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

Disaster events

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

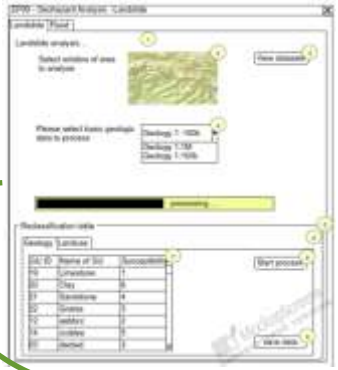
Landslide Pilot in LIFE+IMAGINE

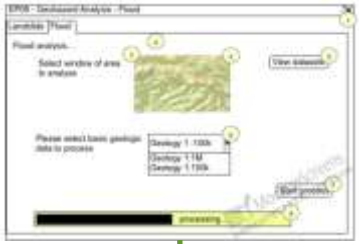
The landslide risk scenario is based on:

- ❑ 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:

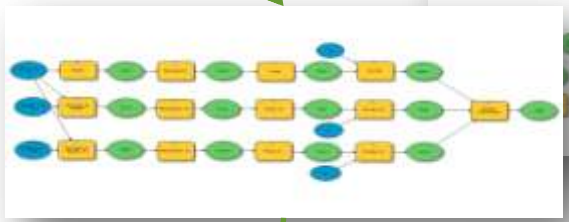
- ❑Environmental impacts of exposed elements (specific focus on road fragility);
- ❑Socio-economic impacts of exposed elements (specific focus on building)

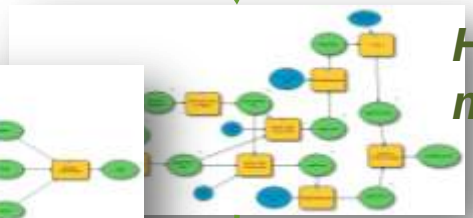




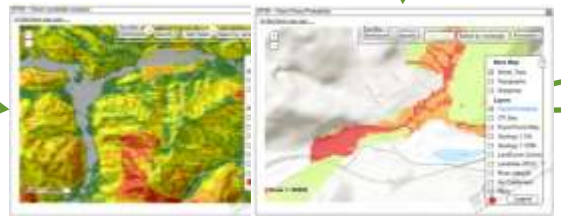
Geo-hazard widget

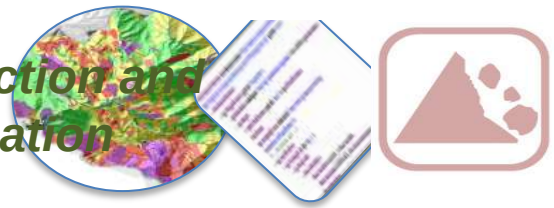
System access





Hazard modelling





Geo-hazard production and INSPIRE harmonisation

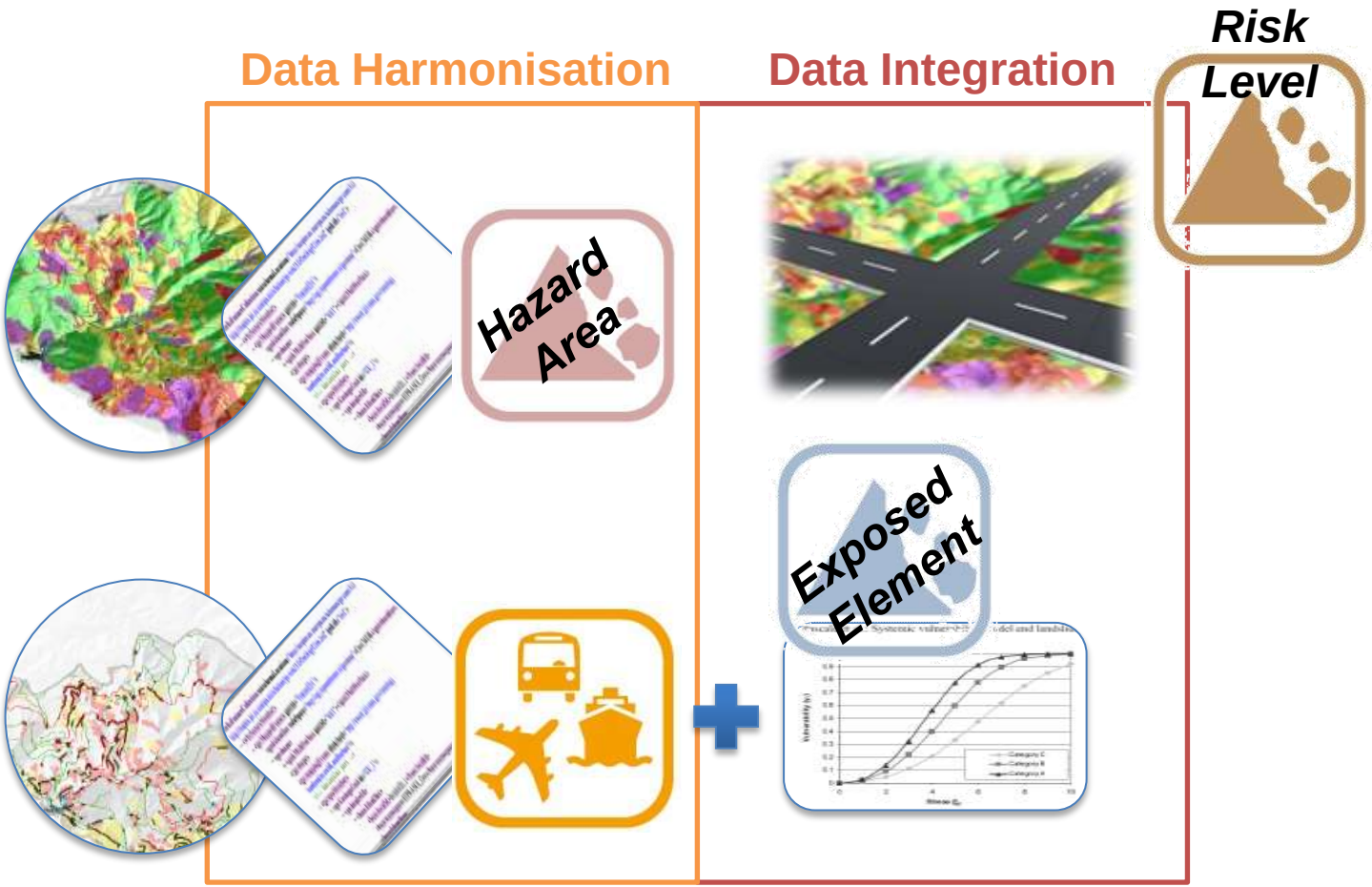
Geohazard Pilot in eENVplus

The landslide and flood hazard scenario is based on:

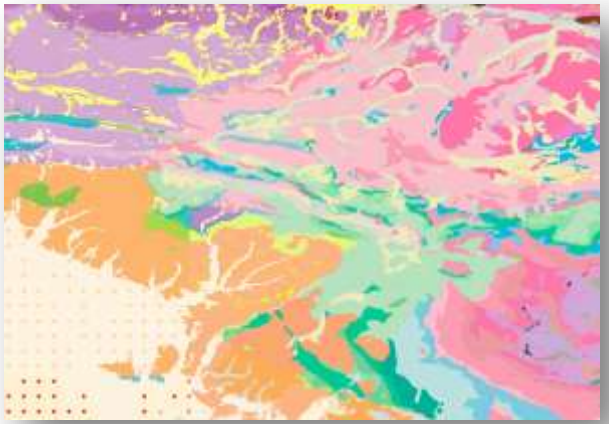
- ❑ A landslide inventory from available historical databases and maps;
- ❑ A semantic harmonised geological map in a cross-border area;
- ❑ Morphometric analysis of DEM;

The pilot wants investigate:

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


Data Harmonisation
Data Integration
Risk Level
Hazard Area
Exposed Element

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

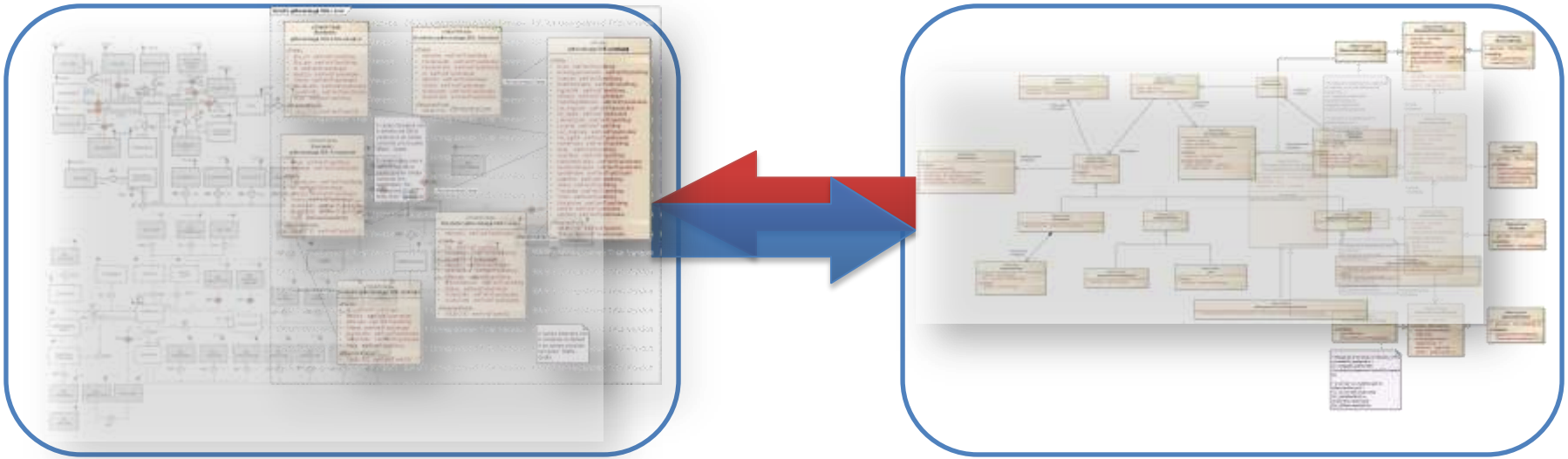
Phase 1
- Datasets models analysis
- Datasets Harmonisation vs INSPIRE Data model

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

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Application Schema 'GeologyCore' (version 3.0rc3)												Application Schema <G
2	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 / Enumeration
3	**GeologicUnit**||Supertypes: *IGeologicFeature|MappedFeature*	A volume of rock with distinct characteristics	GeologicFeature	A conceptual geological feature that ir	featureType				GeoMDB/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
4			**GeologicUnitdId**	Object identifier	Identifier|	1					ID_GEOLOG	feature identifier	Identifier
5			**shape**	The geometry of the mapped feature.	GM_Object|	1					shape	The geometry of the polygon feature.	GM_Object|
6			**inspireId**	External object identifier of the spatial object.||NOTE An	Identifier|	1					ID_GEOLOG	DB name + inspire (string) + Geologic Feature identifier	Identifier
7			**beginLifespanVersion**	Date and time at which this version of the spatial object	DateTime|	1	voidable				not present	set ar constant in the xslt mapping file	DateTime
8			**endLifespanVersion**	Date and time at which this version of the spatial object	DateTime|	1	voidable				not present	set ar constant in the xslt mapping file	DateTime
9			**Name**	The name of Geologic Unit	CharacterString	1	voidable				ID_GEOLOG	DB name + Geologic Feature identifier	string
10			**gml:description**	The geologic unit description; mainly the	CharacterString	0..1					DESCRIPTION	The geologic element description	string
11			**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
12			**geologicUnitType**	Terms describing the type of geologic unit.	Value|CGI_Term	1	voidable				not present	In this database all the feature represent the same	CGI_Term
13			**composition**	Describes the composition of the geologic unit.	CompositionPart	1..*	voidable				LITHOLOGY TABLE	represents the link between geologic feature element and the lithology attribute	Link
14			**mappingFrame**	The surface on which the mapped feature is projected.	Value|Code_List	1					not present	In this database all the feature represent the same mapped frame	Nara Ontology
16	**geologicHistory**|| Supertypes: *IGeologicUnit|MappedFeature*	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 one or more	featureType				GeoMDB/ONEGE	Geological model at the scale 1:1,000,000 partially modified by OneGeology-Europe project to match GeoSciML and maybe INSPIRE GE.	AGE TABLE	AGE AND EVENT ATTRIBUTE PART	
17			**GeologicEventID**	Object identifier	Identifier|	1					ID_GEOLOG	Feature identifier	Identifier
18			**Name**	The Name of Geologic	CharacterString/CGI_Ter	1	voidable				not present	string or CGI_Term	CGI_Term
19			**olderNamedAge**	Older boundary of the age	Value|CGI_Term	1	voidable				URN_AGE_L	CGI_TERM URI	CGI_Term
20			**youngerNamedAge**	Younger boundary of the	Value|CGI_Term	1	voidable				URN_AGE_U	CGI_TERM URI	CGI_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

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– <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">
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      – <ge:specification>
        – <ge:GeologicUnit gml:id="GU_1">

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link:href="urn:cgi:classifier:ICS:StratChart:200908:Holocene" xlink:title="urn:cgi:classifier:ICS:StratChart:200908:Holocene"/>
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          – <ge:name>
              Def: Deltaic, alluvial and coastal plain deposits; aeolian deposits
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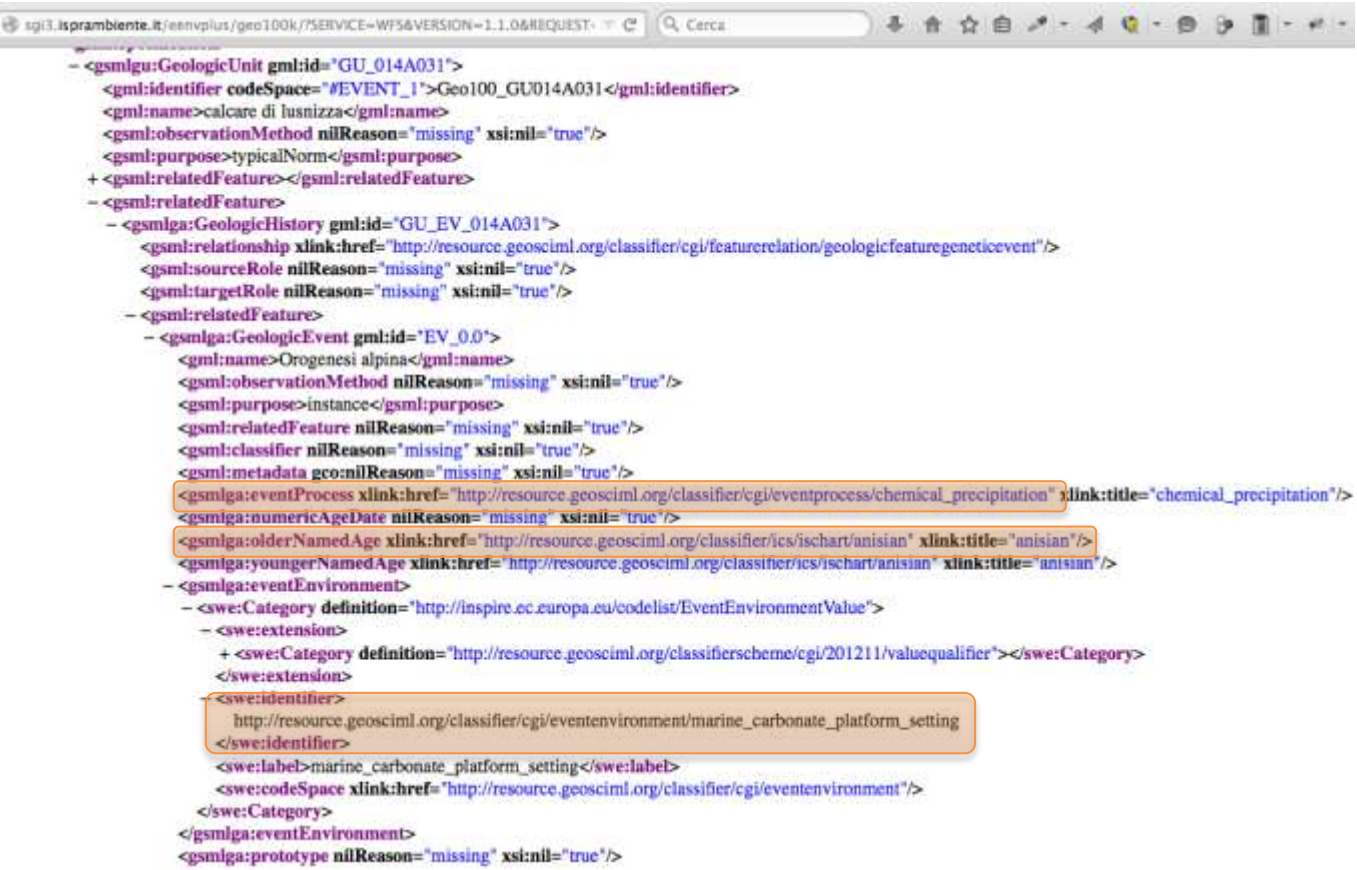
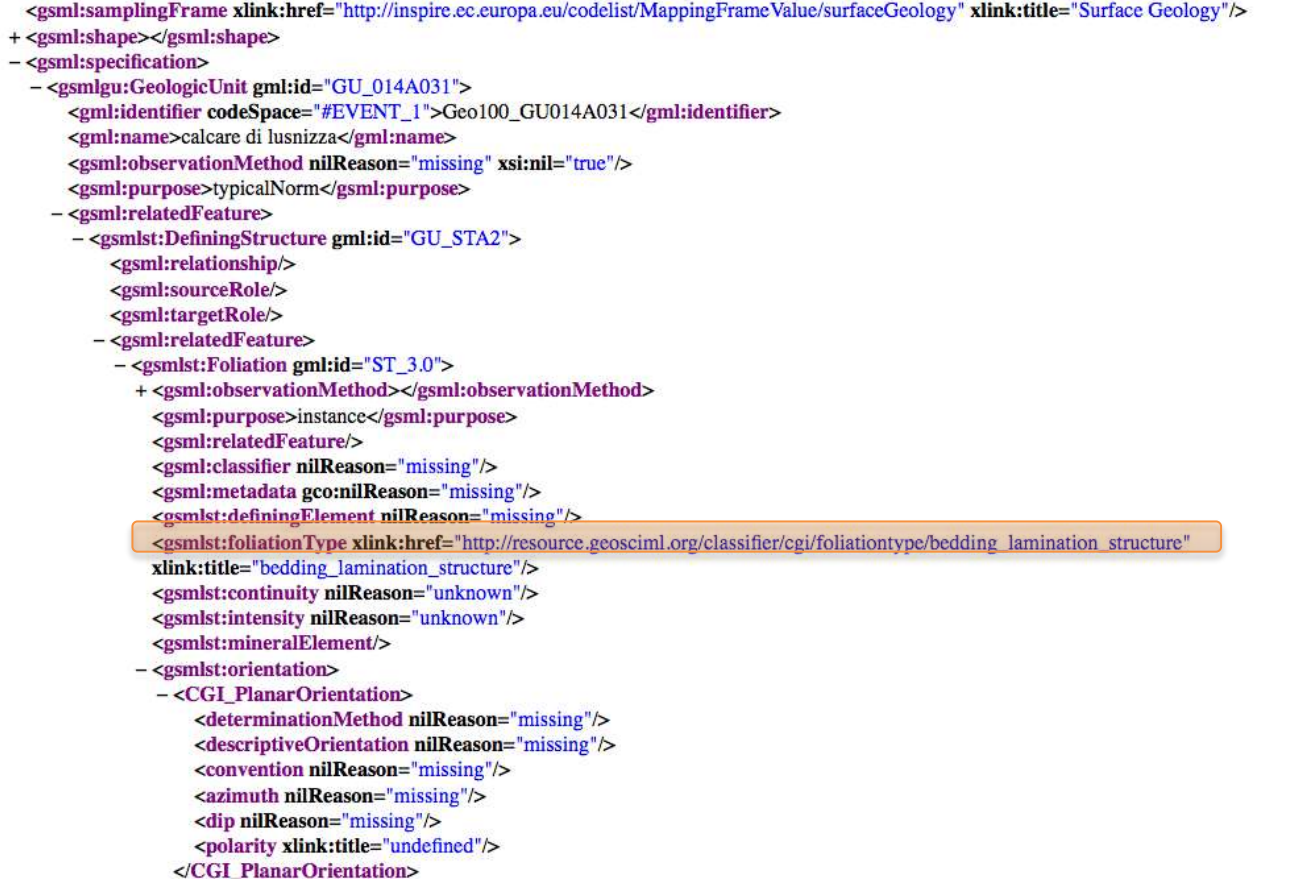
Phase 1: Harmonisation



Phase 1: Harmonisation



Harmonisation NRZ output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    - <nz-core:inspireId>
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        </base:Identifier>
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          - <gml:LinearRing>
            - <gml:posList>
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                848661.1021861559 5164285.731668825 848617.4465789263 5164285.731668825 848617.4465789263 5164329.332521281
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Harmonisation NRZ input

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ISPRA
eENVplus
Geohazard
Base Map
sinergis:dem3
OneGeology
Geology 1m
Lithology 100K
IFFI
1000 km
CESIUM
Sources: Esri, HERE, DeLorme, USGS, Intermap, Increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors and the GIS User Community
– <ge:MappedFeature gml:id="FeatureID1">
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– <ge:shape>
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– <ge:specification>
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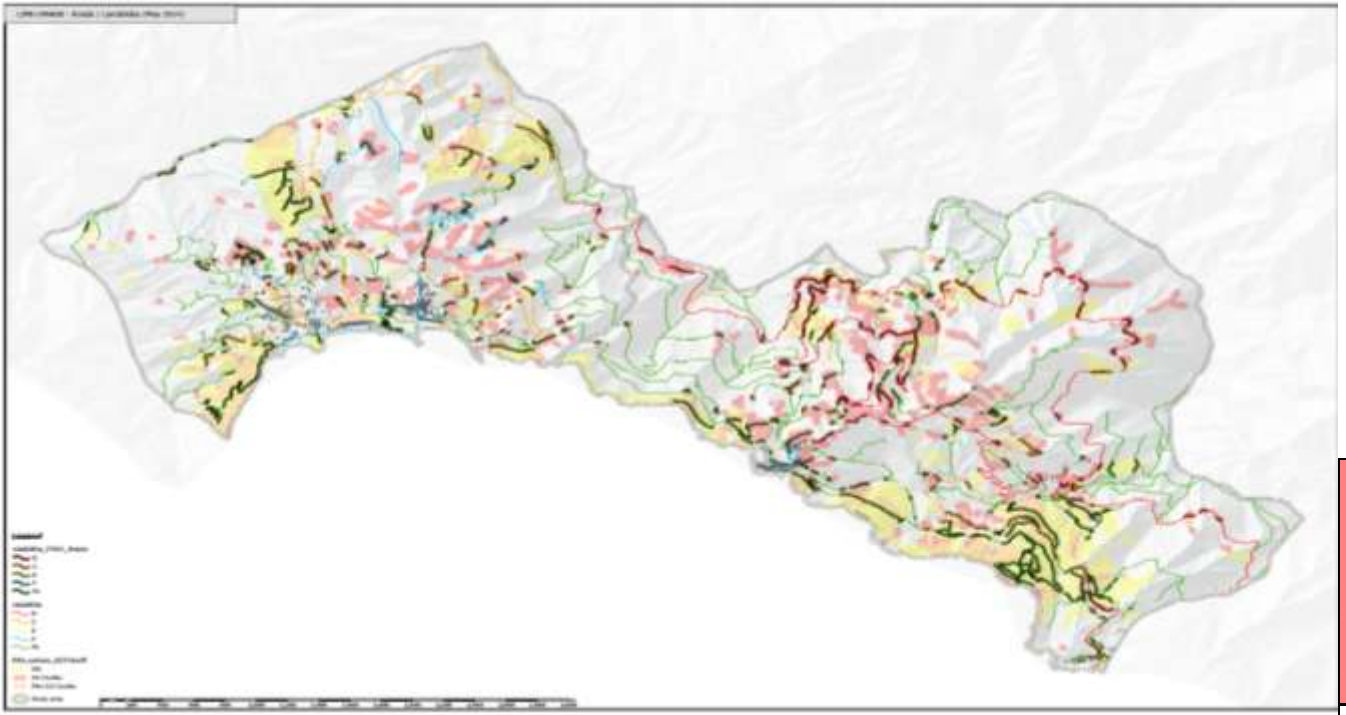
Cesiumshow.mp4

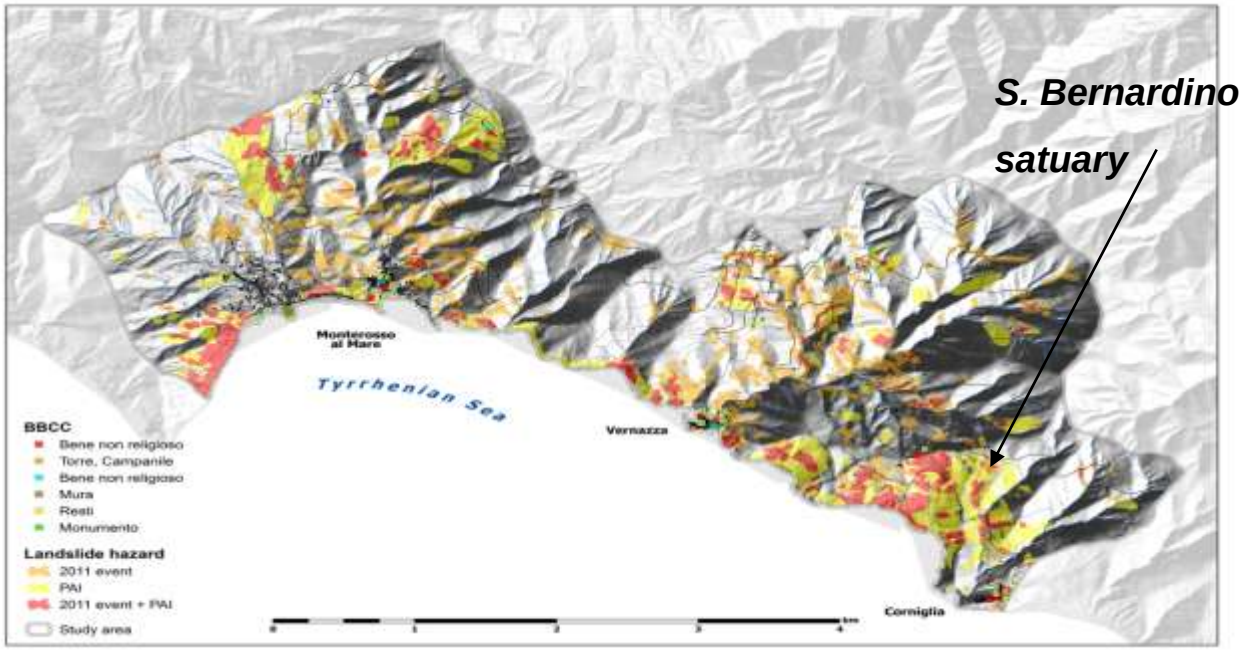
Landslide vs transport network



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

		B - extraurbana principale	C - extraurbana secondaria	E - strade urbane di quartiere	F - strade locali (viab. minore)	Fbis - strade ciclopedonali	TOTALE	Ferrovia
VIABILITA' totale (metri)	Monterosso	829	15568	0	7562	30031	53990	630
	Vernazza	20846	6522	258	721	52435	80782	124
	TOT	21675	22090	258	8283	82466	134772	754
VIABILITA' interessata da PAI (metri)	Monterosso	0	2223	0	483	5071	7777	31
	Vernazza	2636	1573	37	0	9599	13845	114
	TOT	2636	3796	37	483	14670	21622	145
VIABILITA' interessata da Frane 2011 + buffer 20m (metri)	Monterosso	52	2381	0	1046	5568	9047	109
	Vernazza	5600	1663	0	196	8191	15650	29
	TOT	5652	4044	0	1242	13759	24697	138

Landslide vs Cultural Heritage



DENOM	TIPO	FRANE	COMUNE
Ospizio nel Santuario di Nostra Signora del Soviore	foresteria	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 (buf	Vernazza
EDIFICIO	Residenza/Abitazione/Casa/Edificio	Pg3b	Vernazza
Chiesa e convento della Maddalena	CHIESA		Monterosso
ORATORIO DI S.MARIA DI PORTO SALVO	Oratorio		Monterosso
Castello dei Fieschi	RESTI	Pg4	Monterosso
Torre medioevale	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		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 Reggio	RESTI		Vernazza
CINTA MURARIA (RESTI)	Mura		Vernazza
chiesa di San Giovanni	chiesa		Monterosso
CONVENTO DEI CAPPUCCINI	convento		Monterosso
Santuario Santa Maria Del Soviore	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./km^2), 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