

eENVplus pilots and scenarios

Geological map harmonisation Italy - Slovenia

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GeoZS

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ISPRA

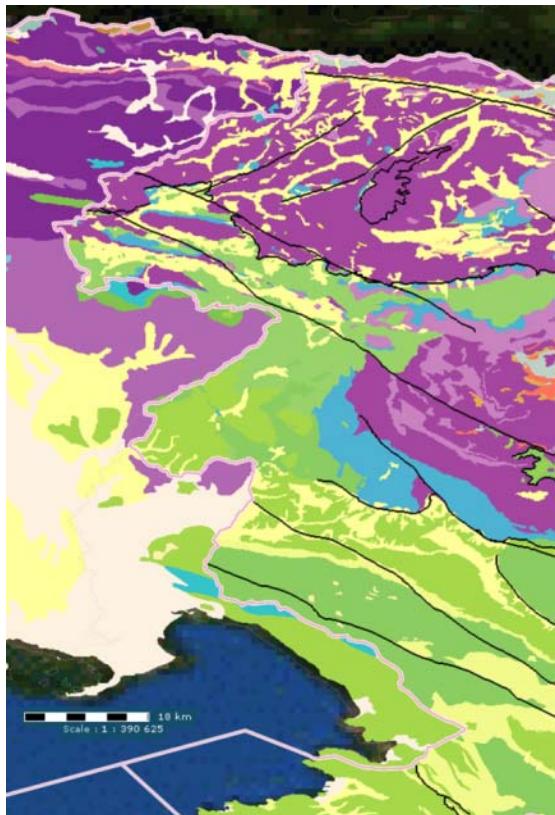
Scenarios >> Pilots: INSPIRE Data Themes

- In 10 pilots, 9 Scenarios, 3 cross-border



Scenario Title	ENV Aspect	Pilots
Implementation of a SEIS for air quality data	Air Quality	BELGIUM
		ITALY
Providing INSPIRE-compliant access to utility services: the case of sewage networks in Flanders	Water	BELGIUM
CSspire	Everyday life issues connected to Environmental aspects	CZECH REPUBLIC / SLOVAKIA
Natural Areas INSPIRE Compliance Toolbox	Nature Conservation	FRANCE
Forest Fire Management Scenario	Environmental Risk (Fire)	GREECE
Window on the Protected Areas - Mobile Conservation Map (WMA MCM)	Nature Conservation	HUNGARY / SLOVAKIA
INSPIRE Geoportal	Nature conservation	ICELAND
Geological Map Harmonization	Environmental Risk (Geohazard)	ITALY / SLOVENIA
Urban Ecological Landuse Planning	Ecological Landuse Planning	PORTUGAL

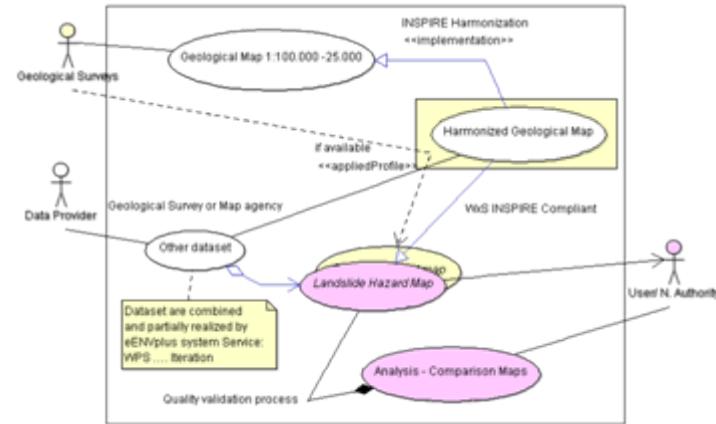
Geological Map Harmonisation Pilot



Use-case 1

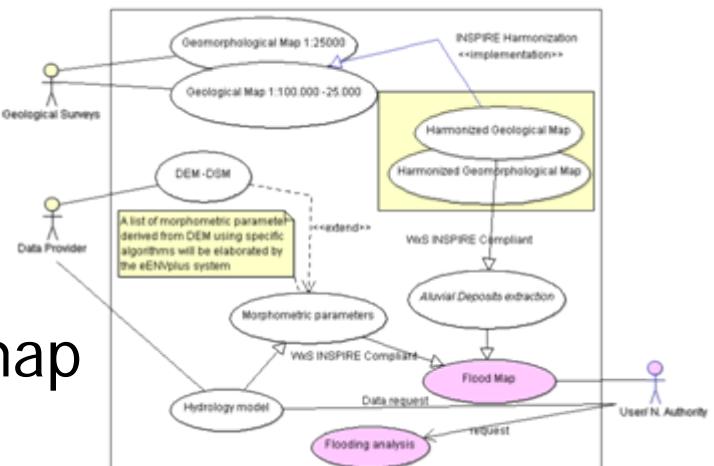
Environmental risk (geohazard):

Landslide susceptibility map



Use-case 2

Environmental risk (geohazard): Flood probability map



- A deep analysis conducted on the 26 different use cases of the 10 pilots lead to the identification of 21 INSPIRE data-themes target schemas to be used in the harmonisation process.

About

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Implementation

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- [Maintenance and Implementation](#)

Adoption

INSPIRE DIRECTIVE

In Europe a major recent development has been the entering in force of the INSPIRE Directive in May 2007, establishing an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment.

INSPIRE is based on the infrastructures for spatial information established and operated by the 27 Member States of the European Union. The Directive addresses 34 spatial data themes needed for environmental applications, with key components specified through technical implementing rules. This makes INSPIRE a unique example of a legislative "regional" approach.

Data Specifications

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- [7 Environmental monitoring Facilities](#)
- [8 Production and industrial facilities](#)
- [9 Agricultural and aquaculture facilities](#)
- [10 Population distribution and demography](#)
- [11 Area management / restriction / regulation zones & reporting units](#)
- [12 Natural risk zones](#)
- [13 Atmospheric conditions](#)
- [14 Meteorological geographical features](#)
- [15 Oceanographic geographical features](#)
- [16 Sea regions](#)
- [17 Bio-geographical regions](#)
- [18 Habitats and biotopes](#)
- [19 Species distribution](#)
- [20 Energy Resources](#)
- [21 Mineral Resources](#)

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font size

SEARCH INSPIRE

- Website and documents
 Website only

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Geological Map Harmonisation Pilot

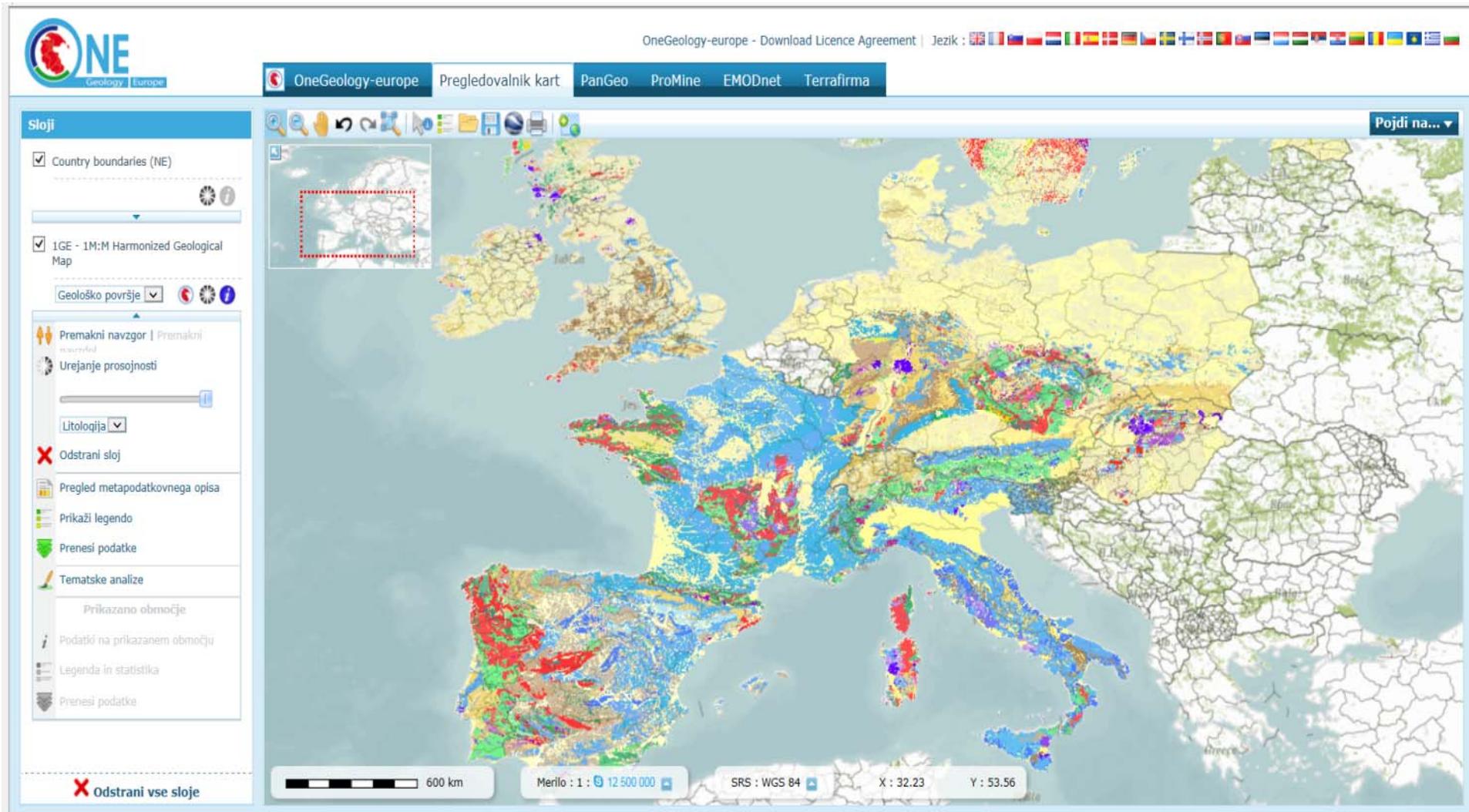
■ Objectives

- A uniform harmonized geological layer across the Italian-Slovenian border based on the INSPIRE Geology model;
- Standard access to geological data, regardless of how each provider manages these data, to improve accessibility to information to most users;
- A common semantic language to exchange geological data.

■ eENVplus components used in the pilot

- Harmonisation toolkit and service
- Validation services
- Standard WCS services as output
- Processing services
- TF services (keywords, metadata and data)

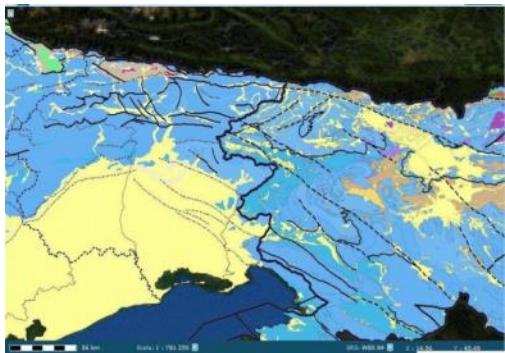
- <http://geoportal.onegeology-europe.org/geoportal/viewer.jsp>



- <http://portal.onegeology.org/>

The screenshot shows a global geological map from the OneGeology Portal. The map uses a color-coded legend to represent different geological units across the continents and oceans. The major oceans labeled are the North Pacific Ocean, South Pacific Ocean, Arctic Ocean, North Atlantic Ocean, South Atlantic Ocean, and Indian Ocean. The map includes a toolbar at the top with various icons for search, zoom, and navigation. At the bottom, there are controls for scale (4000 km), coordinate system (SRS: 2D Latitude / Longitude (WGS84)), and coordinates (X: -170.01, Y: -105.68). A sidebar on the right contains links for Catalogues, Vocabularies, Help, About, and flags for United Kingdom and France. A checkmark indicates "Automatically display layers depending on scale and location".

Starting from OneGeology- Europe activity



OneGeology-Europe dataset

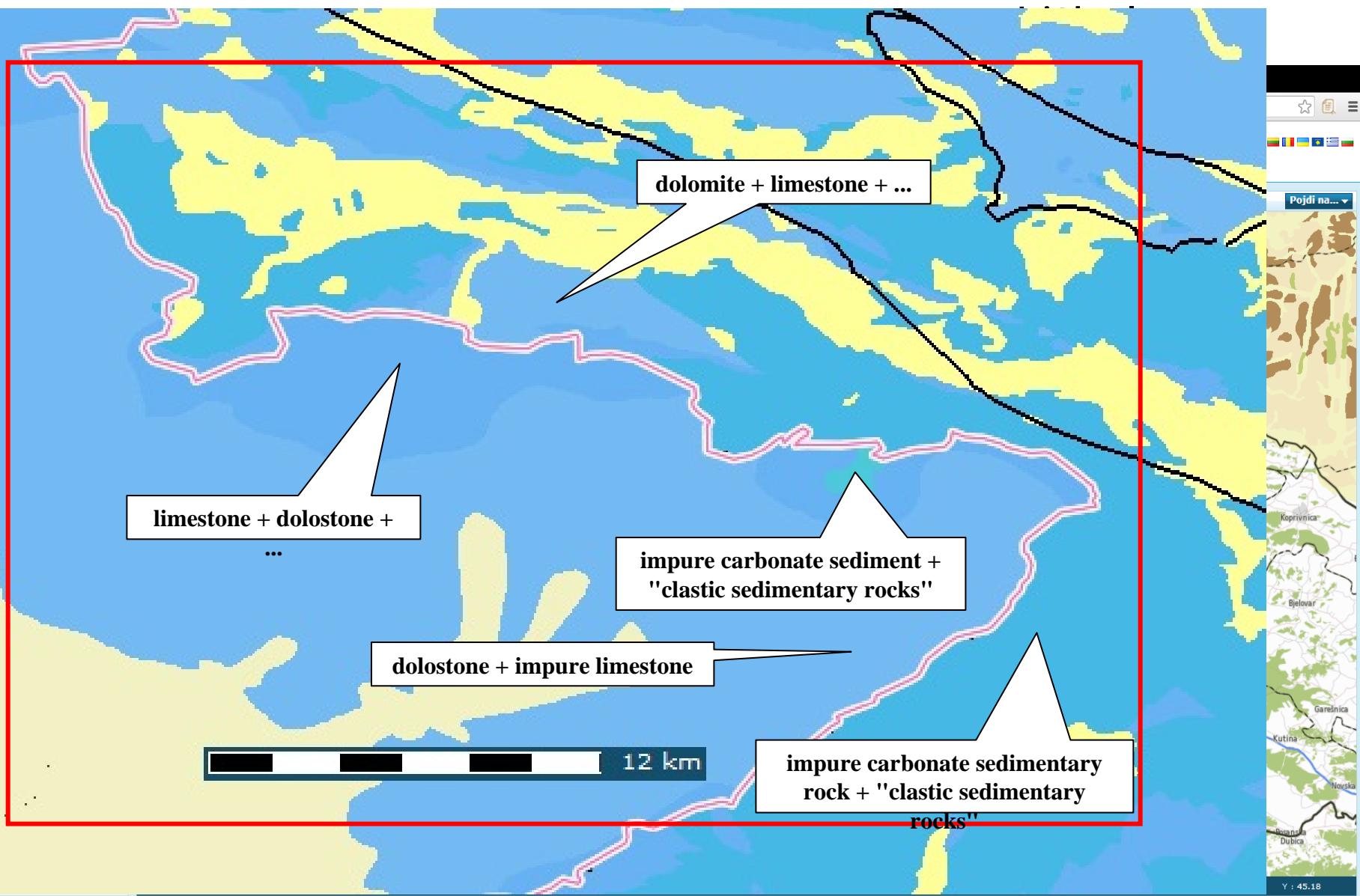
Evaluate litho-stratigraphic anomalies

Solve semantically and geometrically problems

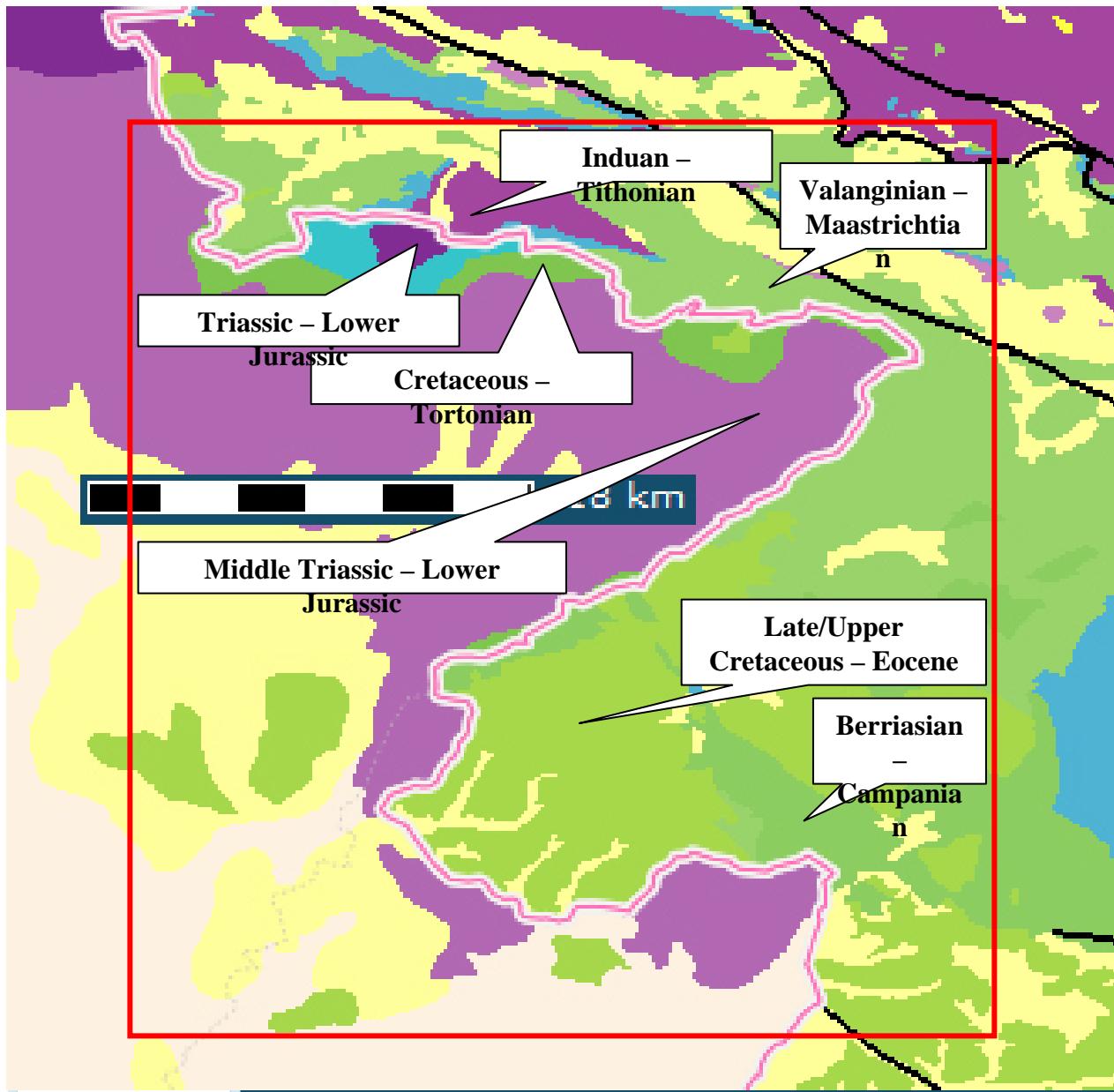
Using 1GE vocabularies

Mapping in GE INSPIRE data model

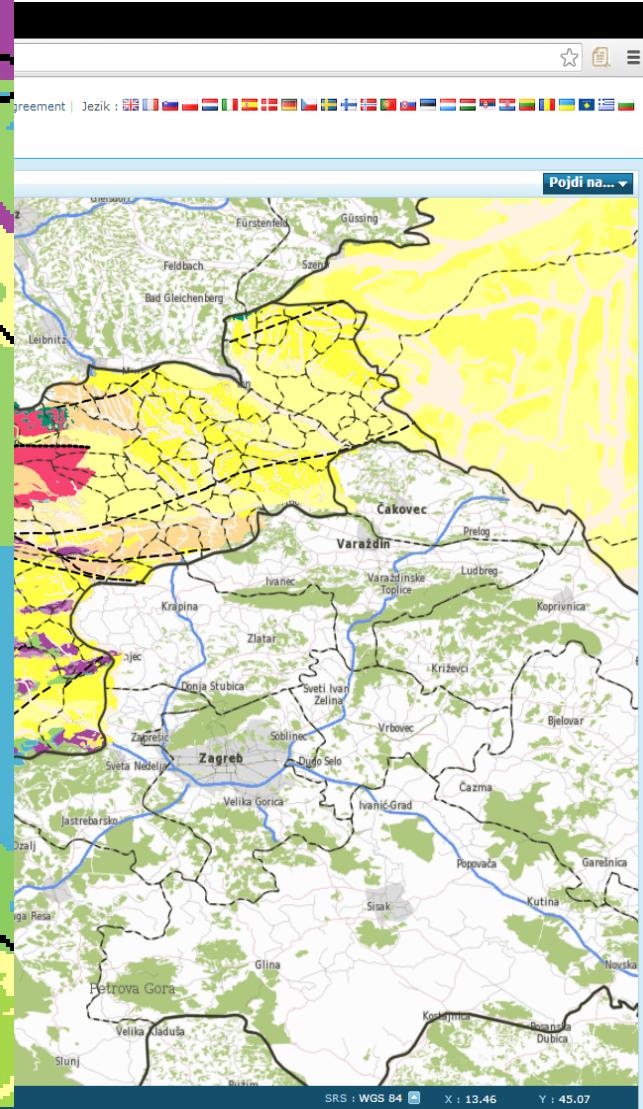
Harmonisation procedure



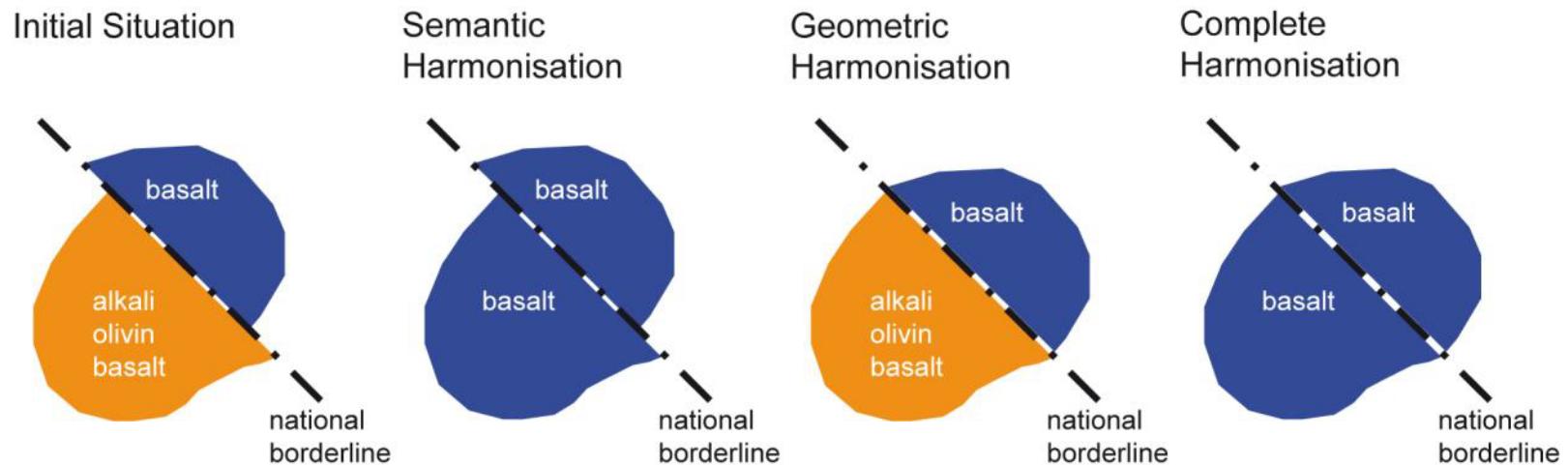
Harmonisation procedure



Age



- Semantic harmonisation
- Geometric harmonisation
- OneGeology Europe aimed to achieve complete semantic harmonisation, but it was only carried out in limited areas



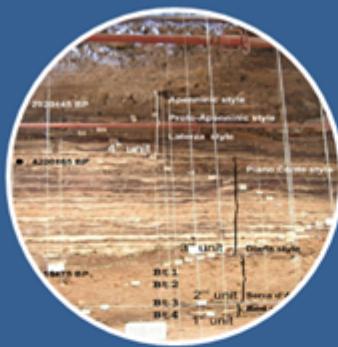
Geologic Unit: Composition Part



Composition part 1

Lithology

Role of composition part Proportion of composition part



Composition part 2

Lithology

Role of composition part

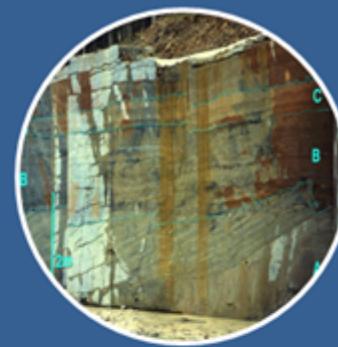
Proportion of composition part



Composition part 3

Lithology

Role of composition part Proportion of composition part



Composition part 4

4

Lithology

Role of composition part

Proportion of composition part



Harmonisation procedure

OPIS_ID	GEOLOGIC UNIT NAME	DESCRIPTION	AGE	NOV_ID	GEOLOGIC UNIT NAME	
3	1	Holocene Fluvial Deposits	Fluvial sediments (gravel, sand, silt and clay)	Quaternary - Holocene	0	Holocene Fluvial Deposits
4	Quaternary Terrestrial Deposits	Clay	Quaternary	1	Quaternary Terrestrial Deposits	
5		Rubble	Quaternary			
6		Alluvial fan (rubble, gravel and silt)	Quaternary			
7		Deluvium (mostly clay with various rock fragments)	Quaternary			
8		Mine waste deposits	Quaternary - Holocene			
9		Clay, peat (marsh deposits)	Quaternary			
10		Clay, silt and weathered peat (marsh and lacustrine deposits)	Quaternary			
11		Gravel and sand	Quaternary			
12		Clayey silt (loess)	Quaternary			
13		Loose fluvial deposits; terraces (gravel, sand, silt and clay)	Quaternary			
14		Coherent fluvial deposits; terraces (conglomerate with gravel intercalations)	Quaternary			
15		Till; moraine	Quaternary - Pleistocene			
16	2	Recent Marine Deposits	Recent marine deposit		Recent Marine Deposits	

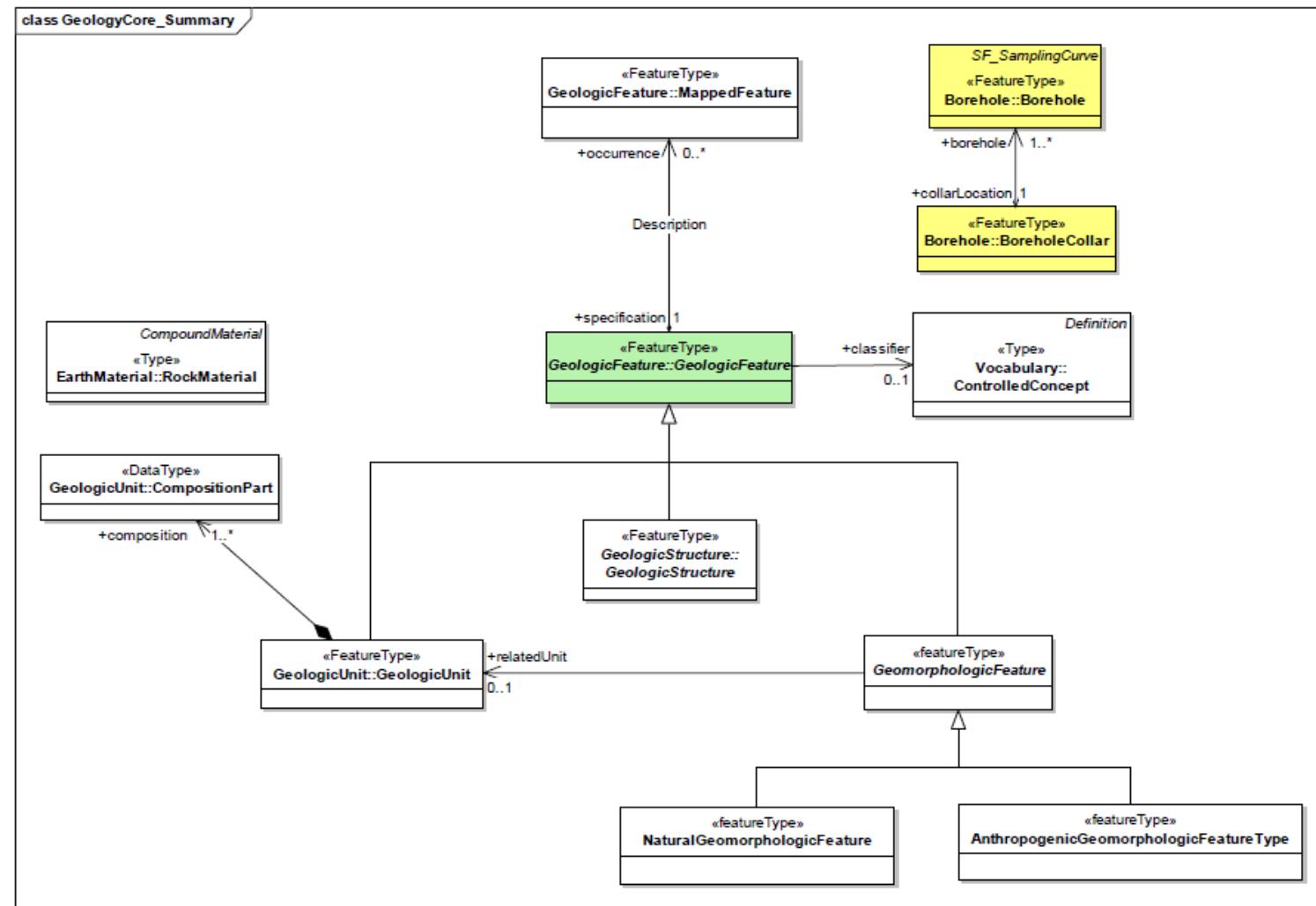
Table 4-6: The 1G-E vocabulary for Sedimentary material.

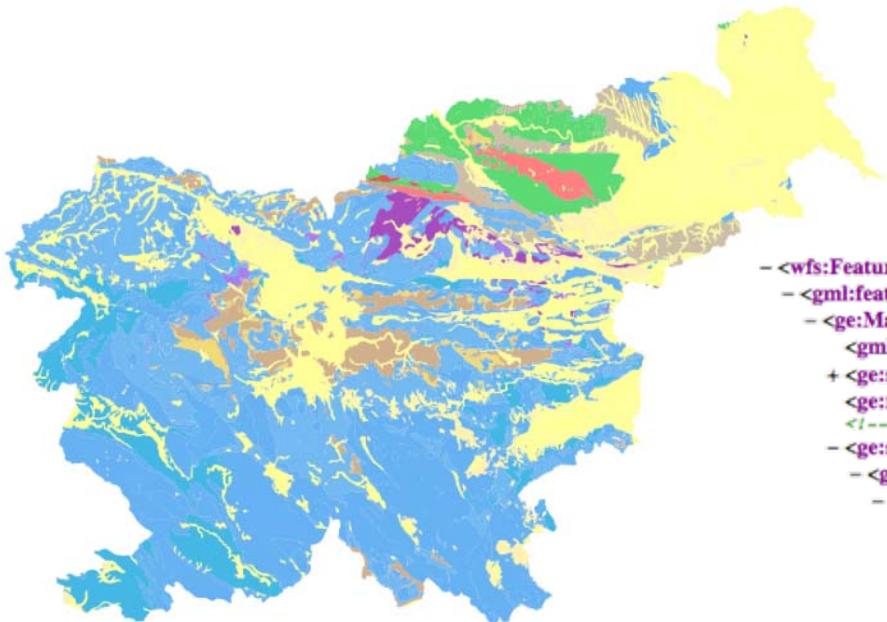
1G-EID	1G-E Term	1G-E Broader Concept	Definition	Holocene to Holocene Terrestrial Deposits and Residuals
1.2	Sedimentary material	compound_material	Material formed by accumulation of solid fragmental material deposited by air, water or ice, or material that accumulated by other natural agents such as chemical precipitation from solution or secretion by organisms. Includes both sediment and sedimentary rock. Includes epiclastic deposits. All stated composition criteria are based on the mineral/compound material (GeoSciML term)/particulate fraction of the material, irrespective of porosity or the pore-fluid. No distinctions are made based on porosity or pore fluid composition (except organic rich sediment in which liquid hydrocarbon content may be considered).	Predominantly Fine-clastic Deposits
1.2.1	Sediment	sedimentary_material	Unconsolidated material consisting of an aggregation of particles transported or deposited by air, water or ice, or that accumulated by other natural agents, such as chemical precipitation, and that forms in layers on the Earth's surface. Includes epiclastic deposits.	ogene Lithothamnium Limestone and Marlstone ogene and Neogene Coarse-clastic Deposits
1.2.1.1	Clastic sediment	sediment	Sediment in which at least 50 % of the constituent particles were derived from erosion, weathering, or mass wasting of pre-existing earth materials, and transported to the place of deposition by mechanical agents such as water, wind, ice and gravity.	aleogene Fine-clastic Deposits e Pliocene Basaltic Tuff and Basalt er Cretaceous to Middle Paleogen Igneous and Other Basin Deposits
1.2.1.1.1	Diamicton	clastic_sediment	Unsorted or poorly sorted, clastic sediment with a wide range of particle sizes, including a muddy matrix. Biogenic materials that have such texture are excluded. Distinguished from conglomerate, sandstone, mudstone based on polymodality and lack of structures related to transport and deposition of sediment by moving air or water. Assignment to an other size class can be used in conjunction to indicate the dominant grain size.	er Cretaceous to Middle Paleogen Platy- to Granular Deposits

	A	B
2	D	litho_1
3	0	1.2.1.1
4	1	1.2.1.1
5	2	1.2.1.1.4
6	3	1.2.1.1.4
7	400	1.2.1.1
8	401	1.2.2.3.1.2
9	402	1.2.2.1.2
10	403	1.2.2.1.1.4
11	5	1.1.1.1.2
12	600	1.1.1.1.2
13	601	1.1.2.1.0.3
14	7	1.2.2.3.2
15	8	1.2.2.3.1.2
16	9	1.2.2.3.2
17	10	1.2.2.3.1.2
18	11	1.2.2.3.1.2
19	12	1.3.1.1.0.4
20	13	1.2.2.3.1.2
21	14	1.2.2.3.1.1.4
22	15	1.2.2.3.1.2
23	16	1.1.2.2.3.1
24	17	1.2.2.3.1.2
25	18	1.2.2.1.3
26	19	1.1.2.1.0.3
27	20	1.2.2.1.4.3
28	21	1.2.2.1.4.3
29	22	1.3.1.1.0.1
30	23	1.3.1.1.0.1

5.2.1 Description of the GeologyCore application schema

A summary of the Geology Core application schema is given in Figure 1.

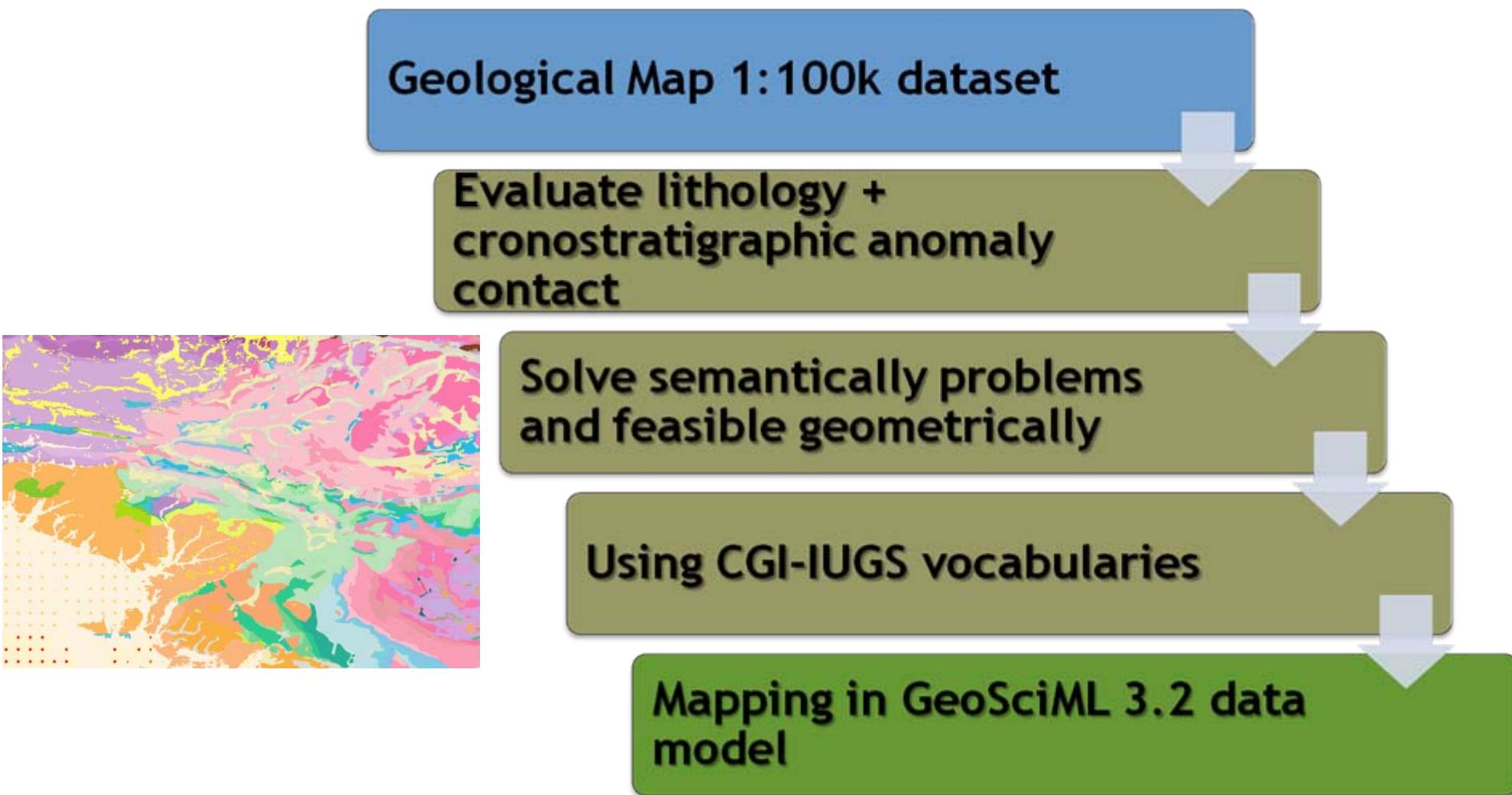




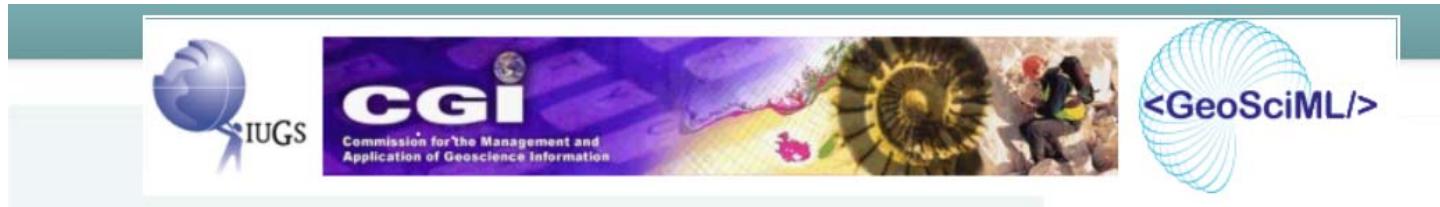
■ WFS INSPIRE compliant

```
- <wfs:FeatureCollection xsi:schemaLocation="http://inspire.ec.europa.eu/schemas/ge-core/3.0rc3 http://inspire.jrc.ec.eu
- <gml:featureMember>
  - <ge:MappedFeature gml:id="FeatureID1">
    <gml:identifier codeSpace="http://sgisprambiente.it/geodata/">Geo1MDB</gml:identifier>
    + <ge:shape></ge:shape>
    <ge:mappingFrame xlink:href="http://sweet.jpl.nasa.gov/ontology/earthrealm.owl#LandSurface">
      <i-- Geological part -->
    - <ge:specification>
      - <ge:GeologicUnit id="GU_1">
        - <ge:inspireId>
          - <base:Identifier>
            <base:localId>InspireID_1</base:localId>
            <base:namespace>ISPRASGI_Geo</base:namespace>
          </base:Identifier>
        </ge:inspireId>
        <ge:name>Geo1MDB_G_1</ge:name>
        - <ge:geologicHistory>
          - <ge:GeologicEvent id="EventID_1">
            - <ge:name>
              Def: Deltaic, alluvial and coastal plain deposits; aeolian deposits
            </ge:name>
            <ge:environment xlink:href="http://resource.geosciml.org/classifier/cgi/eventenvironment/delta">
            <ge:eventProcess nilReason="missing" xsi:nil="true"/>
            <ge:olderNamedAge xlink:href="urn:cgi:classifier:ICS:StratChart:200908:Holocene" xlink:title="urn">
            <ge:youngerNamedAge xlink:href="urn:cgi:classifier:ICS:StratChart:200908:Holocene" xlink:title="">
            </ge:GeologicEvent>
          </ge:geologicHistory>
          <ge:geologicUnitType xlink:href="http://resource.geosciml.org/classifier/cgi/geologicunittype/lithostratigraphic">
        - <ge:composition>
          - <ge:CompositionPart>
            <ge:material xlink:title="urn:cgi:classifier:CGI:SimpleLithology:201001:clastic_sediment">
            <xlink:href="urn:cgi:classifier:CGI:SimpleLithology:201001:clastic_sediment"/>
            <ge:proportion xlink:title="predominant" xlink:href="predominant"/>
            <ge:role xlink:title="unspecified_part_role" xlink:href="unspecified_part_role"/>
          </ge:CompositionPart>
```

Using OneGeology- Europe approach



- GeoSciML is based on Geography Markup Language (GML) for representation of features and geometry and provides a framework for application-neutral encoding of geosciences information.



The screenshot shows the GeoSciML website homepage. At the top left is the IUGS logo. Next to it is the CGI logo (Commission for the Management and Application of Geoscience Information). To the right is a collage of geological images including a globe, a sunflower, and two people in a field. On the far right is the text '<GeoSciML/>' next to a blue circular graphic. Below the header is a navigation menu with links: Home, Introduction to GeoSciML, GeoSciML schemas, Geoscience vocabularies, GeoSciML Standards Working Group (SWG), GeoSciML SWG Wiki, EarthResourceML, and Wiki for earlier versions of GeoSciML. The main content area has a heading 'GeoSciML - current version 3.2'. Below it is a paragraph about the release of version 3.2 in August 2013 and its 13 related modules. A bulleted list follows, including Documentation (HTML), Enterprise Architect UML project file (EAP), XML examples (coming soon), Cookbook for GeoSciML web services for INSPIRE, and XSD schemas. At the bottom left is a yellow starburst icon with the word 'NEW' and a link to an instructional cookbook for GeoSciML web services for INSPIRE from December 2013. At the very bottom is a link to the GeoSciML News Archive.

GeoSciML - current version 3.2

The current release of GeoSciML is version 3.2, released in August 2013. GeoSciML comprises a package of [13 related modules](#). Each module covers a particular domain of geoscience, such as geologic units, earth materials, geologic structures, or boreholes.

- [Documentation \(HTML\)](#)
- [Enterprise Architect UML project file \(EAP\)](#)
- [XML examples \(coming soon\)](#)
- [Cookbook for GeoSciML web services for *INSPIRE*](#)
- [XSD schemas](#)

GeoSciML v3.2 uses ISO and OGC data standards, including GML v3.2, SWE Common v2, and Observations and Measurements v2.

 [Instructional cookbook for GeoSciML web services for *INSPIRE*](#)
(December 2013)

[GeoSciML News Archive](#)

GeoSciML v3.2

- GeoSciML v3.2
 - GeoSciML
 - GeoSciML package dependencies (including external)
 - Color code
 - GeoSciML package dependencies (internal)
 - «Application Schema» GeoSciML-Core
 - GeoSciML-Core package dependencies
 - «Leaf» GeologicFeature
 - Context Diagram : DescriptionPurpose
 - Context Diagram : GeologicFeature
 - Context Diagram : MappedFeature
 - Context Diagram : SamplingFrame
 - Summary Diagram : Geologic Feature
 - «FeatureType» GeologicFeature
 - «FeatureType» MappedFeature
 - «CodeList» DescriptionPurpose
 - «Leaf» GeologicRelation
 - «Application Schema» Borehole
 - «Application Schema» CGI_Utils
 - «Application Schema» Collection
 - «Application Schema» EarthMaterial
 - «Application Schema» Fossil
 - «Application Schema» GeologicAge
 - «Application Schema» GeologicStructure
 - «Application Schema» GeologicTimescale
 - «Application Schema» GeologicUnit
 - «Application Schema» Geomorphology
 - «Application Schema» LaboratoryAnalysis-Specimen
 - «Application Schema» TemporalReferenceSystem
 - «Application Schema» PhysicalProperties
 - «Application Schema» Vocabulary
- External packages

Commission for the Management and Application of Geoscience Information

GeoSciML

Name: Context Diagram : GeologicFeature
 Package: «Leaf» GeologicFeature
 Version: 3.2.0
 Author: CGI Interoperability Working Group

```

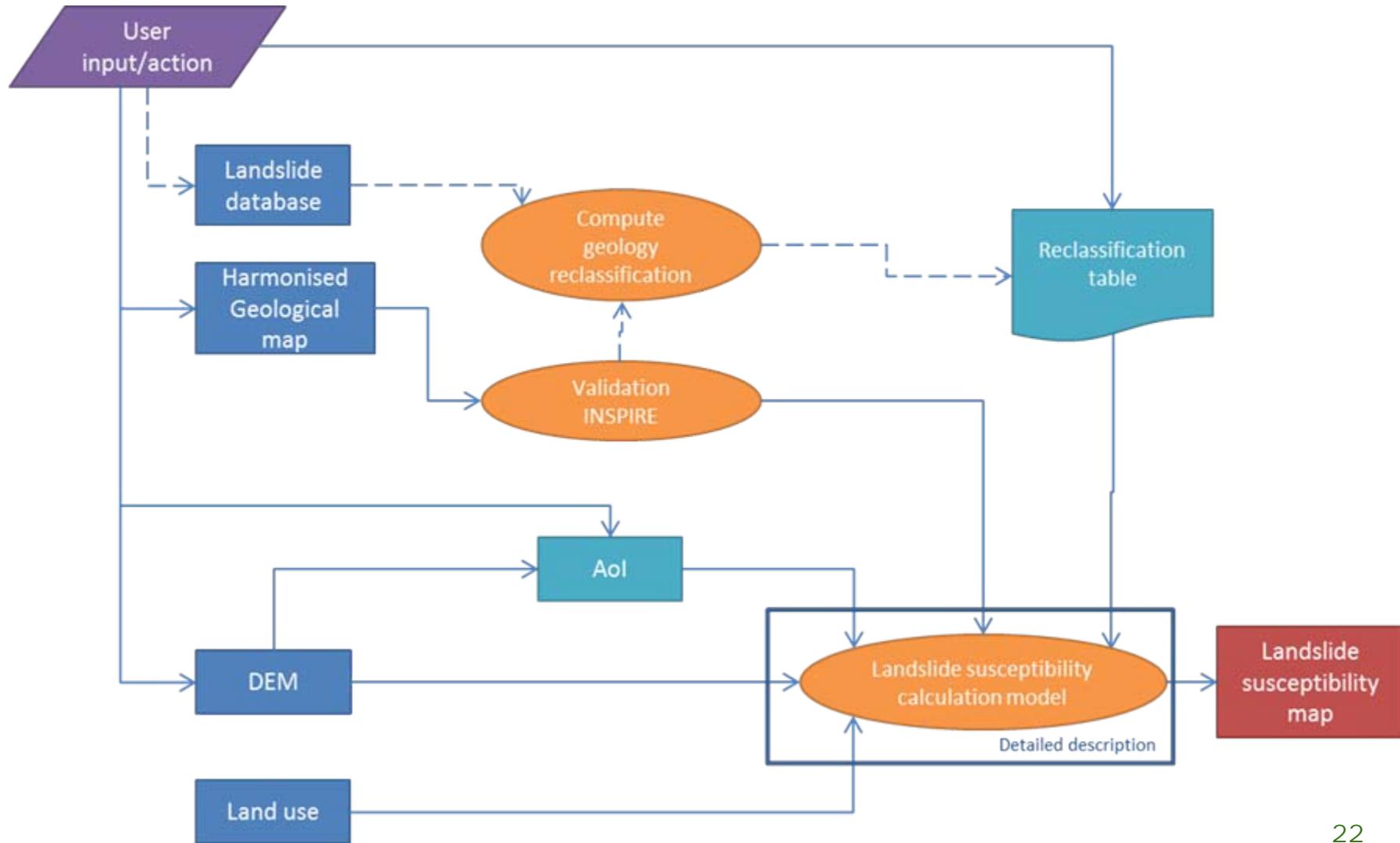
classDiagram
    class MappedFeature {
        <<FeatureType>>
        "0..1" --> MD_Metadata : +metadata ntity set information:: MD_Metadata
        "0..1" --> GeologicFeature : +specification
        "0..1" --> GeologicRelation : +relatedFeature <<voidable>> 1..*
    }
    class GeologicFeature {
        <<FeatureType>>
        "0..1" --> MappedFeature : +occurrence
        "1" --> Definition : +specification
        "1..2" --> GeologicRelation : +relatedFeature <<voidable>> 1..*
        "1" --> constraints : constraints {self.metadata.hierarchyLevel=(feature or dataset or series)}
    }
    class Definition {
        <<Type>>
        "1..2" --> Vocabulary::ControlledConcept : +classifier <<voidable>>
    }
    class Vocabulary::ControlledConcept {
        "1..2" --> Definition : +specification
    }
    class GeologicRelation {
        <<Type>>
        "1..2" --> GeologicFeature : +relatedFeature <<voidable>> 1..*
    }
    class GeologicAge::GeologicEvent
    class GeologicUnit::GeologicUnit
    class GeologicStructure::GeologicStructure
    class Geomorphology::GeomorphologicFeature
    class AbstractSimpleComponent {
        <<Type>>
        Simple Components::Category
        "1..2" --> DescriptionPurpose : +specification
    }
    class DescriptionPurpose {
        <<CodeList>>
        "1..2" --> AbstractSimpleComponent : +specification
        "1..2" --> ReasonsForExistence : +specification
    }
    class ReasonsForExistence {
        Reasons for the existence of this GeologicFeature
    }
    
```

The diagram illustrates the UML class structure for the GeoSciML v3.2 Context Diagram : GeologicFeature. It shows the relationships between various classes such as MappedFeature, GeologicFeature, Definition, Vocabulary::ControlledConcept, GeologicRelation, GeologicAge::GeologicEvent, GeologicUnit::GeologicUnit, GeologicStructure::GeologicStructure, Geomorphology::GeomorphologicFeature, AbstractSimpleComponent, DescriptionPurpose, and ReasonsForExistence. The classes are colored according to their type: purple for FeatureType, green for Type, and yellow for CodeList.

Performed harmonisation process

- Harmonised and validated dataset
 - List of datasets
 - *Geology 100k Italy + Slovenia*
 - *Geology 1M Italy + Slovenia*
 - *Example of landslide Geohazard maps*
 - Harmonisation and validation
 - *Harmonised using Exows >> Geology*
 - *Harmonised using Hale >> Geohazard example*
 - *All are validated using Altova XMLSpy*

Landslide susceptibility map generation workflow



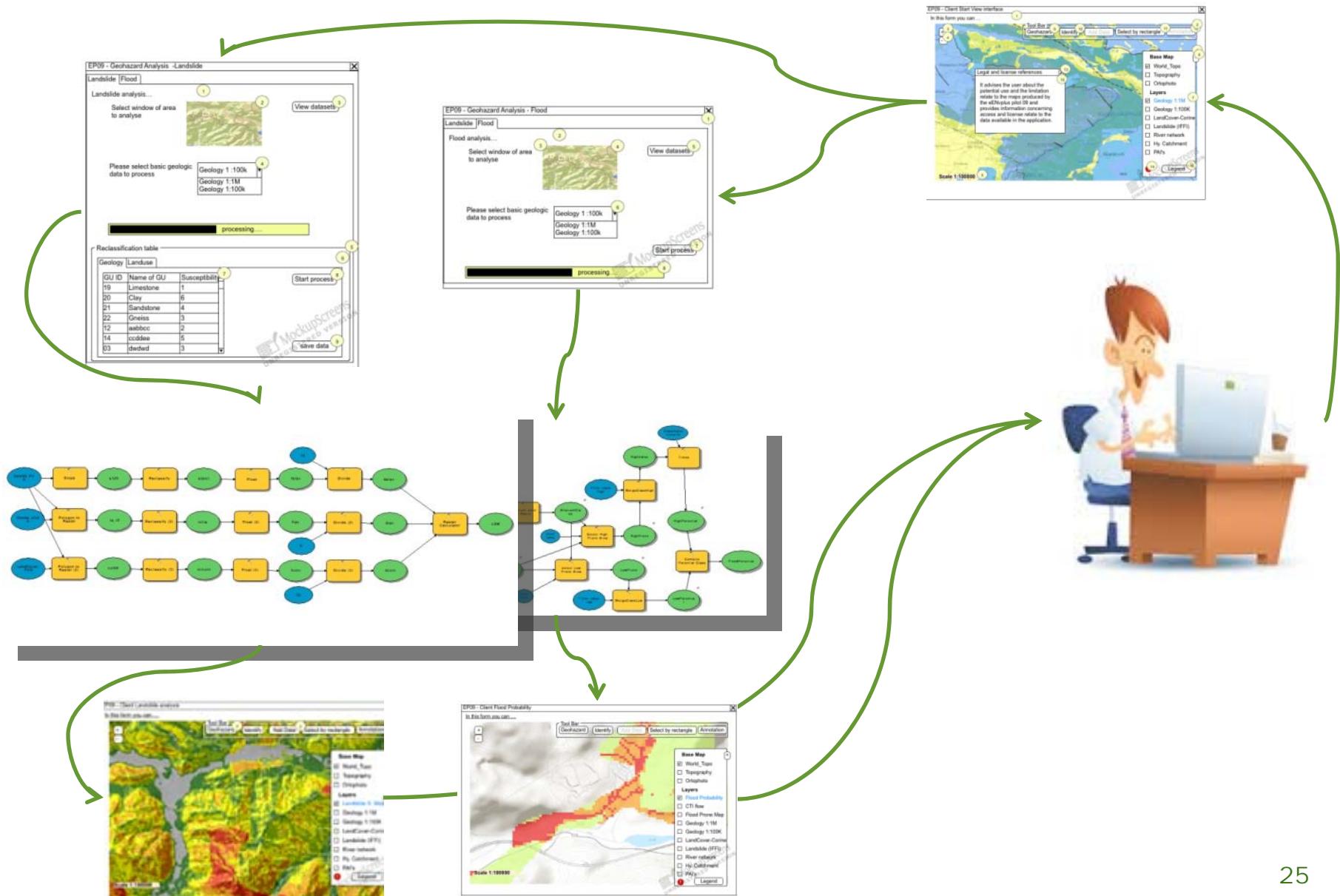
■ Engineering geology reclasification table

CODE # SLO	ENGINEERING-GEOLOGICAL GROUPS	SUSCEPTIBILITY TO		
		LANDSLIDES	ROCKFALLS	DEBRIS FLOWS
1	predominantly unconsolidated clayey soils	6	1	5
2	predominantly consolidated clayey soils	5	2	4
3	marsh, lacustrine soils (clay, silt, peat)	6	1	5
4	alternation of different unconsolidated soils (gravel, sand, silt, clay)	6	2	6
5	alternation of different consolidated soils (gravel, sand, silt, clay)	5	3	5
6	unconsolidated gravel and sandy gravel	4	5	4
7	consolidated gravel and sandy gravel	3	4	3
8	predominantly unconsolidated coarse-grained soils (till, moraine deposits, rubble)	4	5	5
9	predominantly consolidated coarse-grained soils (till, moraine deposits, rubble)	3	4	4
10	clayey and marly soils and rocks	6	3	4
11	alternation of different soils and rocks (clay, marl, sand, sandstone, gravel, conglomerate)	5	4	4
12	conglomerate or sandstone with soil inclusions	3	6	4
13	shale with intercalations of other rocks	6	3	5
14	marlstone and sandstone (flysch) with intercalations of other rocks	6	4	5
15	clastic sedimentary rocks (sandstone, conglomerate) with intercalations of other rocks	6	4	5
16	predominantly marlstone with intercalations of other rocks	5	5	6
17	massive and thick-bedded limestones	2	6	1
18	thin-bedded limestone	3	6	4
19	massive and thick-bedded limestone and dolomite	2	6	2
20	thin-bedded limestone and dolomite	3	6	3
21	massive and thick-bedded dolomite	2	6	2
22	thin-bedded dolomite	3	6	3
23	limestone with intercalations of other rocks	5	6	6
24	carbonate breccia or conglomerate	3	6	3
25	limestone with intercalations of marlstone, marl, silt and clay	4	6	5
26	schistose metamorphic rocks (slates, schists, phyllites)	5	4	4
27	non-schistose metamorphic rocks (gneiss, amphibolite, eclogite, marble, ...)	3	5	3
28	alternation of schistose and non-schistose metamorphic rocks	4	4	4
29	plutonic igneous rocks (tonalite, diorite, granodiorite, ...)	2	6	2
30	pyroclastic rocks with intercalations of other rocks	5	5	6
31	volcanic igneous rocks (trachyte, dacite, andesite, diabase, basalt, spilite, dolerite, variolite, ...)	3	5	3

■ Inputs

Variable Name	Input Type	Default Value	Mandatory
Topography	WMS	n.a	conditional
Ortophoto	WMS	n.a.	conditional
Geology 1:1M	WMS/WFS	INSPIRE Compliant	yes
Geology 1:100K	WMS/WFS	INSPIRE/GSML Compliant	yes
DEM	Raster GDB	n.a.	yes
LandUse CORINE	WMS/WFS		yes

Use case procedure chain



Feel INSPIRED ? ...



Questions ?