

An INSPIRE integrate approach to Environmental Analysis

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ISPRA – Geological Survey of Italy

Main Objectives

- Implementation of a geo-hazard scenario for different sets of indicators (e.g. population, road network, residential area, Cultural Heritage).
- Harmonise the key datasets for scenario based on INSPIRE Directive



- Built an environmental and socio economical indicators database
- Environmental integrated analysis
- A client to view and elaborate the geo-hazard maps

In Italy every year more than 1000 landslides occur and around 20% produce casualties; Area under the risk: 8,1% flood, 7,5% landslide.



Landslide Pilot in LIFE+IMAGINE

The landslide risk scenario is based on:

- A landslide inventory from available historical databases and maps;
- Landslide susceptibility and hazard maps (River Basin Plan – PAI);
- Layers of Exposed elements (e.g. Roads, population, Cultural Heritage);

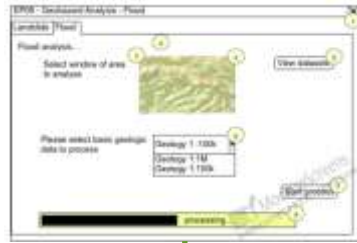
The pilot wants investigate:

- Environmental impacts of exposed elements (specific focus on road fragility);
- Socio-economic impacts of exposed elements (specific focus on building)

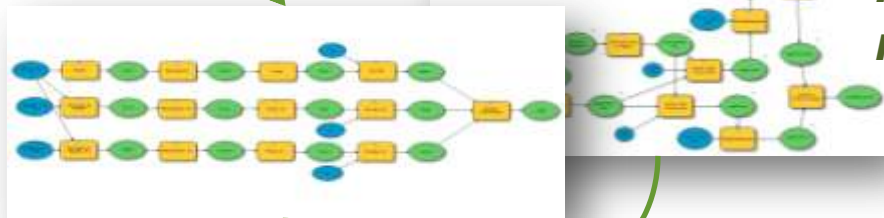


Geo-hazard widget

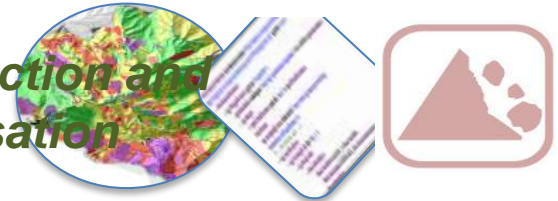
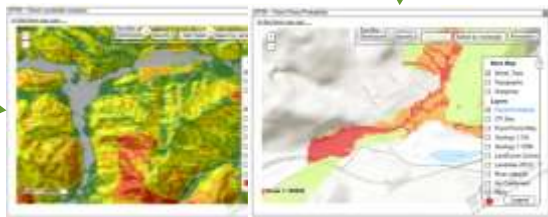
System access



Hazard modelling



Geo-hazard production and INSPIRE harmonisation



Geohazard Pilot in eENVplus

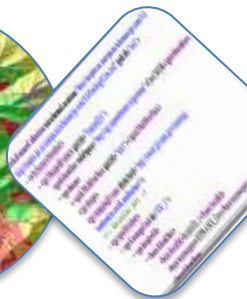
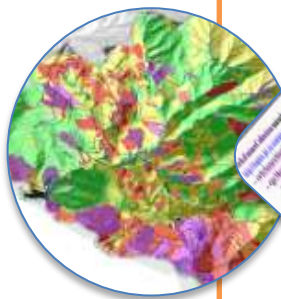
The landslide and flood hazard scenario is based on:

- A landslide inventory from available historical databases and maps;
- A semantic harmonised geological map in a cross-border area;
- Morphometric analysis of DEM;

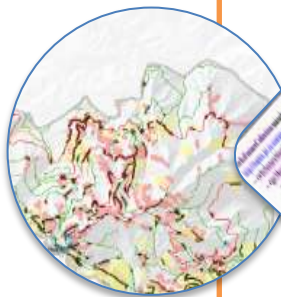
The pilot wants investigate:

- The potential use of harmonised geological map to obtain European continually geo-hazard layers

Data Harmonisation



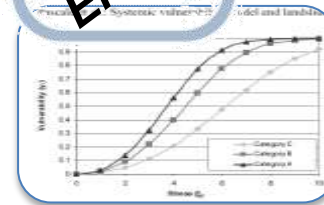
Hazard Area



Data Integration



Exposed Element



Risk Level



Data production approach

Geological Map 1:100k dataset

Evaluate lithology +
cronostratigraphic anomaly contact

Solve semantically problems and
feasible geometrically

Using CGI-IUGS vocabularies
and INSPIRE code-list

Mapping in GeoSciML 3.2 and
INSPIRE data model



Actions chain

Phase 1

- Datasets models analysis
- Datasets Harmonisation vs INSPIRE Data model

Phase 2

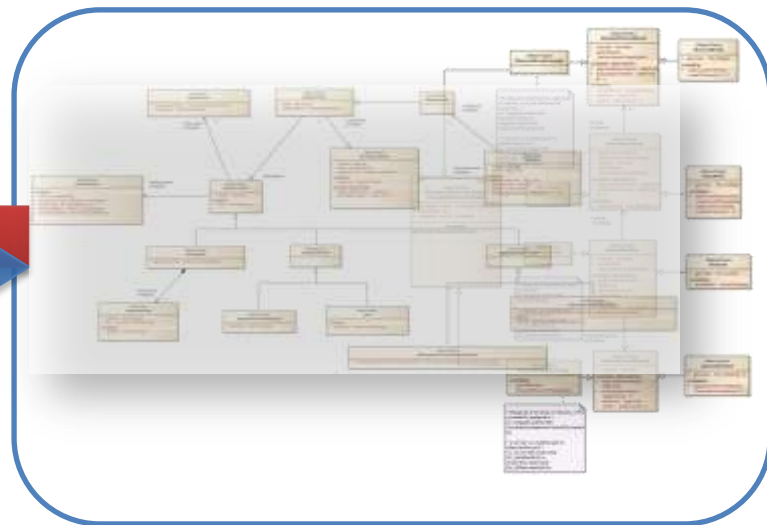
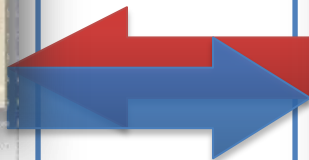
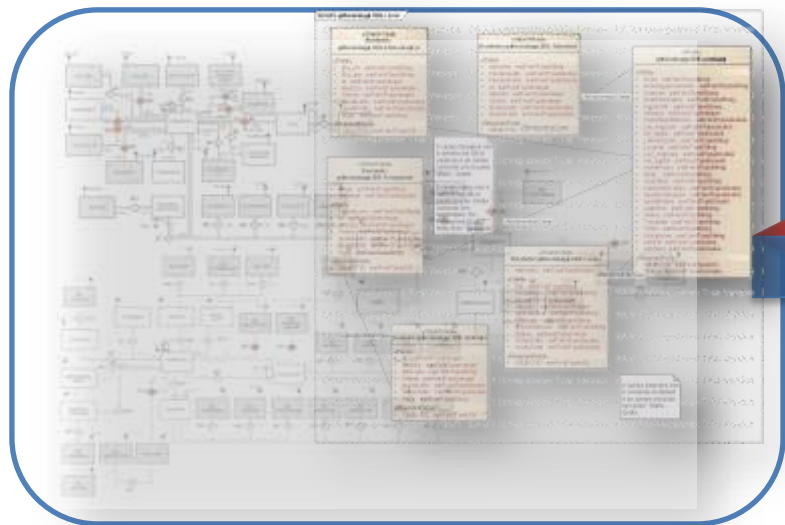
- Use cases development
- Data geoprocessing and integration

Phase 3

- Environmental indicators and analysis

Phase 1: Harmonisation

Harmonisation is the basic action to have a integrated system for geohazard and environmental analysis



Phase 1: Harmonisation

Application Schema 'GeologyCore' (version 3.0rc3)							Application Schema <				
Type	Documentation	Attribute / Association role / Constraint	Attribute / Association role / Constraint documentation	Values / Enumerations	Multiplicity	Voidable / Non-Voidable	Type	Documentation	Attribute / Association role / Constraint	Attribute / Association role / Constraint documentation	Values / Enumerations
GeologicUnit <i>Supertypes: /GeologicFeature / MappedFeature</i>	A volume of rock with distinct characteristics	GeologicFeature	Conceptual geological feature that is	FeatureType			GeoIMDB/ONEGE	Geological model at the scale 1:1,000,000 partially modified by OneGeology-Europe project to match GeoSciML and maybe INSPIRE GE.	ObjectID	identifier	Feature object
		GeologicUnitId	Object identifier	Identifier	1				ID_GEOLOG	Feature identifier	Identifier
		shape	The geometry of the mapped feature.	GM_Object	1				shape	The geometry of the polygon feature.	GM_Object
		inspireId	External object identifier of the spatial object. NOTE An	Identifier	1				ID_GEOLOG	DB name + inspire (string) + Geologic Feature identifier	Identifier
		beginLifespanVersion	Date and time at which this version of the spatial object	DateTime	1	voidable			not present	set or constant in the suit mapping file	DateTime
		endLifespanVersion	Date and time at which this version of the spatial object	DateTime	1	voidable			not present	set or constant in the suit mapping file	DateTime
		Name	The name of Geologic Unit	CharacterString	1	voidable			ID_GEOLOG	DB name + Geologic Feature identifier	string
		gml:description	The geologic unit description; mainly the	CharacterString	0..1				DESCRIPTION	The geologic element description	string
		geologicHistory	An association that relates one or more geologic events to a geologic feature to	GeologicEvent	1..*	voidable			AGE TABLE	represents the link between geologic feature element and the age attribute if are	Link
		geologicUnitType	Terms describing the type of geologic unit.	ValueOfCGL_Term	1	voidable			not present	In this database all the features represent the same	CGL_Term
		composition	Describe the composition of the geologic unit.	ComparisonPart	1..*	voidable			LITHOLOGY TABLE	represents the link between geologic feature element and the lithology attribute	Link
		mappingFrame	The surface on which the mapped feature is projected.	ValueOfCode_List	1				not present	In this database all the features represent the same mapped frame	None Ontology
		geologicHistory <i>Supertypes: /GeologicUnit / MappedFeature</i>	An association that relates one or more geologic events to a geologic feature to describe their age or geologic history.	GeologicEvent	An identifiable event during which an occurrence	FeatureType					GeoIMDB/ONEGE
GeologicEventID	Object identifier			Identifier	1		ID_GEOLOG	Feature identifier	Identifier		
Name	The Name of Geologic			CharacterString/CGL_Ter	1	voidable	not present	string or CGL_Term	CGL_Term		
olderNamedAge	Older boundary of the age			ValueOfCGL_Term	1	voidable	URN_AGE_L	CGL_TERM URI	CGL_Term		
youngerNamedAge	Younger boundary of the	ValueOfCGL_Term	1	voidable	URN_AGE_U	CGL_TERM URI	CGL_Term				

CGI Vocabularies used

International Chronostratigraphic Chart (2013)

<http://resource.geosciml.org/vocabulary/cgi/201211/> + timescale/isc-2013.rdf

CGI Simple Lithology Categories

+ [SimpleLithology201211.rdf](#)

CGI compound Material Constituent Part Role vocabulary

+ [CompoundMaterialConstituentPartRole201211.rdf](#)

CGI Proportion Term Vocabulary

+ [ProportionTerm201211.rdf](#)

CGI Event Environment Categories

+ [EventEnvironment201211.rdf](#)

CGI Event Process Categories

+ [EventProcess201211.rdf](#)

CGI Geologic unit type vocabulary

+ [GeologicUnitType201211.rdf](#)

CGI Consolidation Degree Term Vocabulary

+ [ConsolidationDegree201211.rdf](#)

CGI Foliation Type categories

+ [FoliationType201211.rdf](#)

Phase 1: Harmonisation

```

- <wfs:FeatureCollection xsi:schemaLocation="http://inspire.ec.europa.eu/schemas/ge-core/3.0/ http://inspire.ec.europa.eu/schemas/ge-core/3.0/GeologyCore.xsd">
  - <wfs:featureMember>
    - <ge:MappedFeature gml:id="FeatureID1">
      <gml:identifier codeSpace="http://sgi.isprambiente.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 gml:id="GU_1">

```

```

xlink:href="http://resource.geosciml.org/classifier/cgi/eventenvironment/deltaic_system_setting" xlink:title="deltaic_system_setting"/>
reason="missing" xsi:nil="true"/>

```

```

xlink:href="urn:cgi:classifier:ICS:StratChart:200908:Holocene" xlink:title="urn:cgi:classifier:ICS:StratChart:200908:Holocene"/>

```

```

e xlink:href="urn:cgi:classifier:ICS:StratChart:200908:Holocene" xlink:title="urn:cgi:classifier:ICS:StratChart:200908:Holocene"/>

```

```

- <ge:name>
  Def: Deltaic, alluvial and coastal plain deposits; aeolian deposits
</ge:name>
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<ge:youngerNamedAge xlink:href="urn:cgi:classifier:ICS:StratChart:200908:Holocene" xlink:title="urn:cgi:classifier:ICS:StratChart:200908:Holocene"/>
</ge:GeologicEvent>
</ge:geologicHistory>
<ge:geologicUnitType xlink:href="http://resource.geosciml.org/classifier/cgi/geologicunittype/lithostratigraphic_unit" xlink:title="Lithostratigraphic_unit"/>
- <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"/>

```


Phase 1: Harmonisation

```

sgl3.isprambiente.it/eenvplus/geo100k/?SERVICE=WFS&VERSION=1.1.0&REQUEST=
Cerca
- <gsm1gu:GeologicUnit gml:id="GU_014A031">
  <gml:identifier codeSpace="MEVENT_1">Geo100_GU014A031</gml:identifier>
  <gml:name>calcare di lusznizza</gml:name>
  <gsm1:observationMethod nilReason="missing" xsi:nil="true"/>
  <gsm1:purpose>typicalNorm</gsm1:purpose>
+ <gsm1:relatedFeature></gsm1:relatedFeature>
- <gsm1:relatedFeature>
- <gsm1ga:GeologicHistory gml:id="GU_EV_014A031">
  <gsm1:relationship xlink:href="http://resource.geosciml.org/classifier/cgi/featurerelation/geologicfeaturegeneticevent"/>
  <gsm1:sourceRole nilReason="missing" xsi:nil="true"/>
  <gsm1:targetRole nilReason="missing" xsi:nil="true"/>
- <gsm1:relatedFeature>
- <gsm1ga:GeologicEvent gml:id="EV_0.0">
  <gml:name>Orogenesi alpina</gml:name>
  <gsm1:observationMethod nilReason="missing" xsi:nil="true"/>
  <gsm1:purpose>instance</gsm1:purpose>
  <gsm1:relatedFeature nilReason="missing" xsi:nil="true"/>
  <gsm1:classifier nilReason="missing" xsi:nil="true"/>
  <gsm1:metadata gco:nilReason="missing" xsi:nil="true"/>
  <gsm1ga:eventProcess xlink:href="http://resource.geosciml.org/classifier/cgi/eventprocess/chemical_precipitation" xlink:title="chemical_precipitation"/>
  <gsm1ga:numericAgeDate nilReason="missing" xsi:nil="true"/>
  <gsm1ga:olderNamedAge xlink:href="http://resource.geosciml.org/classifier/ics/ischart/anisian" xlink:title="anisian"/>
  <gsm1ga:youngerNamedAge xlink:href="http://resource.geosciml.org/classifier/ics/ischart/anisian" xlink:title="anisian"/>
- <gsm1ga:eventEnvironment>
- <swe:Category definition="http://inspire.ec.europa.eu/codelist/EventEnvironmentValue">
  - <swe:extension>
    + <swe:Category definition="http://resource.geosciml.org/classifierscheme/cgi/201211/valuequalifier"></swe:Category>
  </swe:extension>
  <swe:identifier>
    http://resource.geosciml.org/classifier/cgi/eventenvironment/marine_carbonate_platform_setting
  </swe:identifier>
  <swe:label>marine_carbonate_platform_setting</swe:label>
  <swe:codeSpace xlink:href="http://resource.geosciml.org/classifier/cgi/eventenvironment"/>
  </swe:Category>
</gsm1ga:eventEnvironment>
<gsm1ga:prototype nilReason="missing" xsi:nil="true"/>

```


Phase 1: Harmonisation

sgl3.isprambiente.it/eenvplus/geo100k/?SERVICE=WFS&VERSION=1.1.0&REQUEST=...

```

- <gsm:GeologicUnit gml:id="GU_014A031">
  <gml:identifier codeSpace="#EVENT_1">Geo100_GU014A031</gml:identifier>
  <gml:name>calcare di lusnizza</gml:name>
  <gml:observationMethod nilReason="missing" xsi:nil="true"/>
  <gml:purpose>typicalNorm</gml:purpose>
  + <gml:relatedFeature></gml:relatedFeature>
- <gml:relatedFeature>
- <gsm:GeologicHistory gml:id="GU_EV_014A031">
  <gml:relationship xlink:href="http://resource.geosciml.org/cla">
  <gml:sourceRole nilReason="missing" xsi:nil="true"/>
  <gml:targetRole nilReason="missing" xsi:nil="true"/>
- <gml:relatedFeature>
- <gsm:GeologicEvent gml:id="EV_0.0">
  <gml:name>Orogenesi alpina</gml:name>
  <gml:observationMethod nilReason="missing" xsi:nil="true">
  <gml:purpose>instance</gml:purpose>
  <gml:relatedFeature nilReason="missing" xsi:nil="true">
  <gml:classifier nilReason="missing" xsi:nil="true">
  <gml:metadata gco:nilReason="missing" xsi:nil="true"/>
  <gsm:eventProcess xlink:href="http://resource.geosciml.org/classifier/cgi/eventenvir">
  <gsm:numericAgeDate nilReason="missing" xsi:nil="true">
  <gsm:olderNamedAge xlink:href="http://resource.geosciml.org/classifier/cgi/olderNamedAge">
  <gsm:youngerNamedAge xlink:href="http://resource.geosciml.org/classifier/cgi/youngerNamedAge">
- <gsm:eventEnvironment>
- <swe:Category definition="http://inspire.ec.europa.eu/et
  - <swe:extension>
  + <swe:Category definition="http://resource.geosciml.org/classifier/cgi/eventenvir">
  </swe:extension>
  <swe:identifier>
  http://resource.geosciml.org/classifier/cgi/eventenvir
  </swe:identifier>
  <swe:label>marine_carbonate_platform_setting</swe:label>
  <swe:codeSpace xlink:href="http://resource.geosciml.org/classifier/cgi/eventenvir">
  </swe:Category>
</gsm:eventEnvironment>
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```

```

<gsm:samplingFrame xlink:href="http://inspire.ec.europa.eu/codelist/MappingFrameValue/surfaceGeology" xlink:title="Surface Geology"/>
+ <gsm:shape></gsm:shape>
- <gsm:specification>
- <gsm:GeologicUnit gml:id="GU_014A031">
  <gml:identifier codeSpace="#EVENT_1">Geo100_GU014A031</gml:identifier>
  <gml:name>calcare di lusnizza</gml:name>
  <gml:observationMethod nilReason="missing" xsi:nil="true"/>
  <gml:purpose>typicalNorm</gml:purpose>
- <gml:relatedFeature>
- <gsm:DefiningStructure gml:id="GU_STA2">
  <gml:relationship/>
  <gml:sourceRole/>
  <gml:targetRole/>
- <gml:relatedFeature>
- <gsm:Foliation gml:id="ST_3.0">
  + <gsm:observationMethod></gsm:observationMethod>
  <gml:purpose>instance</gml:purpose>
  <gml:relatedFeature/>
  <gml:classifier nilReason="missing"/>
  <gml:metadata gco:nilReason="missing"/>
  <gsm:definingElement nilReason="missing"/>
  <gsm:foliationType xlink:href="http://resource.geosciml.org/classifier/cgi/foiliationtype/bedding_lamination_structure"
  xlink:title="bedding_lamination_structure"/>
  <gsm:continuity nilReason="unknown"/>
  <gsm:intensity nilReason="unknown"/>
  <gsm:mineralElement/>
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  <descriptiveOrientation nilReason="missing"/>
  <convention nilReason="missing"/>
  <azimuth nilReason="missing"/>
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  <polarity xlink:title="undefined"/>
  </CGI_PlanarOrientation>
  
```

Harmonisation NRZ output

```

- <gml:featureMember>
- <nz-core:HazardArea gml:id="sinergis-landslide_1429526077941_SHP.1">
+ <gml:boundedBy></gml:boundedBy>
  <nz-core:beginLifeSpanVersion>2015-05-21T17:05:14</nz-core:beginLifeSpanVersion>
  <nz-core:determinationMethod>modelling</nz-core:determinationMethod>
  <nz-core:endLifeSpanVersion nilReason="unknown" xsi:nil="true"/>
- <nz-core:inspireId>
  - <base:Identifier>
    <base:localId>landslide_0</base:localId>
    <base:namespace>http://eenvplus.sinergis.it/geoEnvplus</base:namespace>
  </base:Identifier>
  </nz-core:inspireId>
- <nz-core:typeOfHazard>
  - <nz-core:NaturalHazardClassification>
    <nz-core:hazardCategory xlink:href="http://inspire.ec.europa.eu/codelist/NaturalHazardCategoryValue/landslide"/>
    <nz-core:specificHazardType xlink:href="http://inspire.ec.europa.eu/codelist/SpecificHazardTypeValue/landslideSusceptibility"/>
  </nz-core:NaturalHazardClassification>
  </nz-core:typeOfHazard>
- <nz-core:geometry>
  - <gml:Polygon gml:id="fid_0">
    - <gml:exterior>
      - <gml:LinearRing>
        - <gml:posList>
          848617.4465789263 5164329.332521281 848879.3802223038 5164329.332521281 848879.3802223038 5164242.13081637 848661.1021861559 5164242.13081637
          848661.1021861559 5164285.731668825 848617.4465789263 5164285.731668825 848617.4465789263 5164329.332521281
        </gml:posList>
      </gml:LinearRing>
    </gml:exterior>
  </gml:Polygon>
</nz-core:geometry>
- <nz-core:likelihoodOfOccurrence>
  - <nz-core:LikelihoodOfOccurrence>
    <nz-core:qualitativeLikelihood nilReason="missing" xsi:nil="true"/>
  - <nz-core:quantitativeLikelihood>
    - <nz-core:QuantitativeLikelihood>
      <nz-core:probabilityOfOccurrence>133</nz-core:probabilityOfOccurrence>
    </nz-core:QuantitativeLikelihood>
  </nz-core:quantitativeLikelihood>
</nz-core:LikelihoodOfOccurrence>
</nz-core:likelihoodOfOccurrence>
</nz-core:HazardArea>
</gml:featureMember>

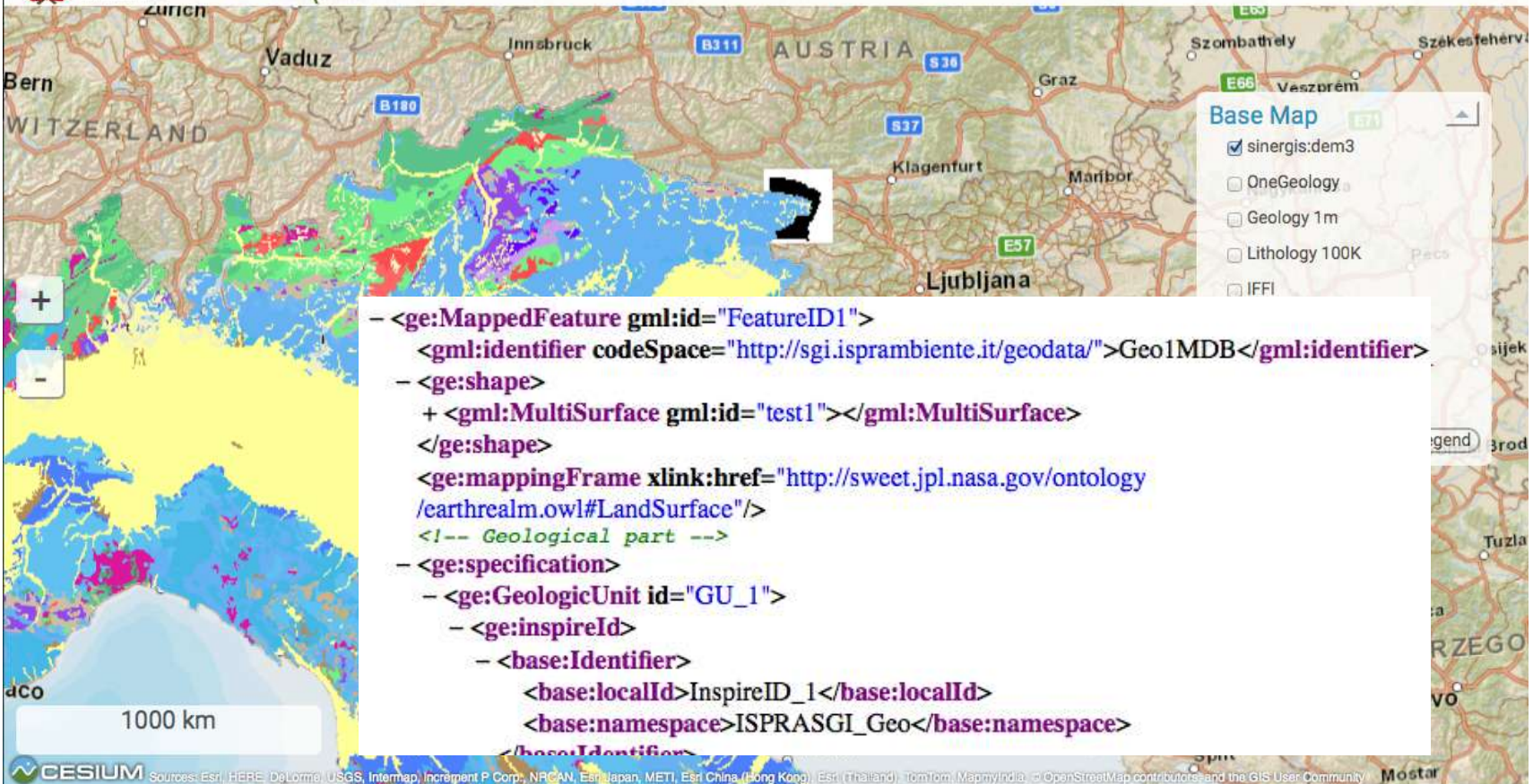
```

Harmonisation NRZ input

```

<gml:featureMember>
- <nz-core:HazardArea gml:id="HazardAreaNr.424">
  <gml:description>ID_sorgente:0;MAPID:0:Note:</gml:description>
  <nz-core:beginLifeSpanVersion>2014-03-25T00:00:00+01:00</nz-core:beginLifeSpanVersion>
  <nz-core:determinationMethod>indirectDetermination</nz-core:determinationMethod>
- <nz-core:inspireId>
  - <base:Identifier>
    <base:localId>101607_Ambito19 - Cinque Terre</base:localId>
    <base:namespace>IT_PA1_RegioneLiguria</base:namespace>
    <base:versionId>1.0</base:versionId>
  </base:Identifier>
</nz-core:inspireId>
- <nz-core:typeOfHazard>
- <nz-core:NaturalHazardClassification>
  <nz-core:hazardCategory xlink:href="http://inspire.ec.europa.eu/codelist/NaturalHazardCategoryValue/landslide"/>
  <nz-core:specificHazardType xlink:href="http://inspire.ec.europa.eu/codelist/SpecificHazardTypeValue/landslideSusceptibility"/>
</nz-core:NaturalHazardClassification>
</nz-core:typeOfHazard>
<nz-core:source xlink:href="#id_0110024500"/>
- <nz-core:geometry>
  - <gml:Polygon gml:id="_525a36b2-7f65-4627-9bff-b8a41c1539de" srsName="EPSG:3044">
    - <gml:exterior>
      - <gml:LinearRing>
        + <gml:posList></gml:posList>
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    </gml:exterior>
  </gml:Polygon>
</nz-core:geometry>
- <nz-core:likelihoodOfOccurrence>
  - <nz-core:LikelihoodOfOccurrence>
    <nz-core:qualitativeLikelihood>Pg4</nz-core:qualitativeLikelihood>
    <nz-core:quantitativeLikelihood xsi:nil="true"/>
  - <nz-core:assessmentMethod xlink:href="http://www.cartografiarl.regione.liguria.it/PianiDiBacino/PdBSpezia/PDB_Ambito19.asp?dove=Pg4">
    - <base2:DocumentCitation gml:id="doc_occ423">
      - <gml:description>
        shpfile:IFFI PA1 join:Fornitore:Provincia di La Spezia:PDB:Ambito19 - Cinque Terre

```

```

- <ge:MappedFeature gml:id="FeatureID1">
  <gml:identifier codeSpace="http://sgi.isprambiente.it/geodata/">Geo1MDB</gml:identifier>
  - <ge:shape>
    + <gml:MultiSurface gml:id="test1"></gml:MultiSurface>
    </ge:shape>
    <ge:mappingFrame xlink:href="http://sweet.jpl.nasa.gov/ontology/
    /earthrealm.owl#LandSurface"/>
    <!-- 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:GeologicUnit>
    </ge:specification>
  </ge:MappedFeature>
  
```

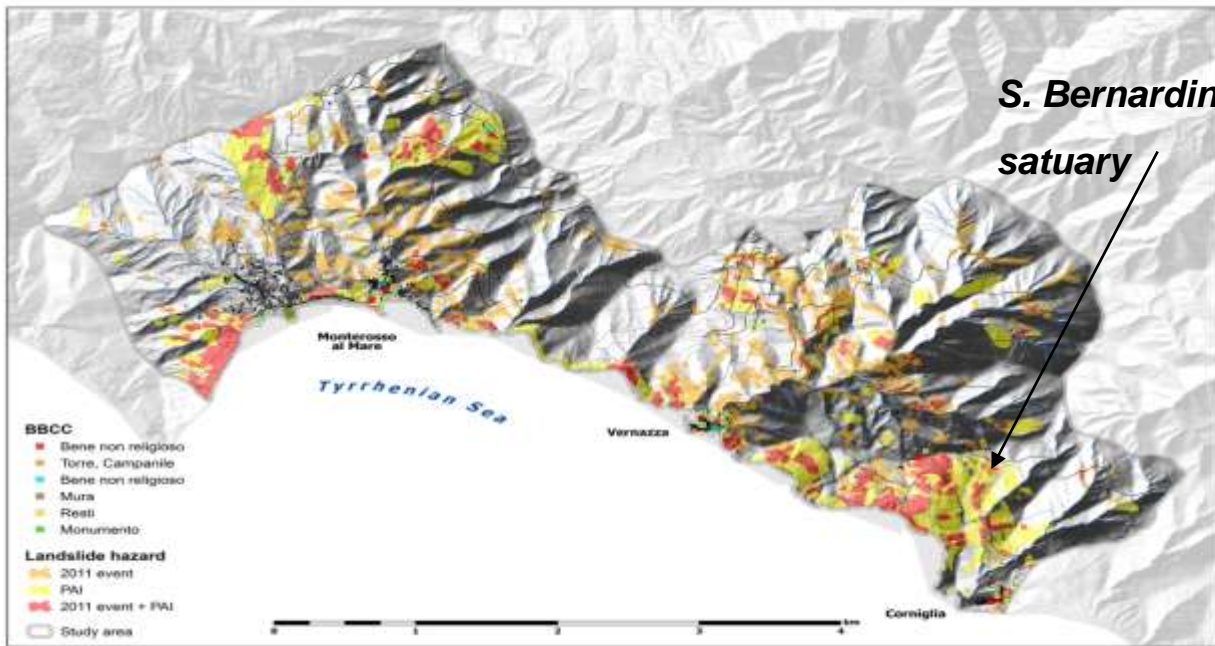


Cesiumshow.mtv



	B - extraurbana principale	C - extraurbana secondaria	E - strade urbane di quartiere	F - strade locali (viab. minore)	Fbis - strade ciclopedonali	TOTALE	Ferrovia
VIABILITA' totale (metri)	829	15568	0	7562	30031	53990	630
	Monterosso	20846	6522	258	721	52435	80782
	Vernazza	21675	22090	258	8283	82466	134772
	TOT						754
VIABILITA' interessata da PAI (metri)	0	2223	0	483	5071	7777	31
	Monterosso	2636	1573	37	0	9599	13845
	Vernazza	2636	3796	37	483	14670	21622
	TOT						145
VIABILITA' interessata da Frane 2011 + buffer 20m (metri)	52	2381	0	1046	5568	9047	109
	Monterosso	5600	1663	0	196	8191	15650
	Vernazza	5652	4044	0	1242	13759	24697
	TOT						138

We have identified more than 400 critical point along the transport network, with a average elongation around 200 meters.



DENOM	TIPO	FRANE	COMUNE
Ospezie nel Santuario di Nostra Signora del Sociovere	torresteria	Pg4	Monterosso
Torre Aurora	TORRE	Pg3b	Monterosso
Oratorio di Santa Caterina	oratorio		Vernazza
STATUA DI NETTUNO (C.D. GIGANTE)	Statua/Complesso scultoreo/Monumento civile		Monterosso
Torre quadrata del castello	TORRE	Pg4	Monterosso
Santuario di S. Bernardino	chiesa	Frana 2011, tipo 99 (duf)	Vernazza
EDIFICIO	Residenza/Abitazione/Casa/E.difeso	Pg3b	Vernazza
Chiesa e convento della Maddalena	CHIESA		Monterosso
ORATORIO DI S. MARIA DI PORTO SALVO	Oratorio		Monterosso
Santello dei mercanti	RESTI	Pg2	Monterosso
Torre medicinale	TORRE		Vernazza
CASE	Complesso di edifici		Vernazza
CAPPELLA (RESTI)	Cappella	Pg3b	Vernazza
Chiesa dei Cappuccini	CHIESA	Pg3b	Monterosso
Chiesa parrocchiale di S. Margherita di Antiochia	CHIESA	Pg3b	Vernazza
PALAZZO	Palazzo/Palazzina		Vernazza
CAMPANILE DELLA PARROCCHIALE	Campanile/Torre campanaria		Monterosso
PALAZZO DELLA LOGGIA DEL 'PODESTA' (RESTI)	Palazzo/Palazzina		Monterosso
Santuario Nostra Signora di Regale	RESTI		Vernazza
CINTA MURARIA (RESTI)	Mura		Vernazza
chiesa di San Giovanni	chiesa		Monterosso
CONVENTO DEI CAPPUCINI	convento		Monterosso
Santuario Santa Maria Del Sociovere	chiesa	Pg4	Monterosso
chiesa di San Pietro	chiesa		Vernazza
Chiesa e convento di S. Francesco	chiesa		Vernazza

An important indicator of environmental impact is the interaction between cultural heritage point and natural prone area, we need to take in account in the disaster resilience evaluation.

Landslide damage

Number, area and density of landslides (no./km²), landslide index (%) in the regional, provincial and municipal territory of the pilot area

Landslides and Communication Infrastructures

Critical points along the highway, road and railway networks

Landslides and Residential Areas

Urbanised surface affected by landslides, number of residential and public buildings (i.e. schools, hospitals etc. . .) potentially exposed by landslides, (if available the CTR vector layer of buildings in regional databases)

Population exposed to landslides phenomena

Number and % of exposed inhabitants in the area (only if data is available at Regional and Local level)

Input data: Inventory of Landslides Phenomena in Italy (IFFI Project), ISTAT Sections of Population Census, Administrative Boundaries, geo-database of civic numbers (if available in the Regional databases)

Landslides and Cultural Heritage

Number and % of exposed cultural heritage in the pilot area

Landslides and Agriculture:

Impacts of the landslides on the agriculture (e.g. terraces) in terms of surface and revenues (if available Land Use 1:10.000 among the Regional Database)

Damage estimation:

Estimation of potential damages and works for landslide risk mitigations (if available data on past events from National Department of Civil Protection)



Environmental impact indicators developed



Environmental and socio-economic impact indicators in progress

Environmental and socio-economic impact indicators

Major outcomes

- ❑ Development of landslide risk analysis models, based on datasets compliant with the INSPIRE Directive or OGC standard;
- ❑ Development a common Environmental (geohazard) Analysis system;
- ❑ Definition of a procedure to evaluate environmental impacts, with a set of indicators, to estimate the % of population, urban areas, infrastructures, terraces and Cultural Heritage affected by landslide events;
- ❑ Improve stakeholder and citizen awareness;
- ❑ Improve the land use planning processes in the long-term, by suggesting interventions aimed at mitigating the impacts;



Thank you for the attention!

? Questions ?

Project reference

Web: <http://www.eenvplus.eu>
<http://www.life-imagine.eu>