular base layers as Open Street Map.

Once maps are saved, it is possible to embed them in any web page or get a PDF version for printing.

2.2 GeoNode functionalities

2.2.1 Spatial Data Discovery

GeoNode allows users to browse and search for geospatial data. Data discovery can be carried out filtering the uploaded geospatial data by free text field, data typology, data category, keywords, data owners, belonging geographical region, spatial data extension.

Features include:

- Powerful spatial search engine
- Federated OGC services
- Metadata catalogue

2.2.2 Import and Manage

GeoNode allows users to upload and share geospatial data, securely. GeoNode makes it easy to upload and manage geospatial data on the web. Any registered user can upload and make content available via standard OGC protocols such as Web Map Service (WMS) and Web

Feature Service (WFS). Data is available for browsing, searching, styling, and processing to generate maps which can be shared publicly or restricted to specific users only.

Supported upload formats include shapefile, GeoTIFF, KML and CSV. In addition, it is possible to connect to existing external spatial databases and services.

Features include:

- Publish raster, vector, and tabular data
- Manage metadata and associated documents
- Securely or publicly share data
- Versioned geospatial data editor

2.2.3 Interactive Mapping

GeoNode allows users to create and share interactive web maps. GeoNode comes with helpful cartography tools for styling and composing maps graphically. These tools make it easy for anyone to assemble a web-based mapping application with functionality traditionally found in desktop GIS applications. Users can gain enhanced interactivity with GIS-specific tools such as querying and measuring.

Features include:

- WebGIS client
- Graphical style editor
- Create multi-layer interactive maps
- Share and embed maps in web pages

2.3 Standards and protocols

GeoNode is based on a set of Open Geospatial Consortium (OGC) standards. These standards enable GeoNode installations to be interoperable with a wide variety of tools that support these OGC standards and enable federation with other OGC compliant services and infrastructure.

2.3.1 Web Map Service

The Web Map Service (WMS) specification defines an interface for requesting rendered map images across the web. It is used within GeoNode to display maps in the pages of the site and in the WebGIS application to display rendered layers.

WMS provides an API to retrieve map images (PNG, JPEG, etc.) of geospatial data. WMS is suitable for visualization and when access to raw data is not a requirement.

2.3.2 Web Feature Service

The Web Feature Service (WFS) specification defines an interface for reading and writing geographic features across the web. It is used within GeoNode to enable downloading of vector

layers in various formats and within WebGIS to enable editing of Vector Layers that are stored in a GeoNode.

WFS provides an API to retrieve raw geospatial vector data directly. WFS is suitable for direct query and access to geographic features.

2.3.3 Web Coverage Service

The Web Coverage Service (WCS) specification defines an interface for reading and writing geospatial raster data as “coverages” across the web. It is used within GeoNode to enable downloading of raster layers in various formats.

WCS provides an API to retrieve raw geospatial raster data directly. WCS is suitable for direct access to satellite imagery, DEMs, etc.

2.3.4 Catalogue Service for Web

The Catalogue Service for Web (CSW) specification defines an interface for exposing a catalogue of geospatial metadata across the web. It is used within GeoNode to enable any application to search GeoNode’s catalogue or to provide federated search that includes a set of GeoNode layers within another application.

CSW provides an interface to publish and search metadata (data about data). CSW is suitable for cataloguing geospatial data and making it discoverable to enable visualization and access.

2.3.5 Tile Mapping Service

The Tile Mapping Service (TMS) specification defines an interface for retrieving rendered map tiles over the web. It is used within GeoNode to enable serving of a cache of rendered layers to be included in GeoNode’s web pages or within the WebGIS mapping application. Its purpose is to improve performance on the client vs asking the WMS for rendered images directly.

3 Collection of data

The GEMex Open Access Database will collect the data during all the life time of GEMex project (i.e., three years). This means it will include the public available preliminary data useful as starting point of the research activities foreseen in the project. The first 6 – 12 months will be dedicated to search and store the preliminary public data in agreement to the works ongoing in the different WPs.

Afterword, once the field works will start, the sampled and produced data will be added to the database in agreement to the confidentiality clauses endorsed by the European Consortium participating in the GEMex project (Final-Anexo 3-Agreement UMSNH-EU-CFE.pdf). Collected and resulting data will be possibly added from month 6 up to the end of the project, figure 1.

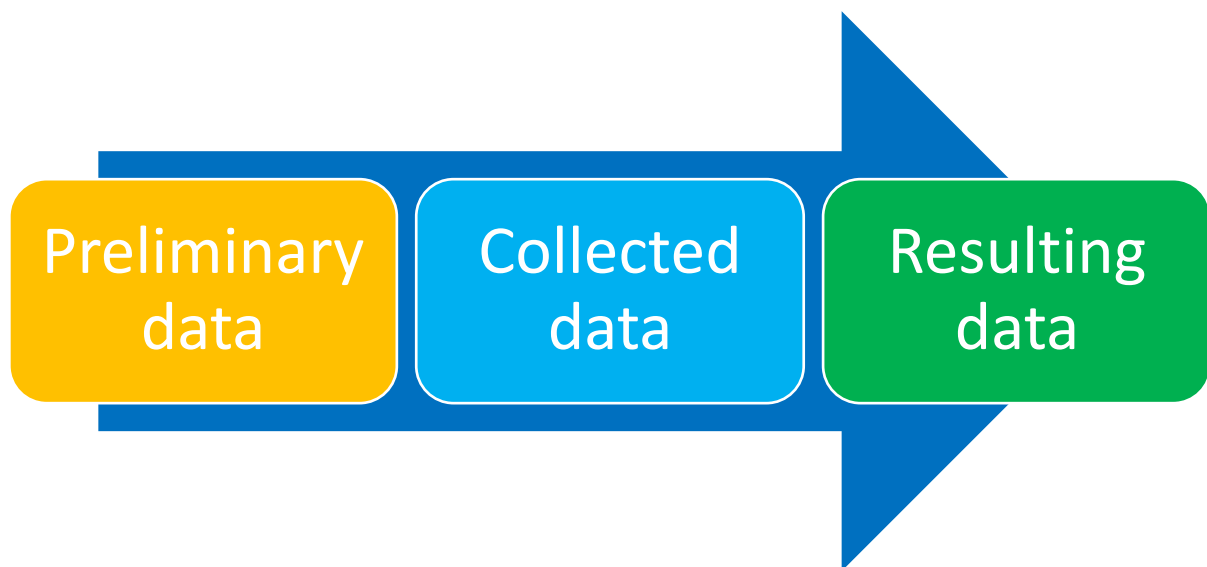


Figure 1 Data collections

The GEMex Open Access Database will host data belonging different topics useful for geothermal researches. In the beginning four data categories, as Geological, Geophysical, Geochemical and Numerical Model will be created to facilitate data search operations and to have Geothermal data well organized. Afterword, each loaded dataset will be assigned to the mentioned topic categories, Figure 2. Possibly new categories can be added if needed.

At first glance data of the different categories can be in different typology. The Geology category will host maps, cross-sections, images, tables. Geochemical category will include mainly tables and possibly maps of distribution whilst Geophysical cross-section, measure points and possibly geophysical maps will belong Geophysical category. The latter category, i.e., Numerical Models, will embed information on numerical models performed as the metadata of them and the derived information, such as maps, surface maps, etc.

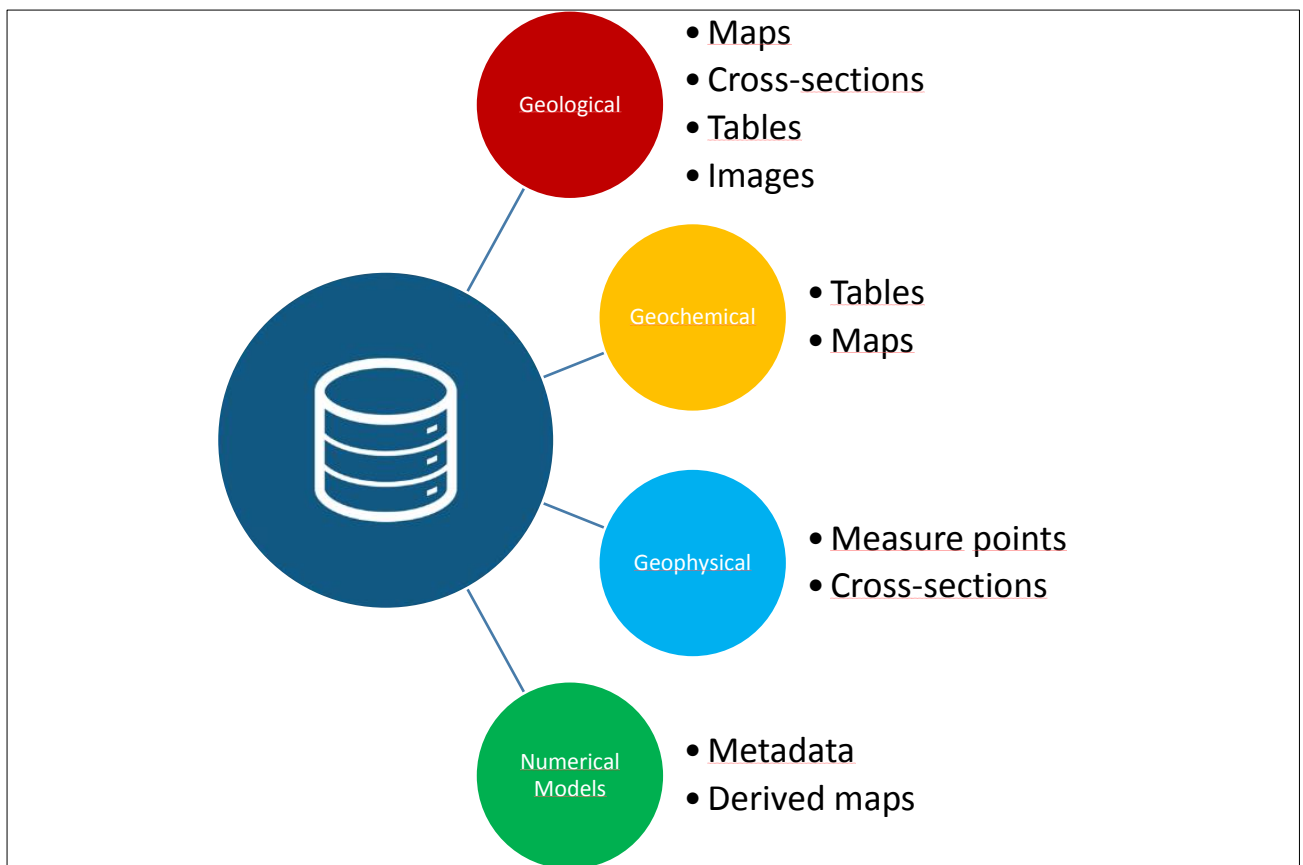


Figure 2 Data categories and typologies

The GEMex Open Access Database will be able to contain the mentioned data typology in different formats, see table 1.

Table 1 Data formats

Data typology	Data Format
Maps (vector, raster and grid)	Tiff, jpg, pdf, geotiff, ...
	Shp, geodatabase, sqlite, ...
	Asc, grd, ...
Table	xls, csv, ...
Cross-Sections	Tiff, jpg, pdf, ...
Images	Tiff, jpg, pdf, ...
Metadata	xml

3.1 Foreseen data

Here below are listed the foreseen datasets grouped by geothermal data category, which will be sampled/produced/derived in the context of GEMex project:

Geological data

- Outcrop details (description, coordinates, goal, field worker)
- Lithological data
- Geological samples characterization and location (description, coordinates, outcrop reference, samples code, sample coordinates, goal, sample storage location, responsible)
- Structural data (Kinematics of active structures, stress field)
- Faults orientation, strike

Geophysical data

- Resistivity model optimizations
- Acquired Resistivity data
- MT and TEM new acquisition
- Acquired Active - Passive seismic data
- Gravity station if required
- Distribution of rock modulus of elasticity and correlation with temperature
- Petro-physical properties from samples and analogues

Geochemical

- Stable and radiogenic isotope analyses
- Fluid inclusions analyses
- Mineralo-petrographic analysis
- Magnetic and geochronological data
- Geochronological investigation on altered and unaltered rocks
- Microanalyses of minerals
- X-ray micro-tomography of altered and unaltered rocks
- Isotope (stable and radiogenic) and characterization of the geothermal fluids (waters and gases)
- CO₂, CH₄, H₂S, Rn (isotopes) fluxes from soils

Numerical Model

- Integrated 3D regional/reservoir geological model
- Surface maps derived from the Integrated 3D regional/ reservoir geological model
- 3D regional/ reservoir thermal model
- Surface maps derived from the 3D regional/local thermal Model
- 3D regional/ reservoir hydrogeological model
- Surface maps derived from the 3D regional/local hydrogeological model

- Maps derived from regional geothermal resources assessment
- Integrated 3D reservoirs simulation

Basic metadata will be provided together with the datasets mentioned.

Existing/preliminary public or available/allowed information will be collected and stored in the proper category in the GeoNode database. A 'General data' category will be arranged to accommodate general data as:

- Digital Elevation Model (DEM)
- Road and path locations for both sites

Geophysical data (e.g. from seismic and MT and EM surveys) will be archived/produced following the common standard format (e.g. SGY, EDI, DDF), while geological, geochemical, petrological and petro-physical information coming from field work, fluid or core samples will be stored in proprietary spreadsheet internal representation.

4 User handbook

This section helps to use GeoNode from user perspective. This handbook describes how to:

1. Use and manage the different GeoNode basic resources.
2. Use the GeoNode searching tools to find your resources.
3. Manage Layers and Maps, update the styles.

4.1 GeoNode basic resources

GeoNode welcome page shows at the top of the page the toolbar including quick links to basic resources: layers, maps and documents.

Layers are publishable resources representing a raster or vector spatial data source. Layers also can be associated with metadata, ratings, and comments. By clicking the Layers link you will get a list of all published layers, figure 3.

The screenshot displays the 'Explore Layers' interface on the GeoNode platform. The top navigation bar includes links for Layers, Maps, Documents, People, and Groups, along with a search bar and a 'Sign in' button. The main content area is titled 'Explore Layers' and features a sidebar with filters and a main list of layers. The sidebar includes a 'Cart' section, a 'Create a map' button, and a 'Filters' section with a 'TESTO' dropdown, a 'Search by text' input, and a 'TYPE' dropdown showing 'Raster' (3) and 'Vector' (13). The main list shows 16 layers, with the first three being: 'precipitacion media anual' (CLIMATOLOGY METEOROLOGY ATMOSPHERE), 'structural stations' (GEOLOGY), and 'acoculco loshumeros DEM 15m' (ELEVATION). Each layer entry includes a thumbnail map, a title, a description, and metadata like author, date, and view count.

Figure 3 List of available layers

Maps are comprised of various layers and their styles. Layers can be both local layers in GeoNode as well as remote layers either served from other WMS/WFS servers or by web service layers such as OpenStreetMap, figure 4.

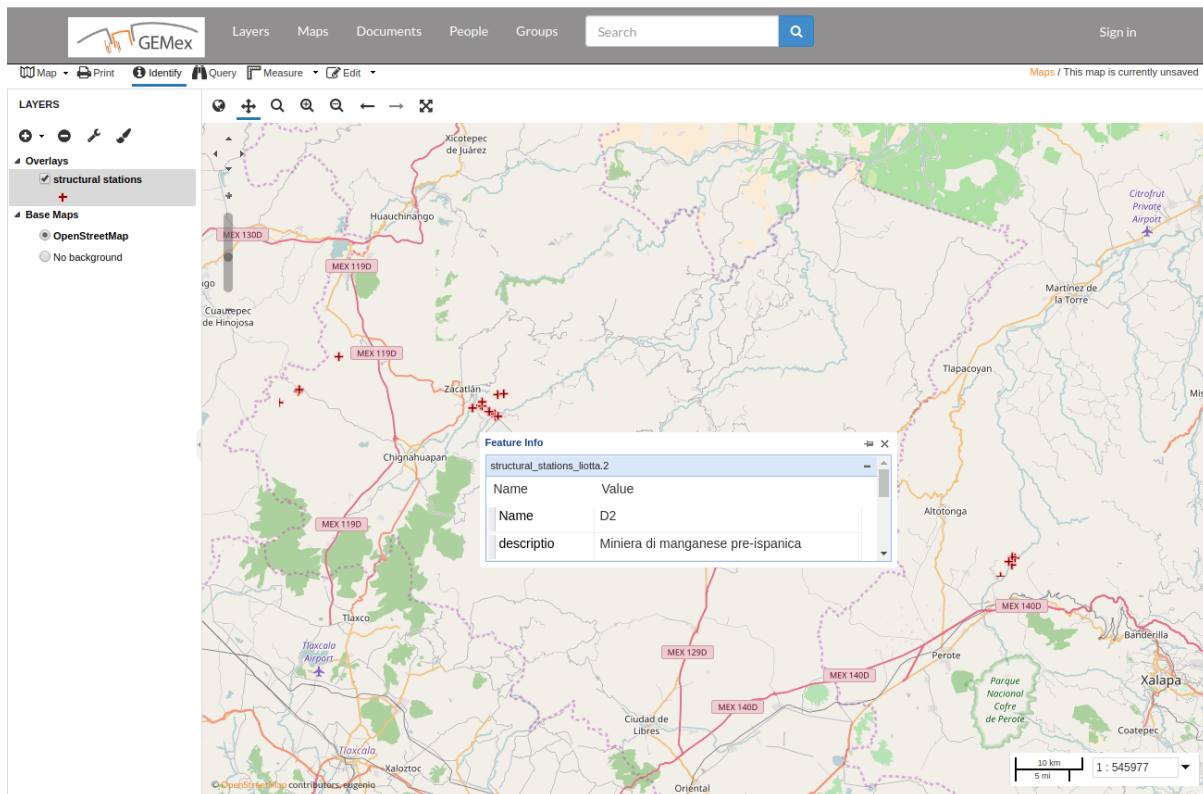


Figure 4 GeoNode webGIS interface to display maps

GeoNode WebGIS allows user to perform maps browsing (as map zoom in, zoom out, pan and extent) by using the tools available in the toolbar (figure 5).

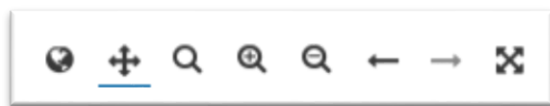


Figure 5 WebGIS navigation toolbar

The top toolbar, here in figure 6, provides functionalities to save map (it needs the user registration), to publish map as iFrame, to print map and to perform useful map analysis. The button represented by 'i' which stands for 'Information' allows users to interrogate the map by clicking on a map item. The query button permits to carried out query on vectorial data table by using logic operators. Eventually Measure function renders the length or surface of a sketched line or polygon in the map.

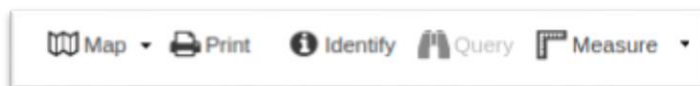


Figure 6 WebGIS map management bar

In the left side of the WebGIS framework there is the 'Table of Contents' where all the loaded layer in the map are listed. The user is able to move the layers up and down only dragging and dropping the interested layer. Moreover, the table of content bar, showed in figure 7, gives the

possibility: i) to load new layers both from the available layer in GeoNode and from online web services; ii) to delete a layer; iii) customize the style of the layer and iv) configure the properties of a layer.

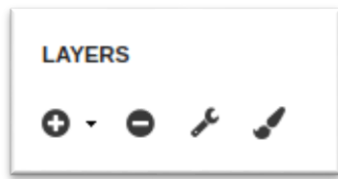


Figure 7 Table of content toolbar

As mentioned, layers from web map services can be added by choosing ‘Add a new server...’ from the combo box appears when user click on ‘plus’ icon and then ‘Add layers’. The URL of the web services have to be provided with this syntax:

`http://example.com/geoserver/wms`

The wrench icon allows the users to set up and adjust the layer properties, such as description, title, transparency, the typology of the info box and to set layer limit by scale. The paint icon is useful for changing the style of the layer.

By right click on a layer in the table of content a context menu reports the same function of the toolbar shown in figure 7.

As for the layers and maps GeoNode allows to publish tabular and text data and manage metadata and associated documents. By clicking Documents, the user will get the list of the published documents. Through the document detailed page is possible to view, download and manage a document, figure 8.

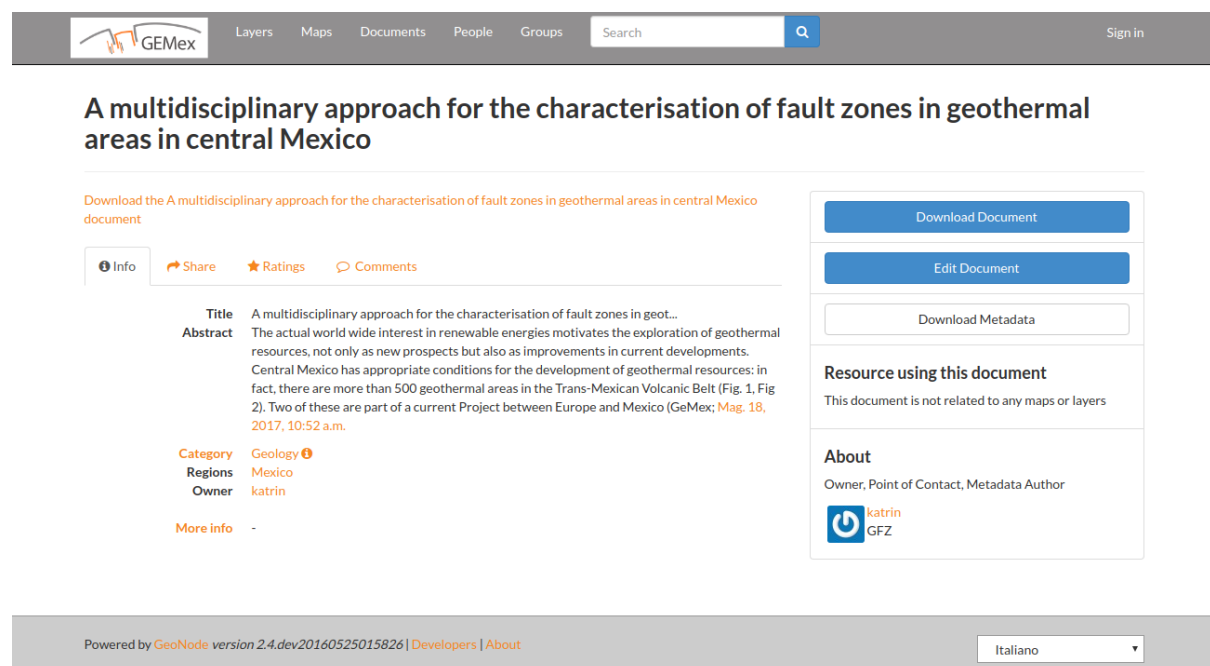


Figure 8 Document details page

4.2 GeoNode search tool

In GeoNode welcome page, click the Search button to bring up the Search page. This page contains a wealth of options for customizing a search for various information on GeoNode. This search form allows for much more fine-tuned searches than the simple search box is available at the top of every page.

It is possible to search data by Text, Categories, Type, Keywords, Date, Regions or Extent. All these information are filled-in in each dataset metadata. During the filtering operation the list of layers is updated on the fly.

4.3 Geonode management of layers and maps

At the moment the GEMex Open Access Database does not allow to register new user. All the operation to load data, metadata compilation, permission assignment on data are not available. Only the GeoNode administrator has the grant for these operations. In order facilitate the collection operation, new users with administrative capabilities can be set up if needed during the life time of the GEMex project.

From the Layers, Maps and Documents list pages users can now get information on layers/maps/documents, download layers/documents metadata in different format (i.e., ISO, FGDC, ebRIM, Dublin Core, DIF and Atom), create maps from a layer, download map layers (if layers can be released), view maps, print maps, query map layers, view documents metadata and download document (if document can be released).

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