COLLECTION OF USE CASES FROM EACH TCS

Appendix-1 for Deliverable D6.4 (M18)

Document information Summary

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Main Author(s):	Jan Michalek
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Reviewer(s):	Keith Jeffery, Daniele Bailo and Matt Harrison
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SUMMARY

This document consists of use cases described by individual WPs (WP8-WP17) in deliverables Dx.4 (M6). The Use Cases are describing a typical workflow that the users typically work with and are expecting similar functionality from the EPOS web portal. For designing the GUI of the EPOS web portal and its functionality, this information is crucial. The typical use cases were collected by the WP6&7 team from TCS WP8-WP17 during the Requirement and Use Cases Collection (January - March 2016).
The uses cases differ by its complexity and the TSCs are usually describing a simple use case first and then a more complex one (usually cross-disciplinary use case). The simple use case is usually describing search for single domain specific data their simple visualization and download. The complex use cases are expecting to search for datasets from various disciplines. The visualization of datasets is expected to be done one by one or as a combination of various datasets. Furthermore the detailed analysis of all datasets is expected to be done via the web portal interface either using predefined tools or using a programmable interface. The final results of analysis can be saved and additionally made searchable for other users of EPOS portal.

Most of the use cases are describing how they expect to access data but some of them are also describing provision/update of their own datasets (e.g. WP10-2) towards the EPOS.
WP8 and WP12 are also providing a class diagrams and sequence diagrams for their use cases.
The complete list of use cases and navigation to them is provided via the "Table of Contents" below.

List of TCSs

- WP8 (SEIS): 2 use cases. First is using seismological data only and the second one is cross-disciplinary using data from other TCSs
- WP9 (NFO): 2 use cases. First is using seismological data only and the second one is cross-disciplinary using data from other TCSs
- WP10 (GNSS): 12 various use cases
- WP11 (VOLC): 1 simple use case
- WP12 (SATEL): 2 main use cases which are related to the retrieval and visualization of data products and execution of on demand processing services
- WP13 (GEOM): 5 various use cases
- WP14 (ANTH): 1 use case
- WP15 (GEOL): so far 14 use cases
- WP16 (MSL): 2 use cases + suggestions for more use cases
- WP17 (GETB): no use case so far

WP8 Use Cases

WP8 - Use Case 1: Very basic use case to gather all seismological data and data products after a strong earthquake in a given area and plot or list them

Use case name / topic

- -

Very basic use case to gather all seismological data and data products after a strong earthquake in a given area and plot or list them.

Use case domain

- -

This use case is:
- Discipline-oriented, namely focusing on the discipline of: primarily seismology but it can be useful for other disciplines
- Multidisciplinary, namely focusing on the disciplines of: seismology, geology, earthquake engineering

Use case description - *In this section the use cases will be outlined. This section may require iterative refinements.*

- -

As a researcher in seismology (and/or as a duty officer at an operational center that needs to provide scientific information to people and media), I want to know all the relevant information available for a given area where a strong earthquake occurred in the past (or just struck). This will allow for the identification of the main tectonic, geological, seismological features and information of the area. This is important to gain more scientific information for proper first assessment of the existing information, download the data of interest and to better target new research to study further the area and the earthquake specifically (or for the information to be divulged to the media for example).

Actors involved in the use case - *A list of the actors who communicate with this use case.*

- -

- <IT System leader, Researcher, (duty officer of seismological operational center)>
- <Seismologist>

Priority - *How important is this Use Case to the TCS?*

- -

High.

Pre-conditions

- -

A strong earthquake has occurred in a given area.

Flow of events – user view - *Determine the start and the end of the typical Use Case scenario. If a use case scenario grows too complex, it can be split up into subsequent scenarios.*

- -

Basic sequences and needed steps (user view) - The following steps are needed to answer the question:
1. Either a <researcher> or <operational center> provides earthquake location and magnitude of a M6+ earthquake in the Euro-Mediterranean area.
2. < Researcher > wants to know what is known and available of the epicentral area and in particular:
    a. Maps of seismicity 24H, 3d, 3m, 1y, 10y from the event origin time (OT)
    b. Maps of the available focal mechanisms (or moment tensors)
    c. Plots of the recorded strong and weak motions ordered by distance from the epicenter
    d. Shake maps of the earthquake
    e. Maps of historical earthquakes
    f. List of the historical earthquakes
    g. Seismic hazard map of the region
    h. Map and list of the known faults in the area

System workflow - system view

- -

1. In order to execute step 1, the existence of an operational center is not required since the user could be a scientist interested to trigger the whole procedure for research purposes (in this case the earthquake might be an old one).
2. The system based on the earthquake location identifies the:
    a. Rectangular area where to make the following queries to the different DBs and/or the country and associated institutions where the products are available (e.g., shakemaps).
    b. Shared storage area where the products will be made available.
3. In order to execute step 2a, the system must perform the following actions:
    a. Query the DB and extract the past events according to time (i.e., 24H, 3d, 3m, 1y, 10y) and to magnitude (e.g., M>3.0).
    b. Make as many maps with the seismicity as requested (one or more standard formats with predefined background geographic information (terrain, national and administrative boundaries, municipalities, roads and railways, etc.).
    c. Push the plots to the pre-defined storage area above.
4. In order to execute step 2b, the procedure is similar to 3 with:
    a. System queries the moment tensor DB(s). Note that there could be more than that available at EMSC.
    b. Plots on the map the available moment tensors and, if available and reliable according to some quality index, the automatic solution.
    c. Push the plots to the pre-defined storage area above.
5. In order to execute step 2c, the procedure involves the following:
    a. Submit the query using the FDSN web services to EIDA to download the relevant weak and strong motion data.
    b. Plot the waveforms according to distance using a time vs distance plot service.
    c. Push the plots to the pre-defined storage area above.
6. In order to execute step 2d, the procedure involves the following:

   a. Use the web services to query the shakemap DB (it is available at INGV, NIEP, NOA, ETHZ, …) and download the relevant maps (MMI intensity, PGA, PGV, PSA03, PSA10 and PSA30).
   b. Push the plots to the pre-defined storage area above.
7. In order to execute step 2e and 2f, the procedure involves the following:
   a. Use the web services to query the AHEAD DB and download the available event catalogue for the area.
   b. Push the list in CSV format for example to the storage area above.
   c. Plot the retrieved historical earthquake catalogue.
   d. Push the plots to the pre-defined storage area above.
8. In order to execute step 2g, the procedure involves the following:
   a. Submit a query to retrieve the seismic hazard map for the target rectangular area.
   b. Plot the hazard map with the earthquake epicenter represented.
   c. Push the plots to the pre-defined storage area above.
9. In order to execute step 2h, the procedure involves the following:
   a. Submit a query to retrieve the known faults for the target rectangular area.
   b. Plot the known faults with the different symbols according to the faulting mechanism.
   c. Push the list of faults and their relevant parameters in CSV format to the storage area above
   d. Push the plots to the pre-defined storage area above.
10. Notification of completed job is sent to the seismologist, to the duty officer of the seismological operational center.

Post-conditions

The job is finished when the products are present onto the created storage area (workplace storage).

Extension Points

The use case can be easily extended to add more products: for example, the 3D seismic velocity structure is available. Similarly, the resulting products can be assembled into a report which can be edited and commented by the researcher.

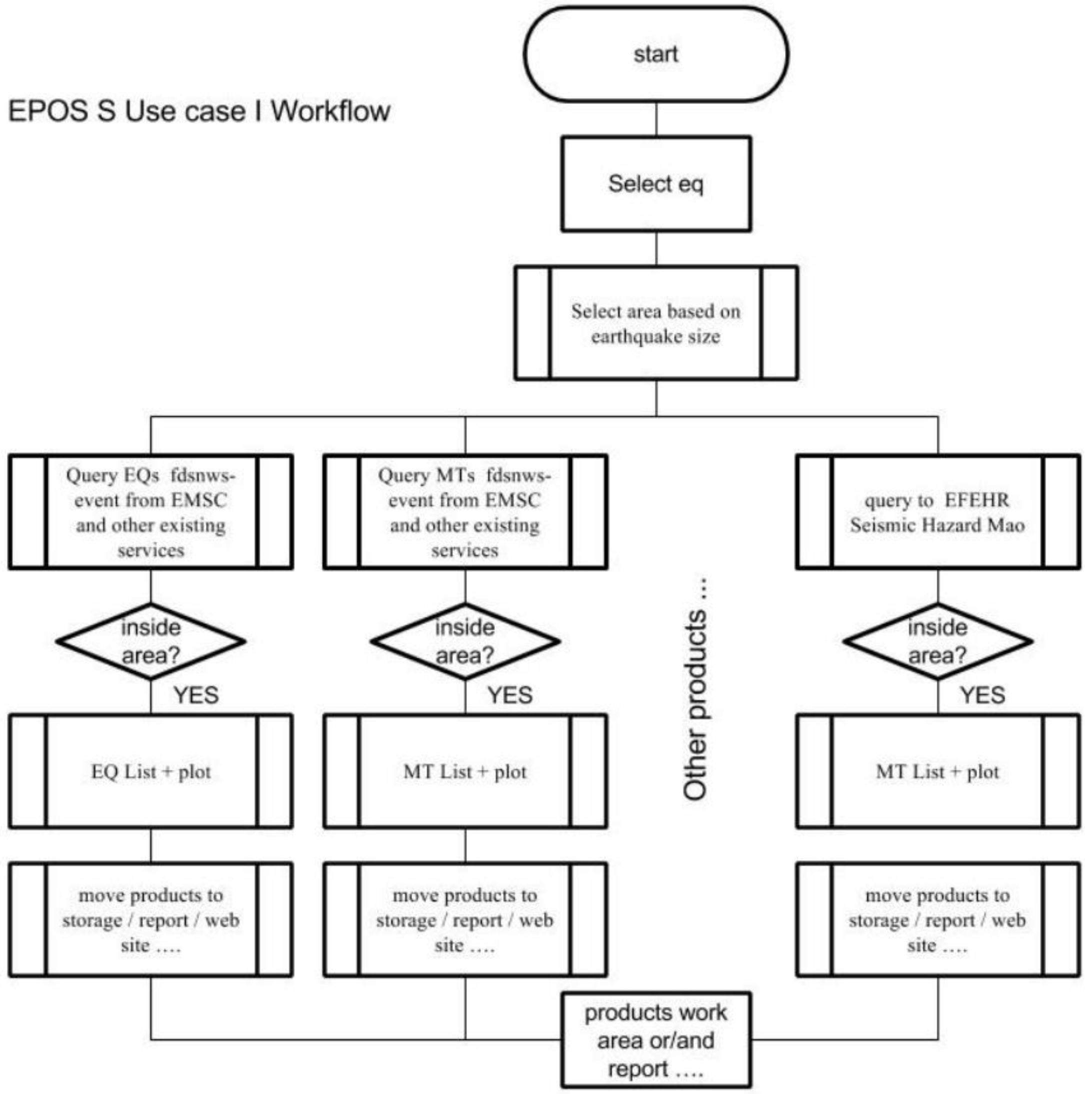
« Used » Use Cases

No, the use case is very basic and it avails of individual services provided for the mot in the TCS-Seismology.

Other Requirements

Prompt availability of the data in a near real-time environment can become a prerequisite in case the user requests the information shortly after the earthquake of interest has occurred.

Class and sequence diagram the use case:



WP8 - Use Case 2: A landslide event in the study region and he/she wants to investigate whether it had been triggered by an earthquake

Use case name/topic

- -

A landslide event in the study region and he/she wants to investigate whether it had been triggered by an earthquake.

Use case domain

- -

This use case is:
- Discipline-oriented, namely focusing on the discipline of: primarily geologists interested in landslides.
- Multidisciplinary, namely focusing on the disciplines of: seismology, geology, geotechnical engineers.

Use case description - *In this section the use cases will be outlined. This section may require iterative refinements.*

- -

The interest of the user has been triggered by a landslide event in the study region and he/she wants to investigate whether it had been triggered by e.g. a local earthquake. As the user has just observed the landslide but has limited information on the cause of the event, the user will try to collect data and try to identify when the event happened and what triggered the event.

Actors involved in the use case - *A list of the actors who communicate with this use case.*

- -

- <IT System leader, Researcher>
- <Landslide geologist>

Priority - *How important is this Use Case to the TCS?*

- -

Moderate.

Pre-conditions

- -

A landslide has occurred in a certain area.

Flow of events – user view - *Determine the start and the end of the typical Use Case scenario. If a use case scenario grows too complex, it can be split up into subsequent scenarios.*

- -

Basic sequences and needed steps (user view) - The following steps are needed to answer the question:

1. <Researcher> chooses the geographical position and the presumed time of a landslide to defines the target area. Retrieves all the products available in a time interval (t0, t1) in an area with radius R< 100 Km from the location of the event (cf. Use Case I for detail). Restrictions based on the dataset and/or product type, name, etc... can also be applied. e.g. seismic waveform data (sensors type = broad-band station, accelerometric station), seismic event data (earthquake bulletin/parameters), GNSS data (sensor type = cGPS), satellite data (multispectral satellite images),...

2. The user will query the TCS-Seismology services (ORFEUS/EIDA) to retrieve continuous seismic waveform data from broad-band and accelerometric stations within the defined time window for the given region (circular area centered on the landslide event). The user may filter the seismic waveforms for a number of pre-calculated quality parameters and request domain specific metadata describing the sensors. This first spatial-temporal query returns a package containing the given waveforms in the domain specific format (mseed) filtered by a number of quality parameters and the domain specific metadata format (station XML).

3. The user will query the TCS-Seismology services (EMSC) to discover whether any seismic event within the defined time window for the given region (circular area centered on the landslide event) may have triggered the landslide. From a quick analysis the user identified that there was a seismic event in the target area that may have triggered the observed landslide.

4. The user will now query the TCS-GNSS data on a narrowed time interval and region to check whether a cGPS station is available in the area and eventually recorded some deformation at the surface. Continuous GPS data will be retrieved together with the domain specific metadata. Results show no deformation visible at the nearest station.

5. The user will now retrieve satellite images (i.e. TCS Satellite data) and try to identify if the seismic event may have triggered the landslide. From the satellite images it is clear that the seismic event and the landslide event are unrelated, thus no chance yet to address at least the origin time of the landslide event. But now the user has a restricted time frame for the origin time of the landslide event identified from the satellite images.

6. The user goes back to the previously downloaded continuous waveforms and tries to detect the landslide event using the seismic data in a restricted time window based on the evidence in the satellite images. The user is successful to identify the landslide event origin time using the seismic waveforms.

7. Having identified the origin time of the landslide event and having proved that this was not triggered by a seismic event the user would like now to estimate the mass movement of the landslide. Unfortunately, it turns out that the seismic waveforms are in a format which is not easily manageable by our user (i.e. raw data) who is used to handle seismic waveforms in physical units.

8. Consequently our user decides to stage-in his assembled data set to the computational facilities (i.e. HPC or HTC, depending on the needs) which match the requirements of the specific computational problem and where the actual computation takes place after the retrieval of the data (transparent to the user). The user will then have a new assembled data set with instrumental correction applied according to the domain-specific metadata.

9. The user can now finally estimate the mass movement involved in the landslide event using a simple relation between the amplitudes in physical units and the mass involved.

10. The user has now an extensive data set composed by: instrumentally corrected waveforms, satellite images proving that the landslide event was not triggered by a seismic event, landslide (possibly with an identifier) with origin time and mass estimation and his/her own simple software written to detect the landslide on the seismic waveforms.

11. As a final step the user might want to share the results of his/her analysis together with the identifiers of the data products generated by him/her and make data and results available to his/her colleagues. The system provides an easy way to bundle the whole package, assigning identifiers and proper metadata, and make it available for discovery.

Once published the results of the analysis could be retrieved by scientists studying the same event from a different perspective. But, in order to facilitate their understanding and usability, the results need to be equipped with metadata which are rich enough and describe the type of product and the way to use it. Cross disciplinary links should also be made possible for example by means of annotations.

System workflow - system view

1. Enable discovery based on multi-layered metadata: from high level discovery metadata to domain specific metadata (*Req 1*).
2. Identify, integrate and link data and products by means of PID (*Req 2*).
3. Enable data processing and visualization on distributed resources (*Req 3*).
4. Collect and manage provenance information (*Req 4*).
5. Bundle, publish and share results (*Req 5*).
6. Enable citation and reproducibility of science (*Req 6*).
7. Provide accountability and usage statistics *(Req 7*).

Post-conditions

The job is finished when the products are present and it has been set up accountability and usage statistics.

Extension Points

None.

« Used » Use Cases

Yes, the use case although different from the previous one adopts a very similar structure.

Other Requirements

Availability of metadata and PIDs.

WP9 Use Cases

Using the advantages of multi-disciplinary data sets, we can organize many simple Use Cases. Table 3 includes general categories of these examples.

Table 3 Example Use Cases,

	Use Cases
Time Series	X Chemical Component in time Geodetic Displacement (all comp) Number of earthquakes per day b-value in time Vp/Vs, Vp, Vs, Attenuation in time at site Heat Flux in time
Maps with surfaces	X Chemical component distribution Map Layers from 3D models (Vp, Vs, Vp/Vs, Poisson ecc) Faults surfaces Geo Layers top and bottom surfaces Seismological Discontinuity surfaces Heat Flux Vertical Sections through 3D models
Positional maps	Interactive Maps of selected site positions Interactive Maps of selected earthquake positions Space-Time earthquakes distribution
Histograms and Dispersion	Selected earthquake parameters' errors distribution Selected earthquakes' depth distribution depth errors vs Origin-time errors Dromocronas (Distance vs P and S Traveltime)
VLAB	Vp/Vs, Vp, Vs, Neqks/Day, CO2 flux, Radon Flux, Geodetic Displacements ALL at site

In the following part, we specified one internal and one cross-disciplinary Use Case in detail.

WP9 - Use Case 1: Selecting and viewing earthquakes' distribution in maps and vertical sections

Use case name/topic: *Selecting and viewing earthquakes' distribution in maps and vertical sections*

Use case domain This use case is *related to one single discipline: seismology. The goal is to allow the user to select earthquake locations from a specific NFO-DB based on some spatiotemporal quality criteria and to plot the distribution on a geographic map and/or along a vertical cross-section in which, extremes are interactively selected on the map. The aim is to help understanding the fault system geometry and spatio-temporal trend of the seismicity pattern.*

Use case description: As a seismologist I want to observe the spatial and temporal distribution of earthquake sources in the fault system volume in different 2D views. I want to be able to choose

- the type of locations to use for plots (1D or 3D obtained with different location
- codes)
- the quality of such locations (rms residuals, coverage, h_err, v_err, nP, nS and
- so on)
- the time window
- the volume (geographic area + depth range)
- the magnitude range
- the magnitude threshold to use different symbols and show focal mechanisms if available

I also want to use a color palette to identify the time range of plotted locations.

On the interactive map, I want to be able to select a horizontally arbitrarily oriented rectangular box to produce a vertical cross-section with earthquake locations. The crosssection should be a projection of earthquakes within the selection box to a vertically oriented face chosen by me.

Actors involved in the use case

- *User Seismologist*
- Seismology researcher

Priority: *High*

Pre-conditions: *User must have logged in*

Flow of events – user view

The following steps are need to answer the question:

1) seismologist user chooses
   a) the specific NFO [the use case is focused on just one NFO]
   b) a time window
   c) a geographic region inside the NFO area (or the whole)
2) seismologist user chooses
   a) criteria to select earthquakes' locations by
      i) type of location
      ii) quality of location
      iii) magnitude range
   b) magnitude threshold to show stronger earthquakes with different symbols and eventually attribute a focal mechanism if available
   c) whether to use a color palette for time
   d) symbols to use for earthquakes beyond the magnitude threshold
3) seismologist user produces a geographical map with shaded topography, seismic station distribution, earthquake locations plotted as dots colored as a function of time and strongest earthquakes plotted with the same color code but with different symbol and focal mechanism associated if available
4) on the produced map, seismologist user
   a) draws an oriented rectangle on the map
   b) obtains a new Distance/Depth (XZ Cartesian) plot with all the locations included within the rectangle within a chosen depth range (scaled plot) with the same color and symbol code as the map and focal mechanisms if available.
5) The locations, magnitudes, focal mechanisms, related locations' quality parameters are restituted to the user in a quakeML catalog with all metadata included.

System workflow - system view

1. The user interface receives the input parameters for query_locations
2. It activates a task (query_locations) connecting to the specific NFO database
3. The task connects to the database and performs a query typically combining information from locations, quality, magnitudes, and focal mechanism tables
4. The task generates a temporary VIEW (see mySQL) in the DB storing the results from the combined query (one line per location)
5. The data contained in the VIEW are also stored in a downloadable quakeML catalog file
6. A listening service takes data from the view and produces the interactive map
7. The interactive map allows to draw the rectangle based on which extremes a sub_task is activated selecting earthquakes from the view based on polygonal in/out function and locations are plotted in a vertical section
8. A button to reset the vertical section plot and redraw the rectangle is made available

Post-conditions *The View is kept in the DB as long as the user session is active or until the session timeout is passed*

Extension Points If the use case has extension points, list them here.

No extension points.

« Used » Use Cases If the Use Case uses other Use Cases, list them here.

No other use cases.

Other Requirements This can include non-functional requirements related to the Use Case. *Privacy legislation, response time of the system*

WP9 - Use Case 2: Viewing and comparing Vp/Vs ratio to Radon concentration in time

Use case name/topic: *Viewing and comparing Vp/Vs ratio to Radon concentration in time*

Use case domain This use case is *Cross-disciplinary. The goal is the comparison of two "entities" related to seismological (Vp/Vs time series) and geochemical (Rn concentration time series) disciplines. The scientific reason for this is looking for changes (in space and time) related to the deformation process (e.g. fracturing and/or fluid migration processes) occurring during the pre- co- or post-seismic phase.*

Use case description: *As a seismologist I want to observe and compare the spatial and temporal behavior of P- and S-wave velocity ratio (referable to the rock volume elastic parameters) with the temporal and spatial pattern in Rn concentration in a defined rock volume (referable to on-going deformation processes), looking for statistically coherent change points, thus possibly ascribable to the same undergoing physical process such as for example the earthquake preparatory phase.*

Actors involved in the use case
- *User Seismologist*
- *Geochemistry researcher*

Priority: *Medium*

Pre-conditions: *User must have logged in*

Flow of events – user view
The following steps are needed to answer the question:

6. *seismologist user chooses*
   a) *the specific NFO [the use case is focused on just one NFO]*
   b) *a time window*
7. *seismologist user chooses*
   a) *a specific seismic station*
   b) *criteria to select seismic rays by earthquake location quality and takeoff angle*
   c) *criteria to generate a moving mean (boundary and default criteria are suggested by the Seismology researchers group*)
   d) *a magnitude threshold to show strongest earthquakes on top of the two time series*
8. *seismologist user chooses*
   a) *one specific site from suggested neighboring Radon sites active in the same period or part of it, based on the step 2*
   b) *criteria to correct for meteorological data and to produce a moving mean (boundary and default criteria are suggested by the Geochemistry researchers group)*
9. *seismologist user produces a combined X (time) vs Y (Vp/Vs ratio) and Y' (Rn concentration) dispersion plot with symbols and strokes*

Alternative sequences and needed steps (user view)

1. *seismologist user may skip to step 3 (Geochemistry) before step 2 (Seismology). Step 1 is forced to be the beginning.*

System workflow - system view

9. *The user interface receives the input parameters for query_vpvs and query Radon*
10. *It activates two tasks, one per CPU, connecting to the specific NFO database*
11. *Each task connects to the database and searches, for the chosen recording site, records that match to the required criteria: SQL queries might be complex or simplequeries, depending on the DB structure, operating on the basic tables containing*
    a) *Vp/Vs: P arrival times (and related quality parameters), S arrival times (and related quality parameters), earthquakes locations, quality of earthquakes locations, takeoff angles, back-azimuth angles*
    b) *Radon concentration: Rn counts, site correction parameters, meteorological site parameters*
12. *Each task restitutes a file on disk in a standardized format for time series (to be*

defined)

13. *A listening service takes the files as soon as they are ready and produces an interactive plot where only scales, symbols and colors can be changed*
14. *A button to "Change criteria" sending to the selection page from step 2 is made available (see post-conditions)*

Post-conditions *The request is kept in memory to be reloaded as default in step 6 of the System workflow*

Extension Points If the use case has extension points, list them here.
No extension points.

« Used » Use Cases If the Use Case uses other Use Cases, list them here.
No other use cases.

Other Requirements This can include non-functional requirements related to the Use Case.
Privacy legislation, response time of the system

WP10 Use Cases

WP10 - Use Case 1: A GNSS network manager wants to add/remove a station to/from his GNSS network contributing to EPOS

Use case name/topic: A GNSS network manager wants to add/remove a station to/from his GNSS network contributing to EPOS
Use case domain This use case is: *discipline-oriented, namely focusing on the discipline of geodesy*
Use case description *As a <GNSS network manager> I want to <add/remove a station to my GNSS network contributing to EPOS> so that I can <include the GNSS stations into the EPOS network and share its data with the community>.*
Actors involved in the use case ● *System user – data provider* ○ *GNSS network manager*
Priority Medium
Pre-conditions GNSS network manager has valid login/password for Site log submission center associated with a GNSS network name.
Flow of events – user view 1. *< GNSS network manager > logs into <Site log submission center> using GUI* 2. *< GNSS network manager > enters an "update (or create) OC (operational center) form" request at the GUI of the <Site log submission center>* 3. *< GNSS network manager > updates (or fills) the OC form with a list of stations and the type of data he will submit* 4. *< GNSS network manager > receives confirmation of responsibility for the list of stations entered in the OC form*
System workflow - system view

1. *The user interface receives login information* 2. *The user interface receives OC updates* 3. *The user input is validated at the <Site log submission center>* 4. *The user interface connects to its internal database and adds the information on GNSS station responsability*
Post-conditions
Extension Points
« Used » Use Cases *No other use cases.*
Other Requirements GNSS network manager has valid login/password for Site log submission center associated with a GNSS network name.

WP10 - Use Case 2: Updating GNSS station information (T1 metadata) at the <Site log submission center>

Use case name/topic: *Updating GNSS station information (T1 metadata) at the <Site log submission center>*
Use case domain This use case is: *discipline-oriented, namely focusing on the discipline of geodesy*
Use case description *As a <GNSS station manager> I want to <update the information on the equipment installed at my GNSS station> so that I can <keep track of this hardware change at the station and disseminate this information to the rest of the community>.*
Actors involved in the use case ● *System user – data provider*   ○ *GNSS station manager*
Priority *Medium*
Pre-conditions *User (station manager) must have the permission to update the station information and must be logged in.*
Flow of events – user view 1. *< GNSS station manager> selects the station for which he wants to update the information at the <Site log submission center>* 2. *< GNSS station manager > enters the information in the GUI of the <Site log submission center>* 3. *< GNSS station manager> receives confirmation/rejection of the new input based on several validation criteria* 4. *< GNSS station manager > receives a standardized file containing all the GNSS station information*
System workflow - system view 1. *The user interface receives the input* 2. *It validates the input* 3. *It connects to its internal database and updates the validated information* 4. *It produces a file based on the new database content*
Post-conditions

The information is sent to the EPOS GNSS data gateway.
Extension Points
« Used » Use Cases A GNSS network manager wants to add/remove a station to/from his GNSS network contributing to EPOS
Other Requirements The station manager must have identified the station for wish he updates the information as part of a network falling under his responsability.

WP10 - Use Case 3: Iberia GNSS velocity field

Use case name/topic: *Iberia GNSS velocity field*
Use case domain This use case is: *Multi-discipline-oriented, namely focusing on the discipline of Geodynamics*
Use case description A search for all computed GNSS derived velocities in Iberia based only on high quality GNSS time series longer than 3 years
Actors involved in the use case ● *Scientists interested in plate tectonics in Iberia* ● GNSS data providers, ● WP10 Product gateway ● WP10 analysis centres who compute GNSS positions and the associated velocities
Priority *High*
Pre-conditions User should be logged in with some EPOS authentication system (shibboleth, eduroam, google etc..)
Flow of events – user view 1. User selects rectangle to define geographic region for which GNSS data and products are required on GNSS product gateway. 2. User refines search to limit results for stations that have time span longer than 3 years and also stations which provide high quality daily solutions - hence this search combines GNSS data availability and GNSS products. 3. A list of URL's to files with velocity solutions for the stations is returned.
System workflow - system view 1. The user interface receives the input of the geographic region and quality metrics 2. It connects to the WP10 Product Gateway preforms a search on the required data 3. A script is produced containing the URL's to files with velocity solutions. 4. The user runs the script (inside the work-flow or independently)
Post-conditions The Request should be logged so that the user can retrieve and rerun the workflow - possibly with different conditions.
Extension Points

« Used » Use Cases
Other Requirements Data Should be Flagged as Public Data should be retrieved within a pre-defined (user configurable) time period else search is cancelled on sub-node

EUROPEAN PLATE OBSERVING SYSTEM phone +39 06 51860.401 / 577 / 652 / 636 | epos@ingv.it | epos.secretariat@ingv.it | www.epos-eu.org

HORIZON 2020

WP10 - Use Case 4: Compute the velocity of a station using external information to detect co-seismic offsets

Use case name/topic: Compute the velocity of a station using external information to detect co-seismic offsets
Use case domain This use case is: *Multi-discipline-oriented, namely in the area of Velocity computations*
Use case description *As a <time-series analyst> I want to <compute the secular motion of the stations> so that I can <compute strain rates>.*
Actors involved in the use case ● *Time-series analyst* ● GNSS data providers, ● Seismic catalogue providers (e.g., WP08) ● WP10 Product Gateway ● WP10 analysis centres who compute GNSS positions
Priority *Medium*
Pre-conditions *User must have logged in.*
Flow of events – user view 1. User selects rectangle to define geographic region for GNSS stations of interest. 2. User retrieves daily coordinates for the GNSS stations of interest from the WP10 Product Gateway 3. User retrieves seismic catalogue with seismic events nearby the region of interest. 4. User computes the offsets for the epoch of the events. 5. User provides updated information on the co-seismic offsets and secular velocities to the WP10 Product Gateway.
System workflow - system view 1. The user interface receives the input of the geographic region and quality metrics 2. It connects to the EPOS ICS Gateway to preform a search on the required data 3. A script is produced containing the URL's to files with time-series and catalogue of seismic events. 4. The user runs the script (inside the work-flow or independently) 5. The user uploads new solutions to the EPOS Product Gateway.
Post-conditions The Request should be logged so that the user can retrieve and rerun the workflow - possibly with different conditions.
Extension Points
« Used » Use Cases
Other Requirements

WP10 - Use Case 5: Obtaining GNSS data for the estimation of Volcano deformation

Use case name/topic: *Obtaining GNSS data for the estimation of Volcano deformation*

Use case domain This use case is: *Multi-discipline-oriented, namely focusing on the discipline of volcanology.*

Use case description
As a <researcher of volcanology> I want to <access GNSS data> so that I can <estimate short-term deformations pre-, co- and/or volcanic eruptions> using high-rate (1Hz) data.

Actors involved in the use case
- System user - Researchers (e.g., WP11)
- GNSS data providers (e.g., WP11 networks)
- WP10 Data Gateway

Priority *Medium*

Pre-conditions
User should be logged in with some EPOS authentication system (shibboleth, eduroam, google etc..)

Flow of events – user view
1. *<volcanogic researcher> chooses location to study*
2. *<volcanogic researcher> chooses the GNSS stations and time interval of the record*
3. *<volcanogic researcher> downloads the desired data (hourly files at 1Hz) for deformation calculation*

System workflow - system view
1. *The user interfaces receives the input: location (coordinates) and time interval*
2. *It connects to the database and searches records on station located on the coordinates for the specified time period*
3. *The user interface delivers a list of stations with the desired data*

Post-conditions
The Request should be logged so that the user can retrieve and rerun the workflow - possibly with different conditions.

Extension Points

« Used » Use Cases

Other Requirements

WP10 - Use Case 6: Volcano velocity/deformation field estimation for multidisciplinary modelling

Use case name/topic: Volcano velocity/deformation field estimation for multidisciplinary modelling

Use case domain This use case is: *discipline-oriented, namely focusing on volcano monitoring*

Use case description
For < volcano monitoring> I want to <access GNSS deformation/velocity estimates> so that I can < use

long/medium term deformation around a volcano for multidiplinary modelling of volcanic processes (comping with InSAR, seismic ...)> derived from 30 s data.
Actors involved in the use case 1. *System user – Researchers/monitoring agency (e.g. WP11)* 2. *GNSS data providers (e.g. WP11 networks)* 3. *WP10 Data Gateway* 4. *other WP TCS's* 5. WP10 analysis centres who compute GNSS positions and the associated velocities 6. possibly other EPOS software and computing facilites
Priority Medium
Pre-conditions User should be logged in with some EPOS authentication system
Flow of events – user view ● User selects rectangle to define geographic region for which GNSS data and products are required on GNSS product gateway. ● User refines search to limit results for stations to fit the appropriate time spans (possibly more then one) ● A list of URL's to files with velocity solutions for each time window for the stations selected is returned to be joint with other data types for further processing ● joint source modeling of multidisciplinary data for a particular volcanic system
System workflow - system view ● The user interface receives the input of the geographic region ● It connects to the WP10 Product Gateway preforms a search on the required data ● A script is produced containing the URL's to files with velocity solutions. ● The user runs the script (inside the work-flow or independently)
Post-conditions The Request should be logged so that the user can retrieve and rerun the workflow - possibly with different conditions.
Extension Points
« Used » Use Cases *No other use cases.*
Other Requirements

WP10 - Use Case 7: Co-seismic displacements associated with a Mw7 earthquake in Greece

Use case name/topic: *Co-seismic displacements associated with a Mw7 earthquake in Greece*

Use case domain This use case is: *Multi-discipline-oriented, namely focusing on the discipline of geophysics.*
Use case description A search for all computed GNSS derived position time series that include the date of the earthquake within a circle of 300km around the epicenter
Actors involved in the use case ● *Scientists interested in active tectonics studies* ● GNSS data providers, ● WP10 Product gateway ● WP10 analysis centres who compute GNSS positions time series
Priority *High*
Pre-conditions User should be logged in with some EPOS authentication system (shibboleth, eduroam, google etc..)
Flow of events – user view 1. User selects a circle on a geographic region for which GNSS data and products are required on GNSS product gateway. 2. User refines search to limit results for stations that spans the day of the earthquake - hence this search combines GNSS data availability and GNSS products. 3. A list of URL's to files with daily solutions for the stations is returned.
System workflow - system view 1. The user interface receives the input of the geographic region and quality metrics 2. It connects to the WP10 Product Gateway performs a search on the required data 3. A script is produced containing the URL's to files with daily solutions. 4. The user runs the script (inside the work-flow or independently)
Post-conditions The Request should be logged so that the user can retrieve and rerun the workflow - possibly with different conditions.
Extension Points
« Used » Use Cases
Other Requirements

WP10 - Use Case 8: GNSS time series at the Eurasia-Nubia plate boundary in Italy

Use case name/topic: *GNSS time series at the Eurasia-Nubia plate boundary in Italy*
Use case domain This use case is: *Multi-discipline-oriented, namely focusing on the discipline of geophysics.*
Use case description A search for all computed GNSS derived position time series longer than 3 years in Italy
Actors involved in the use case ● *Scientists interested in active tectonics studies*

● GNSS data providers, ● WP10 Product gateway ● WP10 analysis centres who compute GNSS positions time series
Priority *High*
Pre-conditions User should be logged in with some EPOS authentication system (shibboleth, eduroam, google etc..)
Flow of events – user view 1. User selects a box on a geographic region for which GNSS data and products are required on GNSS product gateway. 2. User refines search to limit results for stations that have time span longer than 3 years and also stations which provide high quality daily solutions - hence this search combines GNSS data availability and GNSS products. 3. A list of URL's to files with daily solutions for the stations is returned.
System workflow - system view 1. The user interface receives the input of the geographic region and quality metrics 2. It connects to the WP10 Product Gateway performs a search on the required data 3. A script is produced containing the URL's to files with daily solutions. 4. The user runs the script (inside the work-flow or independently)
Post-conditions The Request should be logged so that the user can retrieve and rerun the workflow - possibly with different conditions.
Extension Points
« Used » Use Cases
Other Requirements

WP10 - Use Case 9: GNSS metadata download for GNSS data analysis

Use case name/topic: *GNSS metadata download for GNSS data analysis*
Use case domain This use case is: *Multi-discipline-oriented, namely focusing on the discipline of geodesy.*
Use case description A search for the metadata (e.g. site logs, a priori station information) for each scientific GNSS analysis software.
Actors involved in the use case ● *Scientists interested in GNSS data analysis* ● GNSS data providers, ● WP10 data gateway ● WP10 analysis centres who compute GNSS positions time series
Priority *Medium*

Pre-conditions User should be logged in with some EPOS authentication system (shibboleth, eduroam, google etc..)
Flow of events – user view 1. User selects a box on a geographic region or a list for which GNSS metadata are required on GNSS data gateway. 2. A list of URL's to files with site logs for the stations is returned.
System workflow - system view 1. The user interface receives the input of the geographic region and/or of the input list 2. It connects to the WP10 Product Gateway performs a search on the required data 3. A script is produced containing the URL's to files with site logs. 4. The user runs the script (inside the work-flow or independently)
Post-conditions The Request should be logged so that the user can retrieve and rerun the workflow - possibly with different conditions.
Extension Points
« Used » Use Cases
Other Requirements

WP10 - Use Case 10: Compute the velocity of a station to detect post-seismic motion

Use case name/topic: Compute the velocity of a station to detect post-seismic motion
Use case domain This use case is: *Multi-discipline-oriented, namely in the area of Velocity computations*
Use case description *As time-series analysts we want to compute the motion of GNSS stations before/after large earthquakes so that we can measure post-seismic motion. The stations are located in the central Ionian region, Greece. This area has been repeatedly subjected to strong ground shaking due to the proximity of the islands to the 140-km long CTF (Cephalonia Transform Fault). The 100-km long NNE-SSW fault zone accommodates the relative motion of the Apulia (Africa) and Aegean (Eurasia) lithospheric plates, and has a GPS slip-rate bracketed between 10 and 25 mm/yr. During the last 15 years this fault system generated 4 strong events that caused ground deformation of the order of 1-40 cm.*
Actors involved in the use case ● *Time-series analysts (NOA, NKUA, NTUA, AUTH)* ● GNSS data providers (NOA, NKUA, CRL-WP09) ● Seismic catalogue providers (e.g., WP08) ● WP10 Product Gateway ● WP10 analysis centres who compute GNSS positions ● *Scientists interested in active tectonics studies*
Priority *Medium*

Pre-conditions *User must have logged in.*
Flow of events – user view 1. User selects rectangle to define geographic region for GNSS stations of interest. 2. User retrieves daily coordinates for the GNSS stations of interest from the WP10 Product Gateway 3. User retrieves seismic catalogue with seismic events nearby the region of interest. 4. User computes the co-seismic offsets for the epoch of the events. 5. User estimates the station velocities before / after for the epoch of the events. 6. User provides updated information on the secular velocities to the WP10 Product Gateway.
System workflow - system view 1. The user interface receives the input of the geographic region and quality metrics 2. It connects to the EPOS ICS Gateway to perform a search on the required data 3. A script is produced containing the URL's to files with time-series and catalogue of seismic events. 4. The user runs the script (inside the work-flow or independently) 5. The user uploads new solutions to the EPOS Product Gateway.
Post-conditions The Request should be logged so that the user can retrieve and rerun the workflow - possibly with different conditions.
Extension Points
« Used » Use Cases
Other Requirements

WP10 - Use Case 11: Access to GNSS data quality results for monitoring purposes

Use case name/topic: Access to GNSS data quality results for monitoring purposes
Use case domain This use case is discipline-oriented, namely focusing on the discipline of geodesy.
Use case description *As a <Data-monitoring-center> I want to collect quality monitoring information so that I can monitor the quality of disseminated GNSS data and prepare a feedback to the data providers and support for data users.*
Actors involved in the use case. ● GNSS data monitoring center ● GNSS data dissemination system (in particular data gateway providing access to T3 metadata) ● GNSS data providers (local node operators, preparation of T3 metadata)
Priority High
Pre-conditions GNSS data providers (local node operators) generate and populate T3 metadata for all RINEX files in their repositories using standard tools. T1 metadata are correct and synchronized.

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Flow of events – user view 1. <Data-monitoring-center> updates the list of available stations (T1 metadata). 2. <Data-monitoring-center> collects T3 metadata for all available stations and requested recent period. The collection is foreseen using data dissemination system (via data gateway or intermadiate gateway 3. <Data-monitoring-center> performs a visualization of data quality and, alternatively, another actions.
System workflow - system view 1. <Data-gateway or intermediate-gateway> receives requests for T3 metadata collection for each station (in sequency or simultaneously, depends on both temporal and spatial domains of the request) 2. <Data-gateway> connects to local repository nodes in order to provide requested T3 metadata. The results will be provided to the <Data-monitoring-center> in requested format (JSON, XML, ..)
Post-conditions The concept of flexible data redundancy is adopted.
Extension Points
« Used » Use Cases ● Specific or subset of T3 data queries and search can be re-used by any user searching a minimum quality for GNSS stations – e.g. Multi-GNSS system (GPS, GLONASS, Galileo, BeiDou, SBAS or QZSS), type of observations or frequencies, etc. ● Remote file comparison in support of a file redundancy with a smart selection
Other Requirements

WP10 - Use Case 12: Remote file comparison in support of a file redundancy with a smart selection

Use case name/topic: *Remote file comparison in support of a file redundancy with a smart selection*
Use case domain This use case is: *Discipline-oriented, namely focusing on the discipline of geodesy.*
Use case description *As a <GNSS-user> I want to download data optimal to my request. As a <GNSS-data-gateway> I want to support data download in a smart way using automated decision.*
Actors involved in the use case ● *Data user* ● *Data providers* ● *Data gateway*
Priority: *Medium*
Pre-conditions:
Flow of events – user view 1. <Data-user> selects a subset of GNSS data files for his analysis using GNSS data gateway. 2. <Data-user> requests data download in a smart (predefined options) or in an interactive way. 3. <Data-user> obtains optimally selected files automatically or is asked shown indication on basic file characteristics (tbd, e.g. number of observations, number/list of observation types, number/list of GNSS

System workflow - system view 1. *<Data-gateway> gets the user request on data selection.* 2. *<Data-gateway> communicates with local repositories and requests specific T3 metadata* 3. *<Data-gateway> gives automatically selected files (using predefined options) or provide an interactive selection for data download to the user*
Post-conditions
Extension Points
« Used » Use Cases
Other Requirements

WP11 Use Cases

WP11 – Use Case 1: Search for vulcanological data

Use case name/topic: <u>Search for vulcanological data</u>
Use case domain This use case is multi-disciplinary
Use case description *As a **general scientist** I want to **be able to search for vulcanological data** so that I can **use that data in my current research**.*
Actors involved in the use case • **User**: Data searcher / Scientist • **System**: Data server. The system is also an actor – basically the key role here - because it responds to the initiating actor, the User.
Priority: High. Searching for data is one of the major use cases. Here the focus is on vulcanological data but in general searching for data is the first Use Case that must be in place and function before all the others.
Pre-conditions The preconditions here depend on requirements. If the requirement is that a user must be logged into ICS (e.g.) then there are at least two preconditions: • <u>User must be a registered user in the system</u> – otherwise logging into the system is impossible   ○ There will probably be different types of users with different privileges. The basic type of user

will at least be able to search for data but not necessarily download data. • User must be logged into the system On the other hand if it is not required to be a registered user and logged in, then there is no pre-condition. To validate the Use Case one extra pre-condition must also be in place: • The system contains some vulcanological data – if there is no data to be returned, no matter how wide or generic the search parameters are, the Use Case cannot be fully validated. …
Flow of events Due to the simplistic nature of this Use Case, the two roles it contains will be portrayed in the event flow. Workflow for Use (actor 1) and System (actor 2): *New user* 1. **User** registers with the system 2. **System** completes the registration and sends out confirmation and credentials 3. **User** logs into the system with credentials 4. **User** selects the Search User Interface (search field) and types in his parameters for geochemical search and executes the search. 5. **System** processes the parameters and returns results accordingly. 6. **User** reviews the results and is (hopefully) satisfied. At this point the user might enter another Use Case: **Download data**. If the User is registered with the System then steps 3-6 describe the proper workflow for the Use Case.
Post-conditions • User actions are logged with the System.
Extension Points None.
« Used » Use Cases Determine the systems functionality that might be reused and model this using the <<uses>> relationship. If the use case uses other Use Cases, list them here. • Download data – This use case would be the next logical use case after searching for data and in fact Download data cannot exist without the Search for data use case.
Other Requirements This can include non-functional requirements related to the Use Case. • Good response time when searching for geochemical data.

WP12 Use Cases

Within the framework of TCS Satellite Data they identified two main Use Cases, which are related to the retrieval and visualization of data products (Figure 12.1), and execution of on demand processing services (Figure 12.2).

WP12 - Use Case 1: Viewing and retrieving Earth surface Displacement Time Series on deforming areas

Use case name/topic : Viewing and retrieving Earth surface Displacement Time Series on deforming areas.

Use case domain This use case is: multidisciplinary, namely focusing on the disciplines of: volcanology, seismicity, geodesy, geophysic.

Use case description *As a <geoscientist> I want to <view and retrieve SAR Displacement Time Series of an area of study in a defined time span> so that I can <correlate it with the phenomena under study>.*

Actors involved in the use case

- <researcher>
- <geoscientist>

Priority: High

Preconditions: User must have logged in

Flow of events – user view

1. <geoscientist> performs a query for Displacement Time Series by imposing the area of interest (AoI) and time span related to the phenomena under investigation.
2. <geoscientist> selects among the query results the data product to be visualized
3. <geoscientist> visualizes and analyses all the retrieved data product provided by the TCS

System workflow system view

1. The user interface receives the location, time interval and other query input
2. The system searches the database for the SAR Displacement Time Series
3. Query results are exposed to the user that selects the data product to be visualized
4. The system retrieve the required data product from the TCS
5. The data product is visualized

Postconditions: Search parameters have to be saved

Extension Points: None

« Used » Use Cases: None

Other Requirements: None

Class diagram and sequence diagram:

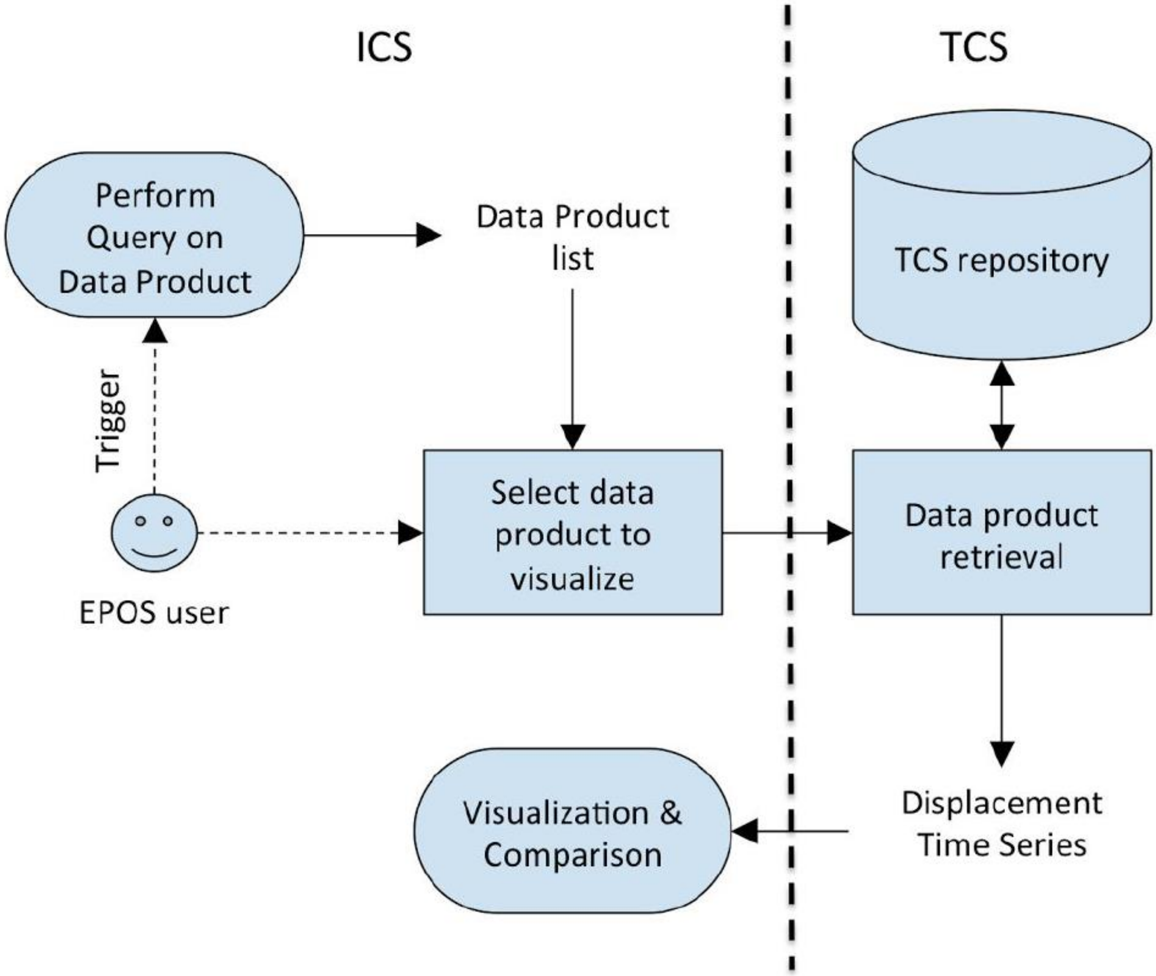


Figure 12.1

WP12 - Use Case 2: Running on demand processing/services

Use case name/topic : Running on demand processing/services

Use case domain This use case is: disciplineoriented, namely focusing on the discipline of: remote sensing

Use case description

As a <remote sensing expert> I want to <run an on demand Senitnel1 SBAS processing> so that I can <analyse the Displacement Time Series of an area of my interest occurred during a defined time interval>.

Actors involved in the use case

- <researcher>
- <expert on remote sensing>

Priority : High

Preconditions: User must have logged in

Flow of events – user view

1. <researcher> performs a query for available services able to process Sentinel1 data.
2. <researcher> selects among the query results the SBAS processing tool

3. <researcher> by imposing the area of interest (AoI) and time span related to the phenomena under investigation, identifies the Sentinel1 data and defines the SBAS parameters for the processing (baseline thresholds, applied filtering, ...)
4. <researcher> run the SBAS processing
5. once ready, <researcher> visualizes and analyses the generated SBAS results

System workflow system view

1. The user interface receives the user input on the available services able ot process Sentinel1 data
2. Query results are exposed to the user that proceed with a selection
3. The user interface receives the EO data type, location, time interval as well as the list of EO data to be used as input for the SBAS processing
4. The processing starts at the TCS level after an operator trigger (button)
5. The system retrieve the generated Displacement Time Series from the TCS
6. The data product is visualized

Postconditions: Search and input parameters have to be saved

Extension Points: None

« Used » Use Cases: None

Other Requirements: None

Class diagram and sequence diagram

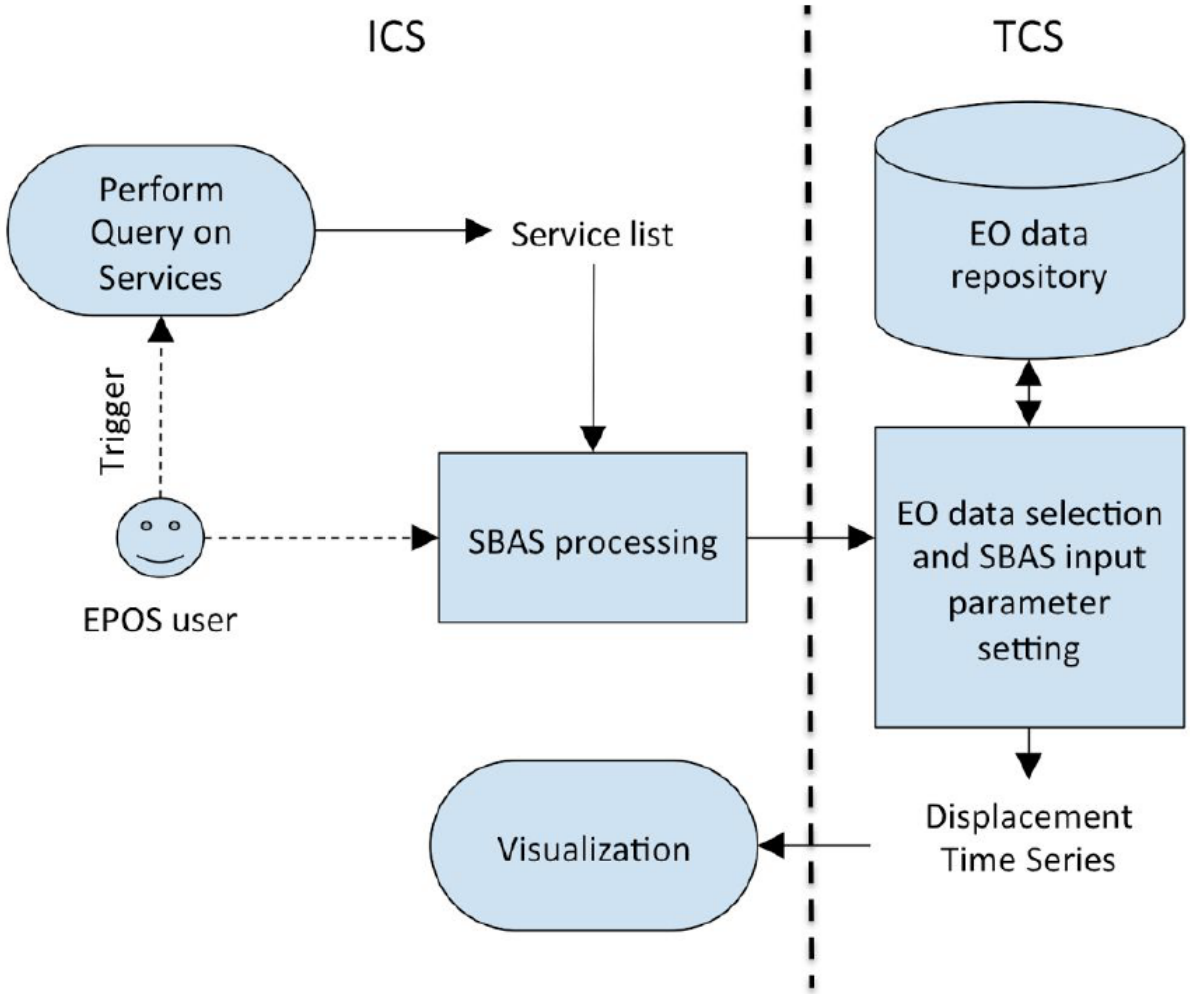


Figure 12.2

WP13 Use Cases

WP13 - Use Case 1: Downloading and viewing geomagnetic variometer and observatory data

Use case name/topic: Downloading and viewing geomagnetic variometer and observatory data

Use case domain This use case is: discipline-oriented, namely focusing on the discipline of Geophysics

Use case description In this section the use cases will be outlined. This section may require iterative refinements.
As a <geophysical researcher> I want to <access geomagnetic data for one or more geomagnetic observatories or variometers, perhaps in some geographic region and for some time period> so that I can <view these data> and <download these data for my own research if visually acceptable>

Actors involved in the use case A list of the actors who communicate with this use case.

- *System user – researcher*
- *Geophysical researcher*

Priority How important is this Use Case to the TCS? (considering the degree of use: unavoidable/ frequent/occasionally/rare)

- o *High (frequent)*

Pre-conditions: *User must have logged in*

Flow of events – user
Basic sequences and needed steps (user view)

1. *<geophysical researcher> chooses observatory/variometer locations and times based on criteria such as regional information and/or observatory name and data sampling interval*
2. *<geophysical researcher> visualises the seven components (X,Y,Z,D,H,I,F) of the vector geomagnetic field for each observatory/variometer, time span and sampling interval selected to assess data quality*
3. *<geophysical researcher> requests data download for each acceptable observatory/variometer data record, or the acceptable parts of complete data record*

System workflow - system view

1. *The user interfaces receives the input: location(s), (optional) observatory/variometer name(s), time start and end, sampling interval(s)*
2. *System connects to the database and searches, for each location, for records that match the required criteria.*
   a. *If data exist, system provides a 7-row stackplot of data for each named observatory/variometer for the time span requested (for variometer data not all components may be available)*
   b. *If data do not exist system reports this to user (web access), with request to change location and time criteria (span and sampling interval), or end.*
3. *System*
   a. *Queries user (web access) for data acceptability (i.e. are data visually acceptable?)*
   b. *Reminder sent if no response. Stop if no further response.*
   c. *If data acceptable to user, prepares data for download/delivery, for each variometer/observatory requested*

Post-conditions
All observatory/variometer data records are visualised and accepted/rejected by user, as appropriate

Extension Points
User may request additional observatory/variometer data records and/or different time spans of data, and data sampling intervals

« Used » Use Cases: *No other use cases used.*

Other Requirements: *Download of data to commercial users is subject to each geomagnetic observatory/variometer data provider's commercial use policy*

WP13 - Use Case 2: Geomagnetic data for global and regional magnetic field modelling

Use case name/topic: Geomagnetic data for global and regional magnetic field modelling

Use case domain This use case is: discipline-oriented, namely focusing on the discipline of Geomagnetism

Use case description In this section the use cases will be outlined. This section may require iterative refinements.
As a <geomagnetic researcher> I want to <assemble a global or regional set of geomagnetic data from magnetic observatories, during magnetically quiet times as identified by small values of magnetic indices> so that I can <perform an off-line geophysical inversion of these data to recover a global magnetic field model and its time-rate-of-change at the epoch centred on the time span of geomagnetic data selected>

Actors involved in the use case A list of the actors who communicate with this use case.

- *<System user - researcher>*
- *<Geomagnetism researcher>*

Priority How important is this Use Case to the TCS? (considering the degree of use: unavoidable/ frequent/occasionally/rare)

- *Medium (occasional use)*

Pre-conditions A list of conditions that must be true before the Use Case starts (e.g. user must have logged in)
User must have logged in

Flow of events – user view
Basic sequences and needed steps (user view)

1. *<geomagnetism researcher> chooses observatory locations, time spans and sampling interval to undertake analysis based on criteria: low values of geomagnetic indices (user chosen)*
2. *<geomagnetism researcher> accepts or rejects observatory data for analysis*
3. *<geomagnetism researcher> receives download of data for offline analysis*

System workflow - system view

1. *The user interfaces receives the input: location (spot, regional or global), time span, sampling interval, magnetic index type and maximum value*
2. *System connects to the database and searches, for each location, for records that match the required criteria*
   a. *If data exist, system provides an optional 4-row (X,Y,Z,F) stackplot of data for each named observatory for the time span requested*
   b. *If data do not exist system reports this to user, with request to change location(s), time criteria (span and sampling interval) and magnetic index type and value*
   c. *One reminder sent, on no reply - stop*
4. *System*
   a. *Queries user (web access) for data acceptability (are data visually acceptable?) for each observatory data record*
   b. *One reminder sent if necessary. No reply=stop.*
   c. *If data are acceptable to user (as validator of data), prepares data for download/delivery, for each observatory requested*

•

Post-conditions *A database/file of geomagnetic data is prepared for delivery, according to the geomagnetic index criteria supplied by the user. Data available to user within 24 hours of request.*
A list of conditions that must be true when the use case ends, no matter which scenario is executed.

Extension Points: *No extension points*

« Used » Use Cases
May repeatedly use the use case < Downloading and viewing geomagnetic variometer and observatory data > (TBC – but probably)

Other Requirements
None
This can include non-functional requirements related to the Use Case.

WP13 - Use Case 3: Geomagnetic model calculator

Use case name/topic: Geomagnetic model calculator

Use case domain This use case is:
- multidisciplinary, namely focusing on the disciplines of geomagnetism and geophysics

Use case description In this section the use cases will be outlined. This section may require iterative refinements.
As a <geoscientist> or <public or non-scientific user> I want to <know the magnitude and/or direction of the Earth's magnetic field at a point and a time, or perhaps in a region, e.g. specfied on a grid> so that I can <use this in my research>

Actors involved in the use case A list of the actors who communicate with this use case.
- <Public or non-scientific user>
  - <Member of public>
  - <Other non-specialist user>
- <Geoscientist>
  - <Academic Geomagnetic researcher>
  - <Geoscientific researcher>
  - <Commercial researcher>

Priority How important is this Use Case to the TCS? (considering the degree of use: unavoidable/ frequent/occasionally/rare)
- High (frequent)

Pre-conditions
User must have logged in

Flow of events – user view
Basic sequences and needed steps (user view)
<User> means either of <Public or non-scientific user> or <Geoscientist>
1. *<User> chooses locations and times to undertake analysis based on criteria: model spatial resolution (lower resolution=IGRF, or higher resolution=WMM)*
2. *<User> accepts model output as table of spot values or grid of values for region of interest and time of interest*

System workflow - system view
1. *The user interface (web access) receives the input: location (or range in lattiude and longitude), time and field model resolution (low=IGRF or high=WMM)*
   a. *One reminder is sent (web access) on no or incomplete input. No reply=stop.*
2. *The system*
   a. *connects to the database and computes, for each location, the 7 components of magnetic*

field from the requested model b. *provides a tabular or gridded report (as appropriate to request) of model output data for each location and time requested. Report supplied through web access and optional email*
Post-conditions *User request is fulfilled and data are available (web access) in tabular or other form*
Extension Points: *No extension points*
« Used » Use Cases *No other use cases (? But perhaps other use cases may use this use case?)*
Other Requirements *Commercial use must respect magnetic model calculator developers commercial use policy*

WP13 - Use Case 4: Microseismic activity in geomagnetic data

Use case name/topic: Microseismic activity in geomagnetic data
Use case domain This use case is: o multidisciplinary, namely focusing on the disciplines of seismology and geomagnetism
Use case description In this section the use cases will be outlined. This section may require iterative refinements. *As a <geophysicist> I want to <identify time intervals in geomagnetic data affected by seismic activity> so that I can <quantify the seismic noise level in geomagnetic data and distinguish this from genuine geomagnetic activity>. …*
Actors involved in the use case A list of the actors who communicate with this use case. ● <geophysicist> ● <geomagnetism researcher>
Priority How important is this Use Case to the TCS? (considering the degree of use: unavoidable/ frequent/occasionally/rare) o *Low (occasional)*
Pre-conditions *User must have logged in*
Flow of events – user view Basic sequences and needed steps (user view) 1. *<geophysicist> chooses magnetic observatory locations, time spans and data sampling interval to undertake analysis* 2. *<geophysicist> receives plot of geomagnetic data labelled by intervals indicating reported seismic activity* 3. *<geophysicist> chooses to compute noise level during seismic intervals and during non-seismic intervals*
System workflow - system view 1. *The user interfaces receives the input: location, time span, sampling interval* 2. *System connects to the database and searches, for each location, for records that match the required criteria* a. *If data exist, system provides an optional 7-row (X,Y,Z,D,H,I,F) stackplot of data for each named observatory for the time span requested, annotated by intervals of known seismic activity, as identified by seismic records* b. *If data do not exist system reports this to user, with request to change location(s), time criteria (span and sampling interval) and magnetic index type and value* c. *One reminder sent, on no reply - stop* 5. *System* a. *Queries user (web access) for data acceptability (are data visually acceptable?) for each observatory data record*

b. *One reminder sent if necessary. No reply=stop.* c. *If data are acceptable to user (as the validator of data), computes RMS level for each geomagnetic component during the identified periods of seismic activity and seperately for non-seismic intervals, for each observatory requested* d. *Reports results to user (web access) with optional email*
Post-conditions
Extension Points: *None*
« Used » Use Cases *May repeatedly use the use case < Downloading and viewing geomagnetic variometer and observatory data > (TBC – but probably)*
Other Requirements: *None*

WP13 - Use Case 5: GNSS position accuracy and geomagnetic activity

Use case name/topic: GNSS position accuracy and geomagnetic activity
Use case domain This use case is: - multidisciplinary, namely focusing on the disciplines of GNSS and geomagnetism
Use case description *As a <geophysicist> I want to <identify time intervals in GNSS data affected by solar/geomagnetic activity> so that I can <quantify the accuray level in the GNSS >.*
Actors involved in the use case
Priority
Pre-conditions
Flow of events – user view
System workflow - system view
Post-conditions
Extension Points
« Used » Use Cases
Other Requirements

WP14 Use Cases

Even if use cases are excellent for showing the possibilities of tasks which can be performed on AH episodes via TCS AH platform they also limit research options. Nevertheless, a simple use case being currently under development for TCS AH platform is provided below. We would like to stress however, that TCS AH will look for options to leave as much research freedom to the users as possible by finding possibilities of providing an “active” platform in contrast to “static” one based on predefined use cases.

WP14 Use Case 1: Anthropogenic mine hazard

Use case name/topic: anthropogenic mine hazard

Use case domain This use case is: Anthropogenic Hazards

- multi-disciplinary, namely focusing on the disciplines of: seismicity, geology, GNSS data, other gathered within a mining episode.

Use case description In this section the use cases will be outlined. This section may require iterative refinements.
As a user I want to obtain set of parameters characterizing stationary hazard and their time dependence. …

Actors involved in the use case A list of the actors who communicate with this use case.

- user
- user with special privileges to access time embargoed data

Priority How important is this Use Case to the TCS? (considering the degree of use: unavoidable/ frequent/occasionally/rare)
o High

Pre-conditions A list of conditions that must be true before the Use Case starts (e.g. user must have logged in) CIBIS episode data centres has to be interconnected with TCS. Requires software has to be integrated with the IT platform and connected to computing resources.

Flow of events – user view

1. Data selection & preparation
    a. Data selection (AH episode) which user will analyse. In case of catalogue, it has to contain at least all of: the date, localisation, event magnitude and/or its energy
    b. Additional data choice like front development, mine borders, geology/tectonics of the given area
    c. Define the coordinates for a given data set (Cartesian or/and geographic, if there is any missing it has to exist the possibility to add it).
    d. determine the threshold of completeness
    e. Data visualisation by:
        - Histograms (with possibility to define ranges for a given data set)
        - Point/line/column plots for selected data [localisation, mine borders, front development etc.].
        - data sorting and selection via different criteria
    f. determination of the probability of the seismic zones with
        A. the method based on the unlimited Gutenberg-Richter model,
        B. the method based on the upper-bounded Gutenberg-Richter model
        C. the unbounded non-parametric distribution estimation
        D. the upper-bounded non-parametric distribution estimation
    g. Zone parameterisation and probability characteristic check
    h. Additionally, user can request zone gravity centre and other zone related parameters.
2. A) Determination of Stationary hazard parameters for a given zone

Data resulting from computations shall be visualised on a map

B) Determination of the time depended hazard parameters

For each zone user can determine the hazard parameters time characteristics during given zone activity. This include a time window definition for a given parameter and final visualisation.

System workflow - system view

Will be definitely of use for management/extraction/ of the data and for determination hazard parameter sets.

Post-conditions visualisation services for data presentation

Extension Points depends heavily on user needs.

« Used » Use Cases

Other Requirements This can include non-functional requirements related to the Use Case. …

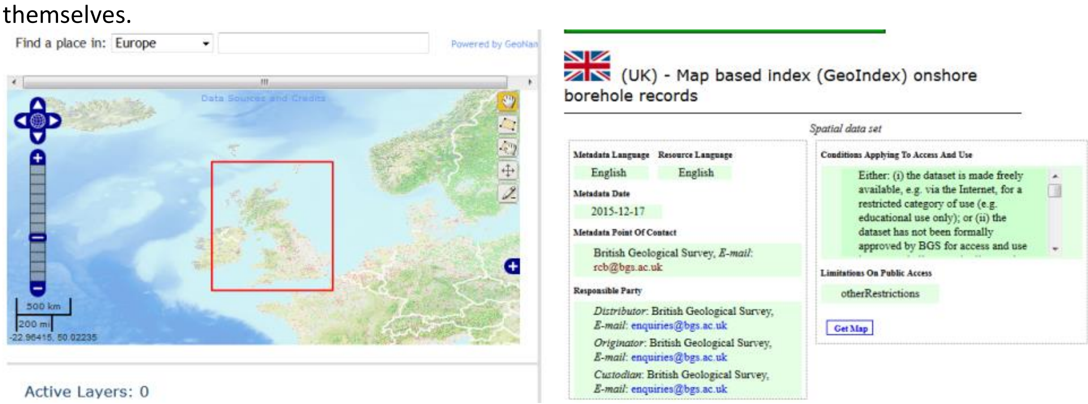
WP15 Use Cases

A fundamental facility to be achieved by EPOS as such will be the ability for researchers to find data across domains and the primary effort has therefore been concentrated around discovery use cases. Typically, use cases describe a system from a user perspective and dictate requirements for the system.
But in reality, use cases also need to be adjusted according to technological possibilities, data availability, feasibility in the given project framework and the level of ambition. In order to obtain the most clear and realistic picture, a holistic approach has been chosen in the current document taking into account the implications of the use cases on the architectural choices. In general three or four levels of discovery use cases have been defined.
This gradual approach is exemplified below on the basis of Borehole related use cases.
For consistency sake each Use Case is identified by a 2 letters identifier and an integer allowing to identify the use case level concerned (ranging from 1 to 4)

Use case levels

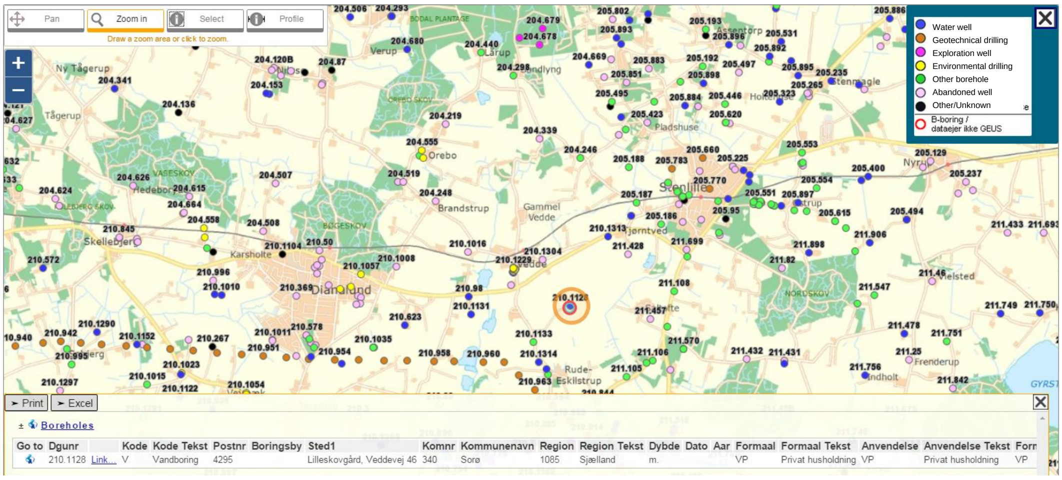
Use case level 1: Dataset discovery

The example below illustrates the discovery of borehole datasets from the UK in the INSPIRE geoportal (another example could be provided in a machine to machine exchange). The main actor searches for available borehole related datasets via a set of search criteria. Search criteria and the information accompanying the search results are limited to the generic type of metadata that is registered on a dataset level such as title, contact person, online resources (web services, web pages etc.), confidentiality, use restrictions, keywords etc. The same would be the case for any other types of data.
The result of the search is a set of potential datasets matching the user search criteria. Each of them is provided with a bounding box corresponding to the geographical extent of the boreholes in the database – not the boreholes themselves.



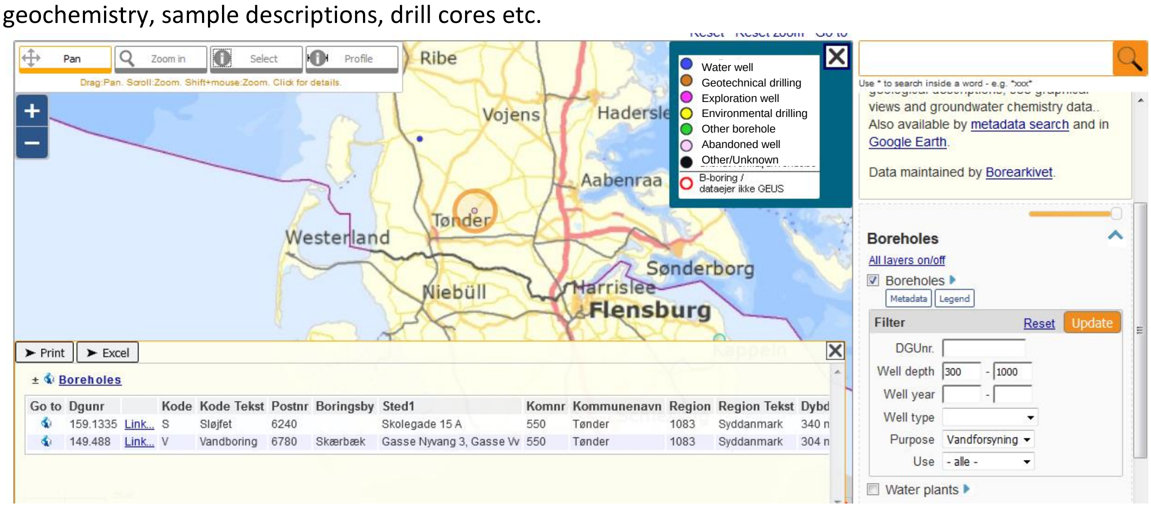
Use case level 2: Simple feature view

Use case level 2 is designed for providing the user with information about the location of the individual data records in a dataset. This means for example that the location of all boreholes in a borehole dataset can be visually discovered. The typical scenario will be that the main actor searches for e.g. boreholes in a geographic area and is presented with a map showing the location of boreholes symbolised according to a commonly agreed symbology. The user can then click an individual borehole on the map and get some simple summary information about that particular borehole.



Use case level 3 : Advanced feature discovery

This level of use case will allow the main actor to perform a search using criteria specific for each data type and retrieve summary information about the resulting features. An example could be that a main actor searches for boreholes in a specific geographic area (e.g. within a bounding box) being deeper than a certain value, that have been drilled for a specific purpose and that have e.g. geophysical log data associated. The result of such a search would be a map showing only those boreholes that fulfil the criteria and by clicking each of the boreholes, summary information is displayed – also containing a link to or information about how to get access to actual data such as geophysical logs, geochemistry, sample descriptions, drill cores etc.



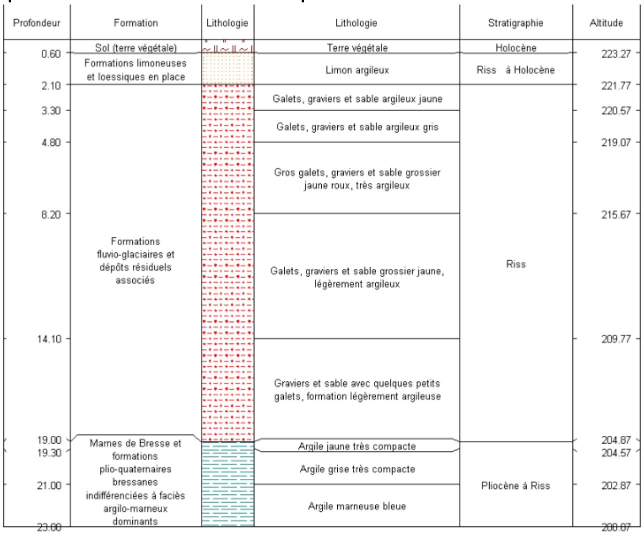
Use case level 4: Advanced complex feature data access

This level of use case allow the main actor, once one or more domain features are identified to access in an interoperable manner to information flows that are structured using shared semantic/data model. This will, in turn allow those flows to be:

- displayed to domain specialist using common tools

- and/or ingested into more complex data processing solutions

The example below shows a borehole log structured description and a GUI build on top of it



Borehole use cases

WP15 - Use Case 1: UC Bh.1: Borehole dataset discovery

Use Case Name/Topic: *Find borehole dataset concerning the channel*
Use case domain: This use case is: • Discipline-oriented, namely focusing on the discipline of: *geology*
Use Case Description Search and discover borehole datasets in a given area (ex: the southern part of the UK) so to find potential sources of information for a 3D modelling of groundwater reservoirs.
Actors involved in the use case • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data exchange
Priority • High
Pre-conditions
Flow of events – user view 1. User accesses the EPOS portal

2. User goes to the search page 3. User draws a rectangle on a map above the channel between France and England 4. User types in “borehole” in a search field 5. User press “search” 6. User assesses the list of results 7. User expands one item in the result list and reads more about the specific borehole dataset 8. User clicks a link to “web site” and is redirected to a portal where the corresponding borehole dataset can be accessed can be downloaded or purchased.
System workflow – system view • In order execute step 5, the EPOS front end sends a request to the EPOS ICS-C backend with a search request containing the bounding box and the search criteria “datatype = borehole”. • The backend requests synonyms from a thesaurus and searches for borehole, well and drilling in EPOS metadata catalogue. • A list of results is returned to the front end.
Post-conditions • User should have gained access to one or more national portals or OGC web services containing borehole information in the relevant area.
Extension Points
<<Used>> Use Cases
Other Requirements • All relevant datasets should be discoverable as “borehole datasets” no matter if they are named borehole, well or drilling datasets. • Online resources need to be registered in the metadata records.

WP15 - Use Case 2: UC Bh.2: Simple feature view of the Borehole Index

Use case name/topic: *Find and map borehole dataset in a specific part of Denmark*
Use case domain: This use case is:

- Discipline-oriented, namely focusing on the discipline of: *geology*

Use case description
Map visualization of boreholes in Denmark.

Actors involved in the use case
- The scientist that uses EPOS GUI
- Machine to machine exchange supporting the underlying services requests and data exchange

Priority High

Pre-conditions
1. User accesses the EPOS portal
2. User goes to the search page
3. User draws a rectangle on a map in Denmark
4. User types in "borehole" in a search field and presses "search"
5. User assesses the list of results
6. The Borehole Index being part of the results the user clicks a link to "view service" and is redirected to an EPOS viewer, where the corresponding map can be explored and queried
7. The system displays the Borehole Index on the map with the corresponding symbology along with the possibility to query graphically each borehole.

Flow of events – user view

System workflow – system view
- In order execute step 5, the EPOS front end sends a request to the EPOS ICS-C backend with a search request containing the bounding box and the search criteria "datatype = borehole".
- The backend requests EPOS metadata catalogue and searches for 'borehole' and provides corresponding datasets including the Borehole Index.
- The GUI provides a cartographic interface with the ability to add the Borehole Index in it

Each borehole entry in the Borehole Index that is represented on the map (with a dedicated symbology) can be queried.
- The GUI (via the ICS-C) provides the relevant interface to query from the Borehole Index content/service for feature information based on their geolocation

Post-conditions
- User should have visualised Borehole Index entries in its area of interest

Extension Points
<<Used>> Use Cases
Other Requirements

WP15 - Use Case 3: UC Bh.3: Advanced borehole feature discovery

Use case name/topic: *Find borehole in a specific area with specific search criteria*

Use case domain: This use case is:

- Discipline-oriented, namely focusing on the discipline of: *geology*

Use case description

Search for boreholes in Denmark being more than 700 metres deep, drilled with the purpose of oil and gas exploration and having geophysical log data available

Actors involved in the use case

- The scientist that uses EPOS GUI
- Machine to machine exchange supporting the underlying services requests and data exchange

Priority High

Pre-conditions

- Borehole Index features should have semantic harmonisation and common data model

Flow of events – user view

1. User accesses the EPOS portal
2. User goes to the search page
3. User draws a rectangle on a map in Denmark
4. User types in “borehole” in a search field and presses “search”
5. User assesses the list of results
6. The Borehole Index being part of the results the users selects it and has the possibility to pass via the GUI dedicated search criteria values (depth, purpose, geophysical log available in that example)
7. The system proposes the Borehole Index entries that matches those search criteria (either on a map or on a list)
8. User expands one item in the result list and reads more about the specific Borehole Index entry (possibility zooms on it on a map).

9. He gets the possibility to interact graphically in the GUI with that borehole description, download the Borehole Index entry of interest in various formats and access the geophysical log available in an interoperable manner.
System workflow – system view • In order execute step 5, the EPOS front end sends a request to the EPOS ICS-C backend with a search request containing the bounding box and the search criteria "datatype = borehole". • The backend requests EPOS metadata catalogue and searches for 'borehole' and provides corresponding datasets including the Borehole Index. • A list of results is returned to the front end. • The GUI (via the ICS-C) provides the relevant interface to query attributes from the Borehole Index content/service
Post-conditions • User should have gained access to one or more Borehole Index entries and their associated OGC web services containing borehole information
Extension Points
<<Used>> Use Cases
Other Requirements

WP15 - Use Case 4: UC Bh.4: Advanced complex feature borehole data access

Use case name/topic: Access to fully structured Borehole data flows available at NRI
Use case domain: • Discipline-oriented, namely focusing on the discipline of: *geology*
Use case description This Use Case is an extension of the previous one (Bh.3) Once a borehole (or set of boreholes) is identified in the BoreholeIndex, access to fully fledged complex feature information flows available at data providers level. These flow provide maximum amount of information on a dedicated sub-topic in a harmonized way (geophysical logs, geological description, ground water level, rock geochemistry, pore gaz chemistry, geotechnical information, ...)
Actors involved in the use case • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data

<table>
<tr><td>exchange</td></tr>
<tr><td>Priority
TBD</td></tr>
<tr><td>Pre-conditions
Borehole associated data flows should have semantic harmonisation and common data model(s)</td></tr>
<tr><td>Flow of events – user view
Identification of relevant Borehole Index entry(ies)
From the entry(ies) possibility to access to more data flows organised by ‘domains’
Each data flow retrieved is available in a commonly agreed semantic/data model for further reuse either in EPOS GUI or user’s client application. For example borehole logs from various data providers could be visualised in a shared borehole log visualisation tool.</td></tr>
<tr><td>System workflow – system view
BoreholeIndex is structured so that information items allowing access to further information are clearly identified and typed to allow dereferencing of pointers to those additional information resources</td></tr>
<tr><td>Post-conditions
User should have gained access in an interoperable manner to structured information regarding the Borehole (s) of interest.
Supplemental information flows retrieved being available according to an agreed semantic/model they are further processable by the user.</td></tr>
<tr><td>Extension Points</td></tr>
<tr><td><<Used>> Use Cases</td></tr>
<tr><td>Other Requirements</td></tr>
</table>

Geohazard use cases

WP15 - Use Case 5: UC Gh.1: Existing dataset discovery

Use Case Name/Topic: *Searching for existing geohazard maps and inventory datasets in a*

specific area (i.e. Northern Italy)
Use case domain: This use case is: • Discipline-oriented, namely focusing on the discipline of: *geology, engineering*
Use Case Description Searching for geohazards affecting a certain area (e.g. Lake Garda area) and, in particular, if geohazard maps or dataset inventories of specific natural hazards exist with the purpose of - exploring existing basic geothematic information, - and/or do a research on a specific geohazard, in order to evaluate possible correlation with other geohazards or geological data.
Actors involved in the use case • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data exchange
Priority • High
Pre-conditions
Flow of events – user view 1. User accesses the EPOS portal 2. User goes to the search page 3. User draws a rectangle on a map bounding the area to be investigated (Lake Garda) 4. User types in a search field a keyword also exploring the pre-defined keywords (i.e. geohazard, landslide, active faults, ground motion, etc) related to different hazard types. 5. User presses “search” 6. User assesses the list of results also exploiting the potential semantic engine based on a thematic thesaurus framework. 7. User expands one item in the results list and reads more about the specific maps and dataset inventory 8. User clicks a link to “web site” and is redirected to a portal, where the corresponding maps and dataset can be explored.
System workflow – system view • In order to execute step 5, the EPOS front end sends a request to the EPOS ICS-C backend with a search request containing the bounding box and the search criteria “datatype =

geohazard". • The backend requests synonyms (step 6) from a thesaurus and invokes a multiple search for geohazard, landslide, active faults, ground motion, engineering geology, sinkholes or seismicity towards the EPOS metadata catalogue. • A list of results is returned to the front end.
Post-conditions • The user should have gained access to one or more national portals or OGC web services containing geohazard or geothematic information in the relevant area, to explore in the detail the resources.
Extension Points
<<Used>> Use Cases
Other Requirements • All relevant datasets should be discoverable as "geohazard datasets"; no matter if they are named Landslide, Rock falls, Active faults or Engineering geology, etc. • Online resources need to be registered in the metadata records.

WP15 - Use Case 6: UC Gh.2: Simple view of a geohazard information layer

Use case name/topic: *Finding, viewing and examining a specific hazard map at different scale in a specific area (e.g. a portion of territory of France).*
Use case domain: This use case is: • Discipline-oriented, namely focusing on the discipline of: *geology, engineering*
Use case description Find, view and consult the active faults map available in a portion of the French territory; with the purpose of exploring the specific sought information (geohazard layer) directly in the EPOS portal, by searching on the map view services.
Actors involved in the use case • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data exchange
Priority • High
Pre-conditions
Flow of events – user view

1. User accesses the EPOS portal 2. User goes to the search page 3. User draws a rectangle on a map in the specific area to be investigated (portion of French territory) 4. User types in a search field a keyword also exploring the pre-defined keywords (i.e. geohazard, landslide, active faults, ground motion, etc) related to the different hazard types. 5. User expands one item in the result list and reads more about the specific hazard map or dataset inventory. User clicks a link to “view service” and is redirected to an EPOS viewer, where the corresponding map can be explored and queried, or to the web service capabilities to have direct access to the resources.
System workflow – system view • In order to execute step 4, the EPOS front end sends a request to the EPOS ICS-C backend with a search request containing the bounding box and the search criteria “datatype = active faults”. • The backend requests synonyms (step 5) from a thesaurus and issues a search for active faults and also seismic faults, tectonic structures, seismicity, etc. towards the EPOS metadata catalogue. • A list of results is returned to the front end as view services composition • The GUI provides a cartographic interface with the ability to add the view service in it and query it
Post-conditions • User should have been able to visualise the geohazard information in a cartographic interface in its area of interest and been offered the possibility to access to OGC web services containing geothematic information in the relevant area.
Extension Points
<<Used>> Use Cases
Other Requirements

WP15 - Use Case 7: UC Gh.3: Multiple querying of geohazard information layers

Use case name/topic: *Finding, viewing, overlapping and examining two or more specific geohazard maps, at different scale, in a defined area (e.g. cross-border area between Italy and Slovenia).*
Use case domain: This use case is:

- Discipline-oriented, namely focusing on the discipline of: *geology, engineering*

Use case description

Crossing two or more geohazard information layers, in order to find any matches.
For example overlap landslide data with InSAR ground motion data in a specific cross-border zone, as between Italy and Slovenia. The intersection of more information layers allows to perform a comparative geohazard analysis

Actors involved in the use case

- The scientist that uses EPOS GUI
- Machine to machine exchange supporting the underlying services requests and data exchange

Priority

- medium

Pre-conditions

- All the hazard inventories and maps must be "queryable"
- The data should have semantic harmonisation and common data model

Flow of events – user view

1. User accesses the EPOS portal
2. User goes to the search page
3. User draws a rectangle on a map in the specific area to be investigated (cross-border area between Italy and Slovenia)
4. User types in a search field a specific keyword in order to explore the existing geo-hazard maps and inventories.
5. User expands one item in the result list and reads more about the specific hazard map or dataset inventory.
6. The user selects two or more hazard layers in order to load them in a viewer/client.
7. The user is able to compare data and perform a comparative analysis, using specific geo-spatial functionalities.

System workflow – system view

- In order to execute step 4, the EPOS front end sends a request to the EPOS ICS-C backend with a search request containing the bounding box and the search criteria "datatype = landslide&InSAR".
- The backend requests synonyms (step 5) issues a search for landslide and also InSAR data

towards the EPOS metadata catalogue to collect related view service. • The list of web services will be charged in a client system in order to perform comparative analysis.
Post-conditions User should have gained access to OGC web services containing geothematic information in the relevant area with a common semantic (data model)
Extension Points
<<Used>> Use Cases
Other Requirements

Geological multi-scale map use cases

WP15 - Use Case 8: UC Gm.1: dataset discovery

Use Case Name/Topic: *Find geological maps datasets at different scale in France*
Use case domain: This use case is: • Discipline-oriented, namely focusing on the discipline of: *geology*
Use Case Description Find the geological map available as bedrock or surface information, or some specific geothematic maps (i.e. geophysics gravimetry) datasets in the central part of France to have potential basic information to build a geological model or to explore geologic information rather a specific research domain.
Actors involved in the use case • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data exchange
Priority • High
Pre-conditions
Flow of events – user view 1. User accesses the EPOS portal 2. User goes to the search page 3. User draws a rectangle on a map in central France

4. User types in a search field a keyword also exploring the pre-defined keywords (i.e. map, bedrock, surface, quaternary deposits, geophysic, etc) 5. User press "search" 6. User assesses the list of results also exploiting the potential semantic engine based on a thematic thesaurus framework. 7. User expands one item in the result list and reads more about the specific maps dataset 8. User clicks a link to "web site" and is redirected to a portal, where the corresponding map dataset can be explored or downloaded.
System workflow – system view • In order execute step 5, the EPOS front end sends a request to the EPOS ICS-C backend with a search request containing the bounding box and the search criteria "datatype = bedrock". • The backend requests synonyms (step 6) from a thesaurus and issues a search for bedrock, geologic map, geologic structure or lithology towards the EPOS metadata catalogue. • A list of results is returned to the front end.
Post-conditions • User should have gained access to one or more national portals or OGC web services containing geological information in the relevant area.
Extension Points
<<Used>> Use Cases
Other Requirements • All relevant datasets should be discoverable as "geological map datasets" no matter if they are named bedrock, geologic map, geologic structure or lithology, etc. • Online resources need to be registered in the metadata records.

WP15 - Use Case 9: UC Gm.2: Simple maps view

Use case name/topic: *Find and view geological map at multiple scale in a specific part of Denmark*
Use case domain: This use case is: • Discipline-oriented, namely focusing on the discipline of: *geology*
Use case description

Find, view and consult the geological map information available in a part of the Denmark to have potential basic information to build a geological model or to explore geologic information rather a specific research domain.
Actors involved in the use case • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data exchange
Priority • High
Pre-conditions
Flow of events – user view 1. User accesses the EPOS portal 2. User goes to the search page 3. User draws a rectangle on a map in the specific part of Denmark 4. User types in a search field a keyword also exploring the pre-defined keywords (i.e. map, bedrock, surface, quaternary deposits, geophysic, etc) 5. User press “search” 6. User assesses the list of results also exploiting the potential semantic engine based on a thematic thesaurus framework. 7. User expands one item in the result list and reads more about the specific maps dataset 8. User clicks a link to “view service” and is redirected to a viewer, where the corresponding map dataset can be explored and queried graphically.
System workflow – system view • In order execute step 5, the EPOS front end sends a request to the EPOS ICS-C backend with a search request containing the bounding box and the search criteria “datatype = bedrock”. • The backend requests synonyms (step 6) from a thesaurus and issues a search for bedrock, geologic map, geologic structure or lithology towards the EPOS metadata catalogue. • A list of results is returned to the front end as view services composition
Post-conditions

• User should have gained access to OGC web services containing geological information in the relevant area.
Extension Points
<<Used>> Use Cases
Other Requirements

WP15 - Use Case 10: UC Gm.3: Advanced geological feature discovery

Use case name/topic: *Find geological features in a specific cross-border part between Italy and France, to search a specific lithology.*
Use case domain: This use case is: • Discipline-oriented, namely focusing on the discipline of: *geology*
Use case description Find geological features appearing on geological maps at a given scale (ex: at 1:500,000 scale) in a specific cross-border part between Italy and France, to search for a specific lithology or metamorphic facies; the purpose will be to analyze specific seismic response or a specific composition in a certain area, where geo-tectonic studies could be performed.
Actors involved in the use case • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data exchange
Priority • medium
Pre-conditions • The geological map features should have semantic harmonisation and common data model
Flow of events – user view 1. User accesses the EPOS portal 2. User goes to the search page 3. User draws a rectangle on a map in central France 4. User types in a search field a keyword also exploring the pre-defined keywords (i.e. map, bedrock, surface, quaternary deposits, geophysic, etc) 5. User press “search” 6. User assesses the list of results also exploiting the potential semantic engine based on a

thematic thesaurus framework. 7. The Geologic Feature Index being part of the results the users selects it and has the possibility to pass via the GUI dedicated search criteria values (lithology,….) 8. The system proposes the Geologic Feature Index entries that matches those search criteria (either on a map or on a list) 9. User expands one item in the result list and reads more about the specific Geologic Feature Index entry (possibility zooms on it on a map). 10. He gets the possibility to interact graphically in the GUI with that borehole description, download the Geologic Feature Index entry of interest in various formats and access the webservice providing it.
System workflow – system view
Post-conditions
Extension Points
<<Used>> Use Cases
Other Requirements

3D/4D Model use cases

WP15 - Use Case 11: UC Mo.1: 3D/4D Model dataset discovery

Use case name/topic: *Find 3D/4D Models datasets available in a given area*
Use case domain: • Discipline-oriented, namely focusing on the discipline of: geology
Use case description: Explore and discover available 3D models datasets in a given area: “As a scientist I want to use the EPOS Portal so that I can easily discover and browse available 3D models datasets.”
Actors involved in the use case: • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data exchange
Priority: (must have, should have, nice to have) • High

Pre-conditions: • 3D/4D Models should be described using a common semantic. This description should be exchanged using agreed technologies
Flow of events: – user view 1. User accesses the EPOS portal 2. User goes to the search page 3. User draws a rectangle on a map above a given area 4. User types in "3D model" in a search field 5. User press "search" 6. User assesses the list of results 7. User expands one item in the result list and reads more about the specific 3D/4D Models dataset. User clicks a link to "web site" and is redirected to a portal where the corresponding 3D/4D models dataset can be accessed can be downloaded or purchased.
System workflow: tbd
Post-conditions: tbd
Extension Points: tbd
« Used » Use Cases: tbd
Other Requirements: tbd
(to be filled in by WP7) After the interview: tbd

WP15 - Use Case 12: UC Mo.2: Simple Feature View of the Model Index

Use case name/topic: *Find and map 3D/4D models dataset in a given area.*
Use case domain: This use case is: • Discipline-oriented, namely focusing on the discipline of: *geology*
Use case description Vizualizaion of available 3D/4D Models in a given area.
Actors involved in the use case • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data exchange
Priority High

Pre-conditions • 3D/4D Models should be described using a common semantic. This description should be exchanged using agreed technologies
Flow of events – user view 1. User accesses the EPOS portal 2. User goes to the search page 3. User draws a rectangle on a map in Denmark 4. User types in "3D model" in a search field and presses "search" 5. User assesses the list of results 6. The 3D/4D Model Index being part of the results the user clicks a link to "view service" and is redirected to an EPOS viewer, where the corresponding map can be explored and queried graphically.
System workflow – system view
Post-conditions • User should have visualised locatable 3D/4D Model Index entries in its area of interest
Extension Points
<<Used>> Use Cases
Other Requirements

WP15 - Use Case 13: UC Mo.3: Advanced 3D/4D Model feature discovery

Use case name/topic: Find a 3D/4D Model corresponding to various search criterias
Use case domain: • Discipline-oriented, namely focusing on the discipline of: geology
Use case description: Targeted filtering and search based on 3D/4D Model descriptive information allowing access to descriptive information on 3D/4D Models.
Actors involved in the use case: • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data exchange
Priority: (must have, should have, nice to have) • High

Pre-conditions: • 3D/4D Models shall be described using a common semantic. This description shall be exchanged using agreed technologies
Flow of events: – user view 1. User accesses the EPOS portal 2. User goes to the search page 3. User draws a rectangle on a map in Germany 4. User types in "3D Model" in a search field and presses "search" 5. User assesses the list of results 6. The Model Index being part of the results the users selects it and has the possibility to pass via the GUI dedicated search criteria values (purpose, type, …) 7. The system proposes the Model Index entries that matches those search criteria (either on a map or on a list) 8. User expands one item in the result list and reads more about the specific Model Index entry (possibility zooms on it on a map, access to a graphical representation of that specific 3D model for preview) 9. He gets the possibility to interact graphically in the GUI with that Model description, download the Model Index entry of interest in various formats and access to more information on the Model in an interoperable manner.
System workflow: tbd
Post-conditions: tbd
Extension Points: tbd
« Used » Use Cases: tbd
Other Requirements: tbd
(to be filled in by WP7) After the interview: tbd

WP15 - Use Case 14: UC Mo.4: Advanced Model complex feature download

Use case name/topic: Access to full 3D/4D Model download made available by NRI
Use case domain: • Discipline-oriented, namely focusing on the discipline of: *geology*
Use case description: This Use Case is an extension of the previous one (Mo.3).

Once a Model is identified, download of this one uniquely identifiable 3D model in an interoperable manner
Actors involved in the use case: • The scientist that uses EPOS GUI • Machine to machine exchange supporting the underlying services requests and data exchange
Priority: (must have, should have, nice to have) TBD
Pre-conditions: • 3D/4D Model shall be structured in a shared semantic and common data model(s) and shalll be exchanged using agreed technologies
Flow of events: – user view 1. Identification of relevant Model Index entry(ies) 2. From the entry(ies) possibility to download the Model itself. 3. The Model being described in a commonly agreed semantic/data model it could be further reused (ex: user's client applications, EPOS GUI, …).
System workflow: tbd • ModelIndex is structured so that information items allowing access to further information is clearly identified and typed to allow dereferencing of pointer to additional information resource.
Post-conditions: tbd • User should have gained access in an interoperable manner to structured information regarding the Model (s) of interest. • The Model being available according to an agreed semantic/model it is further processable by the user.
Extension Points: tbd
« Used » Use Cases: tbd
Other Requirements: tbd

Additional data use cases

Hydrogeology use cases

Drill Core use cases

Active seismic data use cases

Geochemistry use cases

WP16 Use Cases

As most of the DDSS for WP16 are under development it is difficult to define detailed technical use cases from the ICT viewpoint. It is important for WP16 to develop the scientific use cases for the envisaged DDSS. The selection of the different data topics in EPOS-IP was on the basis of some conceptual use cases. As examples, the database on volcanic ash would be utilized by the aviation industry, meteorological institutes and governments in decision making on the response to volcanic ash eruptions. The experimental rock physics and analog model data would be used by scientists modelling sedimentary basin formation and in the exploration for unconventional resources and geothermal energy. The paleomagnetism database would be used in charting geo-hazard frequency.
Some more specific and detailed technical use cases are given below. These descriptions apply to the data products that are already available within our TCS. In a separate successive section we put forward some suggestions for valuable use cases that may be developed for the data products in the TCS roadmap.

WP16 - Use Case 1: Retrieve material parameters for setting up analog experiments

Use case name/topic: *Retrieve material parameters for setting up analog experiments*
Use case domain This use case is focused on the domain of *Geodynamics*
Use case description. <u>Problem</u>: *As an <analog modeller> Graham wants to < decide>< which material (brittle, ductile) is suitable for his experimental setup>.* <u>Elucidation</u>: *Friction and viscosity are crucial experimental parameters that can be influenced by a right choice of used materials.* <u>Persona</u>: *Graham is a geologist in WP15. He usually uses a centrifuge for analogue modelling, which requires rather stiff materials (clay, plasticine). As his centrifuge broke down he now needs weaker materials to setup an experiment under normal gravity conditions.*

<u>Supposed context</u>: *Graham is aware of the fact that EPOS might provide useful information for his setup. He is however not certain about the form of the available information (i.e. of the data product), so he does not know whether* - *he will learn about the availability of data sets that can be used by him for further analysis to decide which materials are suitable, or* - *that he can consult a database or other piece of software in order to directly retrieve raw material values.* *So, he is unaware of the representation of the data that will be valuable to him.* *<u>Result</u>:* *Graham has assessed and downloaded the data sets (and associated papers). He has decided on a suitable material, and moreover he has gained knowledge about the materials which he didn't have before.*
Actors involved in the use case A list of the actors who communicate with this use case. • *Researcher (system user)*   • *Analog modeler*
Priority: *Medium*
Pre-conditions: - *<analog modeller> is logged in as a named user.*
Flow of events – user view Determine the start and the end of the typical Use Case scenario. If a use case scenario grows too complex, it can be split up into subsequent scenarios. Below we propose a bulleted style sequences of step, but we encourage the usage of a workflow diagram with the symbology presented in in Appendix 5. Basic sequences and needed steps (user view) – *<u>Full text search without pre-filtering</u>* 1. *<analog modeller> is going to search for material properties. He searches directly for "viscosity material properties" with the aid of a generic text search box.* 2. *<analog modeller> applies a filter to the rather large result set by choosing from a keywords facet the combination of string values "viscoelasticity" and "analog models".* 3. *<analog modeller> clicks in the updated result set on the entrance "GeoMod2008 materials benchmark: The ring shear test dataset", which brings him to the landing page of this data product.* 4. *<analog modeller> assesses this data set by a) reading the abstract, b) viewing the inline iso19115 metadata, and c) reading the explanantion of the dataset which is provided as a downloadable pdf ("<u>Explanations for the RST dataset.pdf</u>").* 5. *Based on his analysis and the open availability of the dataset <analog modeller> downloads the compressed data package ("<u>RST-data.zip</u>").* Alternatives for steps 1 and 2 (user view) – *<u>Full text search with filter on type of requested data</u>* 1.a *<analog modeller> is going to search for material properties. Therefore he applies a search filter "material properties" (choosen from a topic list) as a constraint on a search query that he is going to execute.* 2.a *<analog modeller> now searches free text with the search string "friction viscosity".*

Alternative for steps 1 and 2 (user view) – <u>Searching through filtering without full text search</u>

1.b *<analog modeller> is going to search for material properties. Therefore he applies a search filter "material properties" (choosen from a topic list) that directly leads him to a result set.*

2.b *<analog modeller> refines the result set by applying the filters "viscosity" and "friction" (within the facet "property type"), and "analog models" (from a list of keywords), again directly leading to new results sets.*

System workflow - system view

<u>Full text search without pre-filtering</u>

1. *The GUI receives the input: new full text search*
   a. *The system connects to the full text index and executes the query "viscosity material properties" over all indexed fields*
      i. *The system makes use of fuzzy search techniques and/or vocabularies to relate "viscosity" to "viscoelasticity".*
   b. *The system returns a results page*
      i. *That is shown in the GUI*
      ii. *That contains filters (facets) that apply to the underlying result set (i.e. all results have a keyword field, and "keyword" is contained as a restricted list of values upon which further refinements can be made; values that do not apply to some individual result are not in the refinement list).*
2. *The GUI receives the input: applied filter*
   a. *The system connects to the full text index and executes the query <keywords: "viscoelasticity" AND keywords: "analog models"> onto the last result set.*
   b. *The system returns a result set that is a refinement of the former one.*
3. *The GUI receives the input: hyperlink clicked*
   a. *The URL is followed (possibly in a new target tab of the browser)*
   b. *User session remains active*
4. *Steps 4 and 5 are not controlled by the system. However, the user may return to update his choice of filter values, in which case action 2 is executed again. (A request for a new search may or may not reset applied filtering.)*

<u>Full text search with filter on type of requested data</u>

1.a *The GUI receives the input: filter applied*
   a. *Search filter "material properties" receives value "material properties".*

2.a *The GUI receives the input: new full text search with filter applied*
   a. *The system connects to the full text index and executes the query <("friction" OR "viscosity") AND (topic: "material properties")>*
      i. *The system makes use of fuzzy search techniques and/or controlled vocabularies to relate "viscosity" to "viscoelasticity".*
      ii. *Search is over all indexed fields, except "material properties", which is only sought within the field "topic".*
   b. *The system returns a results page*
      i. *That is shown in the GUI*

3.a The GUI receives the input: hyperlink clicked *a. The URL is followed (possibly in a new target tab of the browser)* *b. User session remains active* *Steps 4 and 5 are not controlled by the system. However, the user may return to update his choice of filter values, in which case action 1 is executed again.* *<u>Searching through filtering without full text search</u>* 1.b *The GUI receives the input: new search with filter applied* a. *The system connects to the full text index and executes the query <topic: "material properties">* i. *Search is over the field "topic".* b. *The system returns a results page* i. *That is shown in the GUI* ii. *That contains filters (facets) that apply to the underlying result set (i.e. all results have a keyword field, and "keyword" is contained as a restricted list of values upon which further refinements can be made; values that do not apply to some individual result are not in the refinement list).* 2.b *The GUI receives the input: filter applied* *a. The system connects to the full text index and executes the query <keywords: "viscoelasticity" OR keywords: "analog models"> onto the last result set.* *b. The system returns a result set that is a refinement of the former one.* *3.b The GUI receives the input: hyperlink clicked* *a. The URL is followed (possibly in a new target tab of the browser)* *b. User session remains active* *Steps 4 and 5 are not controlled by the system. However, the user may return to update his choice of filter values, in which case action 1 or 2 is executed again.*
Post-conditions - *<analog modeller> is logged in as a named user.* - *<analog modeller> owns a search results object* - *<analog modeller> owns a 'last query executed'* - *<analog modeller> is connected to an active search parameterization profile (with or without constraints).*
Extension Points *None*
« Used » Use Cases Determine the systems functionality that might be reused and model this using the <<uses>> relationship. If the use case uses other Use Cases, list them here. …
Other Requirements This can include non-functional requirements related to the Use Case. …

WP16 - Use Case 2: Comparison of sand with rock

Use case name/topic:
Comparison of sand with rock

Use case domain
This use case is focused on the domain of *Geo-engineering*

Use case description.
Problem:
As an <engineer> Guido wants to < assess><the stability of his underground storage reservoir>. Therefore he wants to <investigate> the hypothesis that < sand is mechanically comparable to rock>,< depending on the scale of observation>.
Persona:
Guido is an geo-engineer from WP14. He worries about the stability of his underground storage reservoir and would like to setup smallscale experiments to test some key issues.
Supposed context:
Guido is aware of the fact that EPOS might provide the information he needs. He is unaware of the representation of data that will be valuable to him.
Result:
Guido has verified that, depending on the scale of observation, sand indeed mechanically behaves comparable to rock.

Actors involved in the use case A list of the actors who communicate with this use case.
- *Researcher (system user)*
    - *Geo-engineer*

Priority: *Medium*

Pre-conditions:
- *< Geo-engineer > is logged in as a named user.*

Flow of events – user view
Basic sequences and needed steps (user view) – *Full text search without pre-filtering (The 'Google Search')*
1. *<Geo-engineer> is going to search for context models of material properties. He searches directly for "sand rock mechanics" with the aid of a generic text search box.*
2. *< Geo-engineer > applies a filter to the rather large result set by choosing from a topic facet the string value "analog models".*
3. *<Geo-engineer > clicks in the updated results set on the entrance "GeoMod2008 materials benchmark: The axial test dataset.", which brings him to the landing page of this data product.*
4. *<Geo-engineer > assesses this data set by a) reading the abstract, b) viewing the inline datacite metadata, and c) reading the explanantion of the dataset which is provided as a downloadable pdf ("Explanations for the AT datasets.pdf").*
5. *Based on his analysis and the open availability of the dataset <Geo-engineer> downloads the compressed data package ("AT-data.zip").*

System workflow - system view
Full text search without pre-filtering
1. *The GUI receives the input: new full text search*
    a. *The system connects to the full text index and executes the query "sand rock*

mechanics" over all indexed fields b. *The system returns a results page* i. *That is shown in the GUI* ii. *That contains filters (facets) that apply to the underlying result set (i.e. all results have a topic field, and "topic" is contained as a restricted list of values upon which further refinements can be made; values that do not apply to some individual result are not in the refinement list).* 2. *The GUI receives the input: applied filter* a. *The system connects to the full text index and executes the query <topic: "analog models"> onto the last result set.* b. *The system returns a result set that is a refinement of the former one.* 3. *The GUI receives the input: hyperlink clicked* a. *The URL is followed (possibly in a new target tab of the browser)* b. *User session remains active* 4. *Steps 4 and 5 are not controlled by the system. However, the user may return to update his choice of filter values, in which case action 2 is executed again. (A request for a new search may or may not reset applied filtering.)*
Post-conditions - *< Geo-engineer > is logged in as a named user.* - *< Geo-engineer > owns a search results object* - *< Geo-engineer > owns a 'last query executed'* - *< Geo-engineer > is connected to an active search parameterization profile (with or without constraints).*
Extension Points *None*
« Used » Use Cases Determine the systems functionality that might be reused and model this using the <<uses>> relationship. If the use case uses other Use Cases, list them here. …
Other Requirements This can include non-functional requirements related to the Use Case. …

WP16: Suggestions for use cases to be developed

The following use cases have a descriptive character. I.e. they cannot be fully worked out at this moment because of the lacking definitions of the applicable DDSS's. Except for the "*Database on large scale laboratory facilities available in EPOS*" (which is in our DDSS priority list) they all apply to data products from the TCS roadmap. However, we have decided to mention them here because of their positive impact on the variety of data products within WP16.

Lab Portal (TNA)

"Graham wants to do an experiment and is looking for a lab where he can do so. He has very specific needs, i.e. wants to simulate mountain building, with brittle-ductile rheology, including monitoring of strain and stress. Moreover he has some constrictions on the time-window and the budget. He checks our lab portal and finds a suitable lab which has all the technicalities and expertise he needs and which is available in the period and has affordable user fees. He complies with the access rules he downloaded from the portal and fills and submit the online-application form, including a description of his project. The latter is send to all members of the respective lab and the selection committee. The latter decides on the basis of a defined and transparent catalogue of selection criteria. Graham is notified on the outcome latest 1 month after submission."

Education

Athena (an active teacher of a secondary school) wants to explain the mountain building process to her students using a hands on activity. She googles "mountain building" and ends up in our WP16 platform. She discovers several videos showing sand box modelling, where layers of sand are compressed and produce scaled structures similar to the ones characterizing mountains. She is inspired by these videos and she decides to build up a simplified sandbox in the lab of her school. Thanks to this "hands on" activity her students learn difficult concepts in an easy and funny way and the teacher is granted for her efficient didactic method.

Geomagnetism

- An Earth scientist is interested in the geodynamic evolution of European orogenic belts (e.g. the Apennines, the Pyrenees, etc.). He uses our TCS to find the available paleomagnetic and magnetic anisotropy data and publications to constrain vertical axis rotation of crustal blocks and strain patterns.
- A student heard that the geomagnetic field is subjected by significant variation, with periods of low intensity, instability and even polarity flips over geological times. He uses our TCS and he finds out the time scale of normal and reverse polarity, as well as records that illustrate geomagnetic variability and field behaviour during polarity reversals.