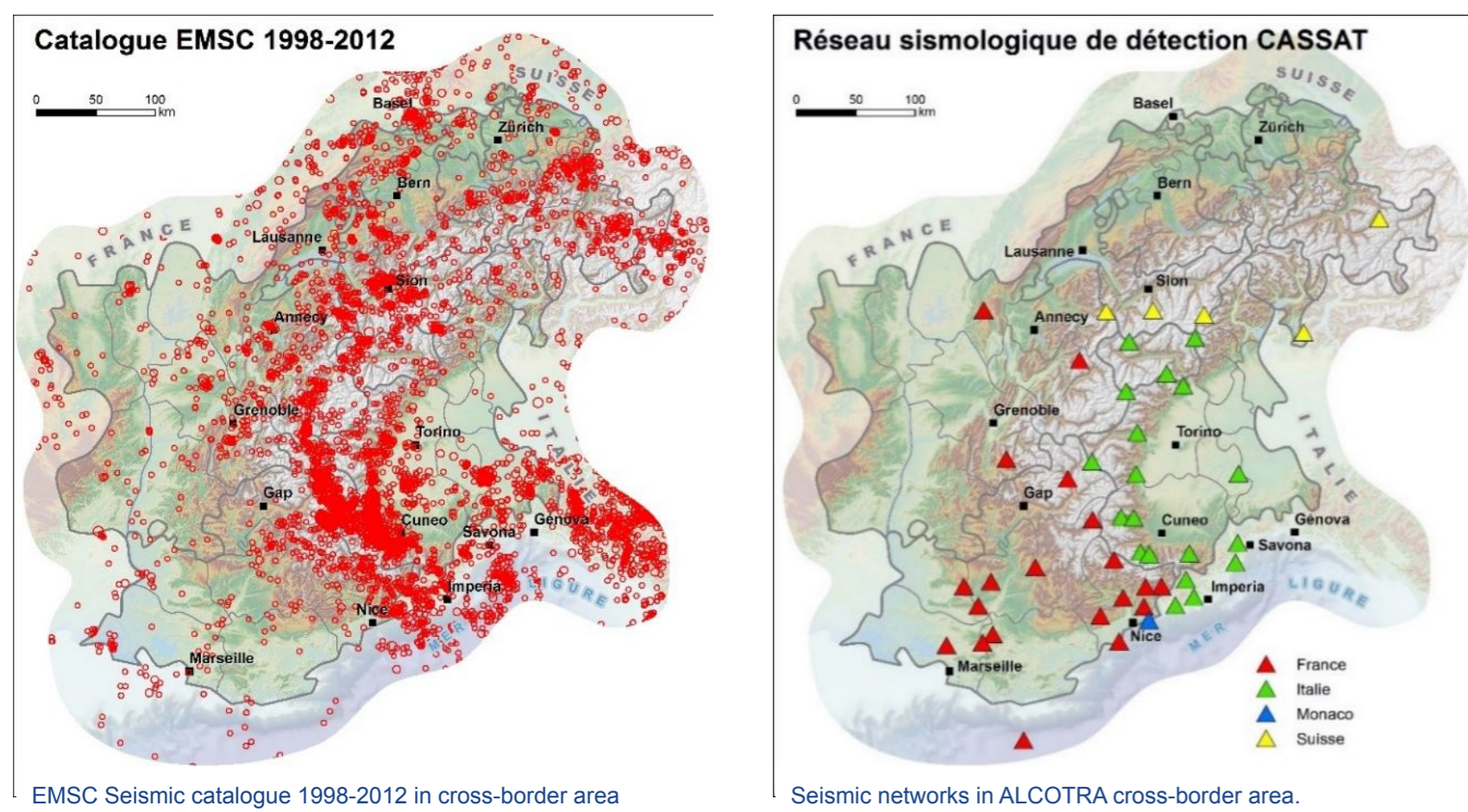**Interreg**
ALCOTRA
RISVAL

Rapid assessment of seismic impact in Western Alpine area: development in Italy and French cross–border project (ALCOTRA RISVAL)

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The **cross-border project** Interreg ALCOTRA RISVAL (Alpine Seismic Risk and Vulnerability) aims to increase the **resilience** of the **Western Alps** territory to **seismic risk**, with the cooperation of **regional government bodies** and **research organization**, in order to improve the response capacity to the impact of significant events and the awareness of both population and institutions responsible for management of the territory and the emergencies. The peri-alpine regions are **highly anthropized** and characterized by a **high social-economic development**, in terms of population density, presence of buildings, infrastructures, economic activities and cultural heritage, in general of **goods exposed** to the impact of different natural phenomena (earthquakes, landslides, floods, etc.) affecting the area, geologically active, sometimes even with **high intensity**. With regard to the **seismic risk** in Western Alps extended region, the most active sectors are the ones close and in the core of the mountain chain.
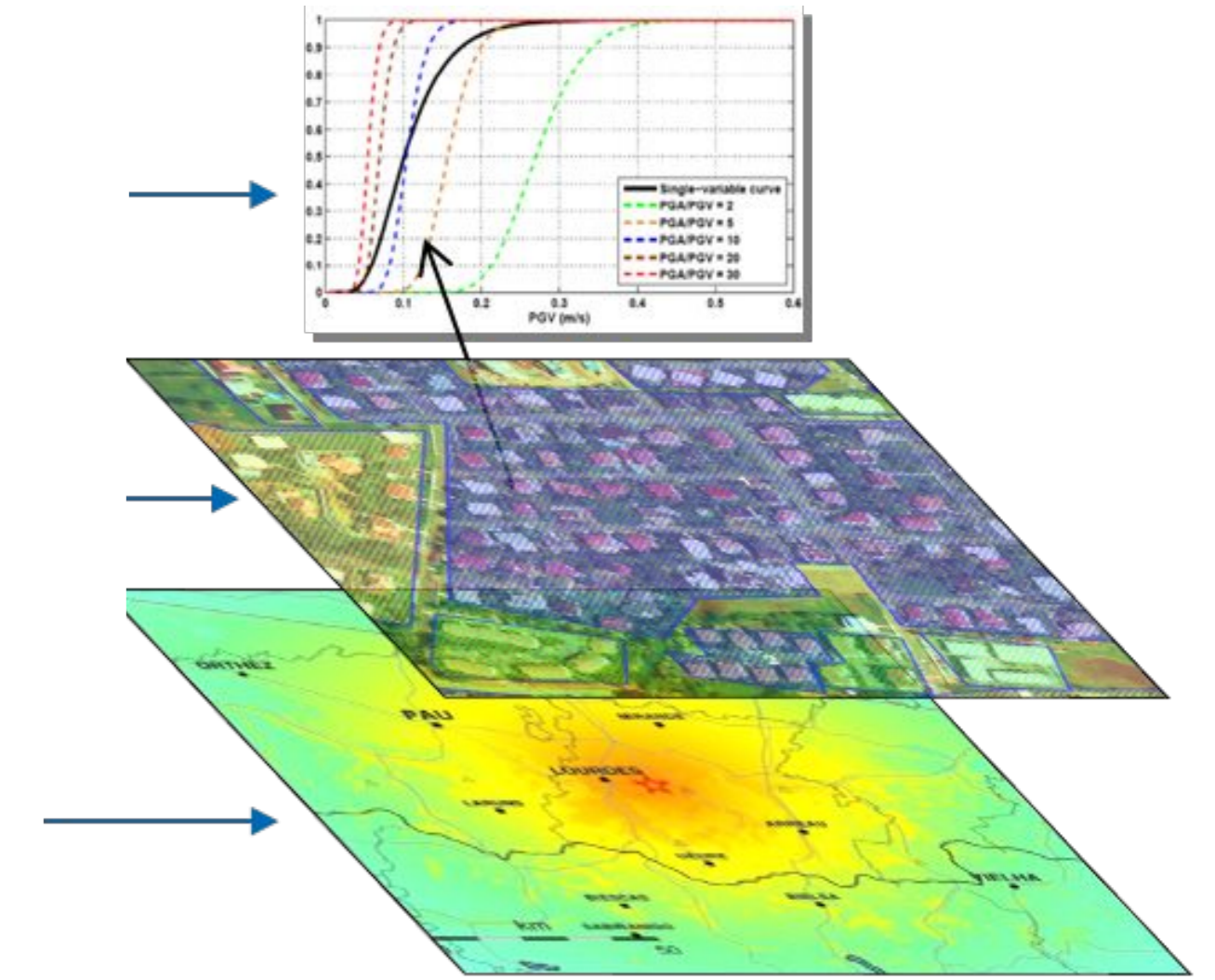
It is useful to develop **tools** that can provide rapid, accurate, easy-to-use **information** that can be supportive in the **evaluation of the impacts** produced by natural phenomena on the elements exposed. Therefore the information produced needs to be easily consulted and interpreted by the **end users**: so it can be **georeferenced**, available through **web-services**, represented with **aggregations** and **schemes** suitable to describe the complexity of the data in a concise but effective way. With regard to the **seismic risk** in Western Alps, the operating chains on both French and Italian sides include the **regional monitoring networks** and the **localization and analysis systems**, that give information about **source characterization** through different developed **specifically algorithms**, and about **ground motion propagation** on the territory through the USGS **ShakeMap** code (Wald et al., 2005).
The cooperation with government and territorial agencies provides the availability of a large amount of territorial information organized in **geodatabases**.

Vulnerability model
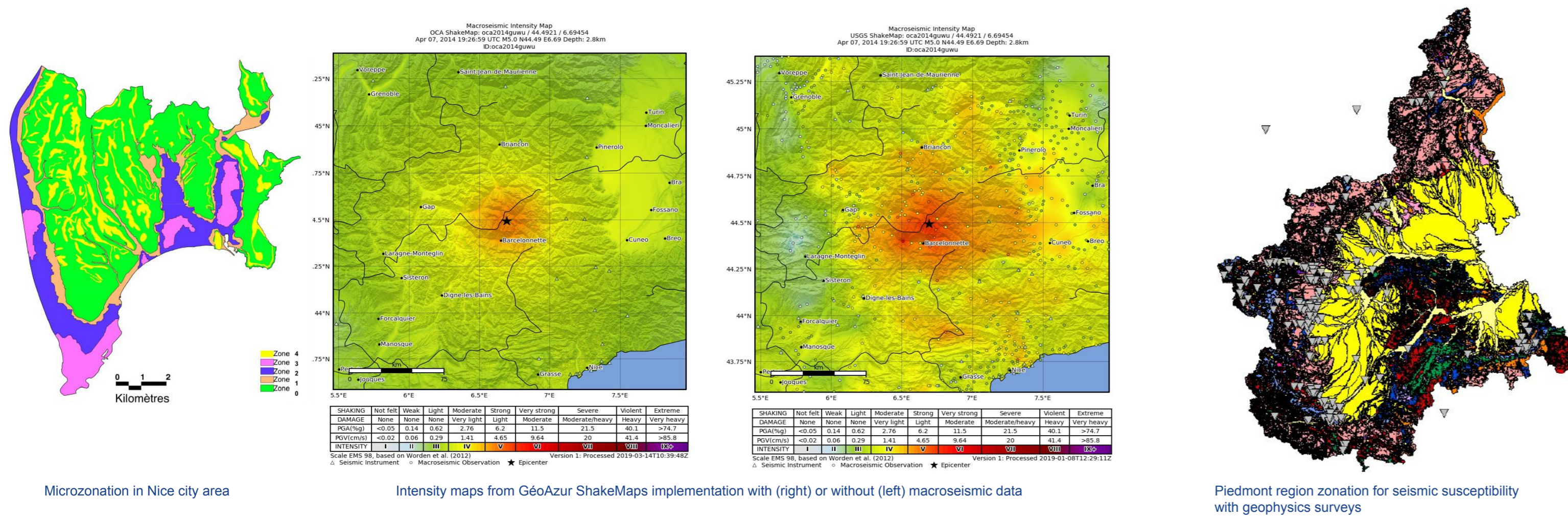
Zoning of exposures and vulnerabilities

ShakeMap

EMSC Seismic catalogue 1998-2012 in cross-border area

Seismic networks in ALCOTRA cross-border area.

1 - SEISMIC INPUT

PACA REGION

ShakeMap v4.1 installed at CNRS GéoAzur centre.
Data acquisition by SeisComP3 code (Weber et al., 2007).
Focal parameter assessment based on SeisComP3 code.
Mw estimation calculated by CNRS software MWNEAR (Cara et al., 2017)
GMPEs: implemented one proposed for Northern and Central Italy (Kotha et al., 2016)
Site condition map: based on VS30 values from topography, integrated with data from microzonation studies for Nice city area (CEREMA).
Amplification factors: default (Borcherdt, 1994).
Ground motion derived intensity: default (Worden et al., 2012)
Implementation: automatic production in real-time, then improved by implementation of macroseismic 'did you feel it' data by BCSF (integrated automatically through web-services) and by INGV (integrated manually). A good correspondence across border is verified on Barcelonnette 2014 event.
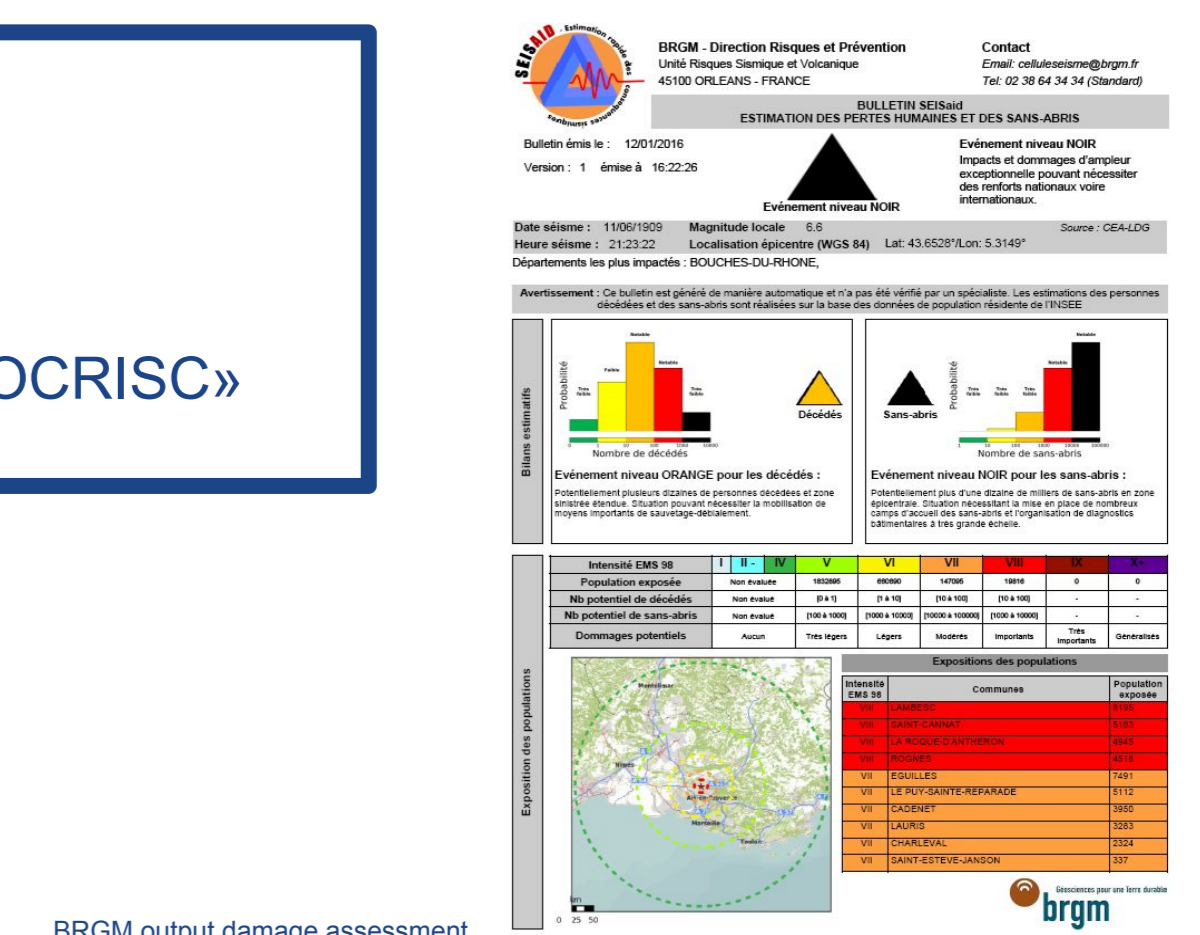
NORTHWESTERN ITALY

SkakeMap v3.1 operating at RSNI (Regional Seismic network of Northwestern Italy) main centre, testing ShakeMap v4.1 at ARPA Piemonte centre.
Data acquisition by NAQS (Nanometrics Acquisition Service) + SeisComp3 code.
Focal parameter assessment by RSNI code (Scafidi et al., 2019).
Mr (magnitude energy) assessment in development.
GMPEs: testing different new ones, now different implementation for low magnitude (Frisenda et al., 2005) [3.5 ML] or high magnitude (Sabetta e Pugliese, 1996)
Site condition map: based on VS30 values from Italian Geological map (1:100.000), testing integration with Piedmont regional map based on geophysical surveys (ALCOTRA CASSAT).
Amplification factors: default factors (Borcherdt, 1994), testing factors calibrated for the area and with different velocity ranges for soil classification.
Ground motion derived intensity: maps are determined with local relation (Faccioli et Cauzzi, 2006)
Implementation: automatic production in real-time, improved by implementation of DPC accelerometric data.

3 - OUTPUT

PACA REGION

Evaluation of damage on EMS-98 scale.
Output defined by joint work with the Interreg project POCTEFA «POCRISC»

EMS-98 scale 5 level damage

BRGM output damage assessment

Microzonation in Nice city area

Intensity maps from GéoAzur ShakeMaps implementation with (right) or without (left) macroseismic data

Piedmont region zonation for seismic susceptibility with geophysics surveys

2 - EXPOSITION AND VULNERABILITY DATA
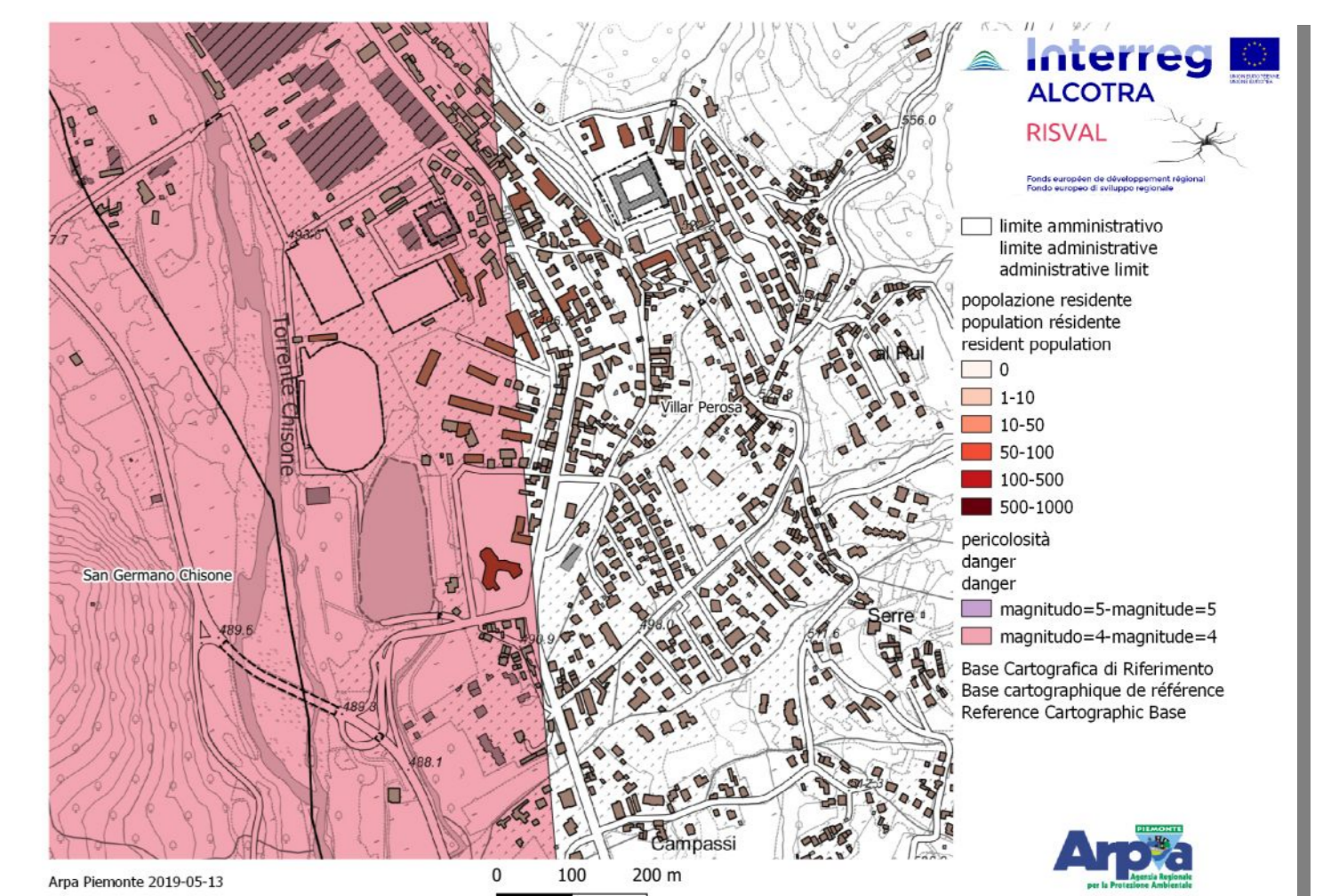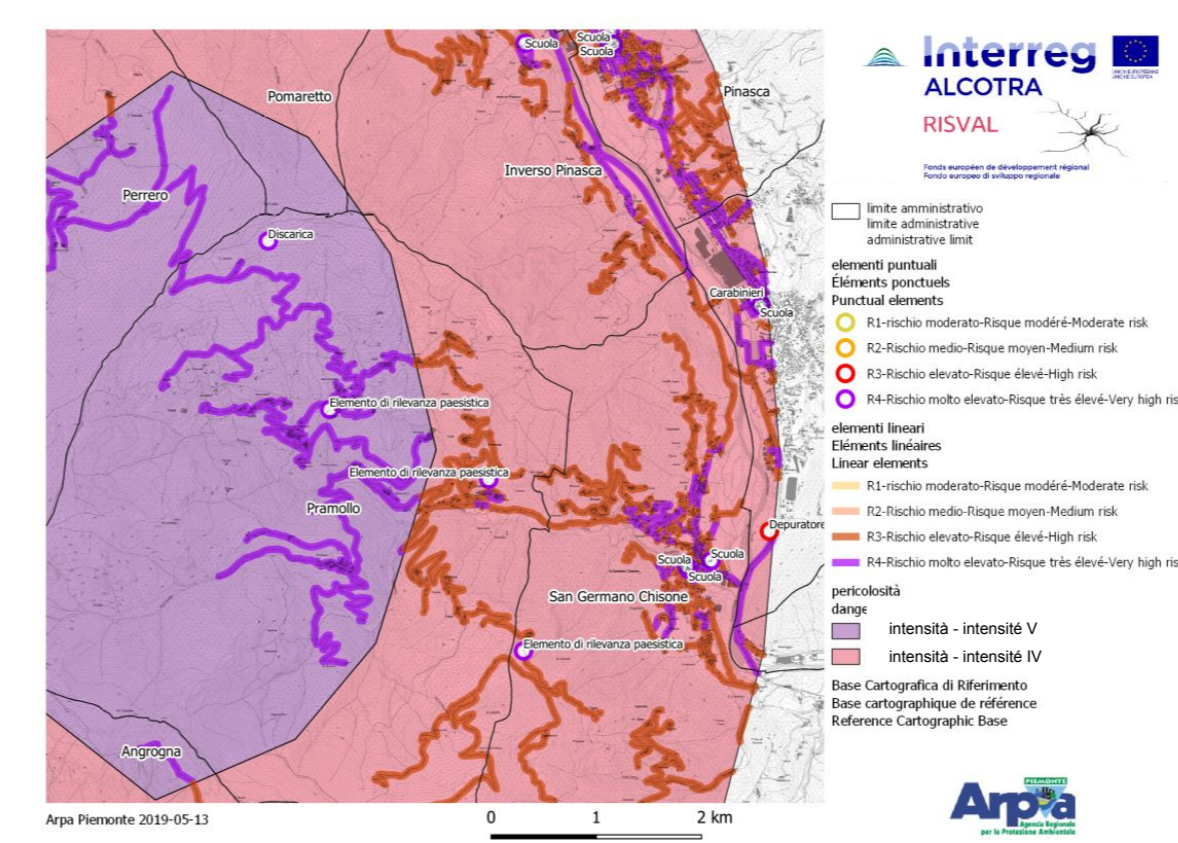
FRANCE

National geodatabases about type and use of building managed by BRGM.
Topology and **detail** of georeferenced information: polygonal at sub-municipal detail (INSEE-IRIS)

PIEDMONT REGION

Tools used are open source, mainly QGIS and PostgreSQL/PostGIS.
Output results with maps, tables, graphics, available for government institutions through dedicated webgis service, in OGC WMS/WFS format, and downloadable.
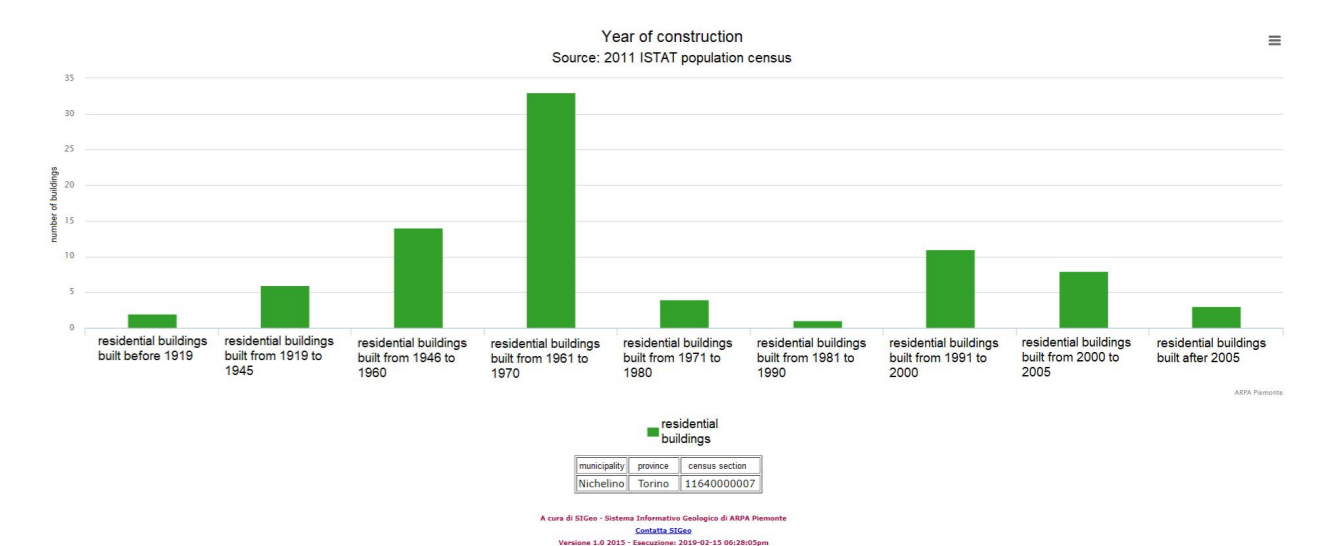
PIEDMONT REGION

Regional geodatabases about: land use, road infrastructure, type and use of building (realized according to *2007/60/CE Floods Directive for the construction of the databases and related cartography of the flood risk in 2013, 2015 and 2017*).
Regional geoDB of seismic verification summary on strategic buildings and bridges managed by Regione Piemonte and for National Department of Civil Protection (SIV).
National census data and real estate quotes from the statistics and revenue agencies.
Topology of georeferenced information: punctual (strategic buildings), linear (roads), polygonal (land use).
Detail of georeferenced information: individual element detail (strategic buildings, roads) or aggregated data at sub-municipal detail (e.g. population density, age and values of buildings).

Regione Piemonte strategic buildings seismic verification summary database

Geodatabase of punctual, linear, polygonal exposed elements

Intensity	Municipality	Resident population	Economic value assessment (€)
V	Pramollo	156	€ 1.099.776,00
V	Angrogna	0	€ 15.360,00
V	Perrero		€ 470.016,00
IV	Pomaretto	1068	€ 784.941,00
IV	Torre Pellice	0	€ 0,00
IV	Pramollo	70	€ 799.640,00
IV	San Germano Chisone	1754	€ 1.190.271,00
IV	Porte	15	€ 52.224,00
IV	Villar Perosa	1361	€ 37.732,00
IV	Angrogna	189	€ 2.489.856,00
IV	Inverso Pinasca	743	€ 673.361,50
IV	Perosa Argentina	3349	€ 1.445.908,00
IV	Perrero	247	€ 3.482.564,00
IV	Pinasca	2999	€ 885.764,00

Output results in different formats: maps, tables and graphics, with statistical aggregated information

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