The Safety project: Updating geohazard activity maps with Sentinel-1data

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ECHO/SUB/2015/718679/Prev02-SAFETY

Project Co-financed by the EU-Union Civil Protection Mechanism

Fringe 2017, Helsinki 5 June 2017

AENOR ER Gestión I+D+i UNE 166002 IDI-0024/2011

HR EXCELLENCE IN RESEARCH

Sentinel-1 for Geohazard regional monitoring and forecasting

European Commission, Directorate-General Humanitarian Aid and Civil Protection (ECHO)

01/01/2016 – 01/01/2018

Developing and testing a procedure to provide Civil Protection Authorities (CPA) with the capability of periodically evaluating and assessing the potential impact of geohazards (volcanic activity, landslides and subsidence) on urban areas and infrastructures, over regional areas.

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DST DIPARTIMENTO DI SCIENZE DELLA TERRA
PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
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Consiglio Nazionale delle Ricerche
Gobierno de Canarias
un solo pueblo
Consejería de Política Territorial, Sostenibilidad y Seguridad
Dirección General de Seguridad y Emergencias

Why Sentinel-1?

- Regular worldwide coverage
- High temporal sampling (6/12 days)
- Free access

Challenges

1) Readability

2) Reliability

3) Regional scale

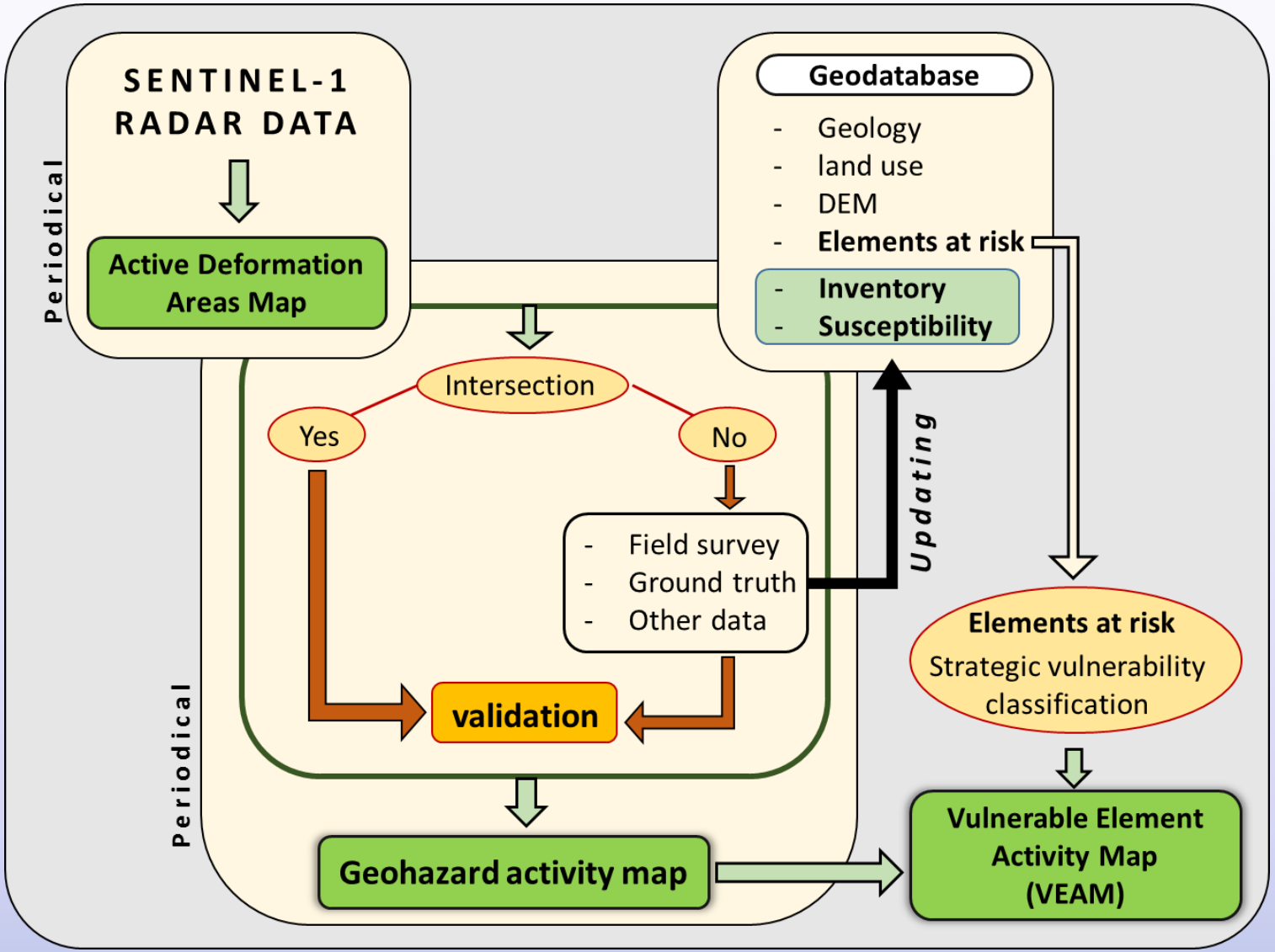
Main constraining factors:

1) Spatio-temporal noise (i.e. the map sensitivity)

2) Huge number of information (PSs)

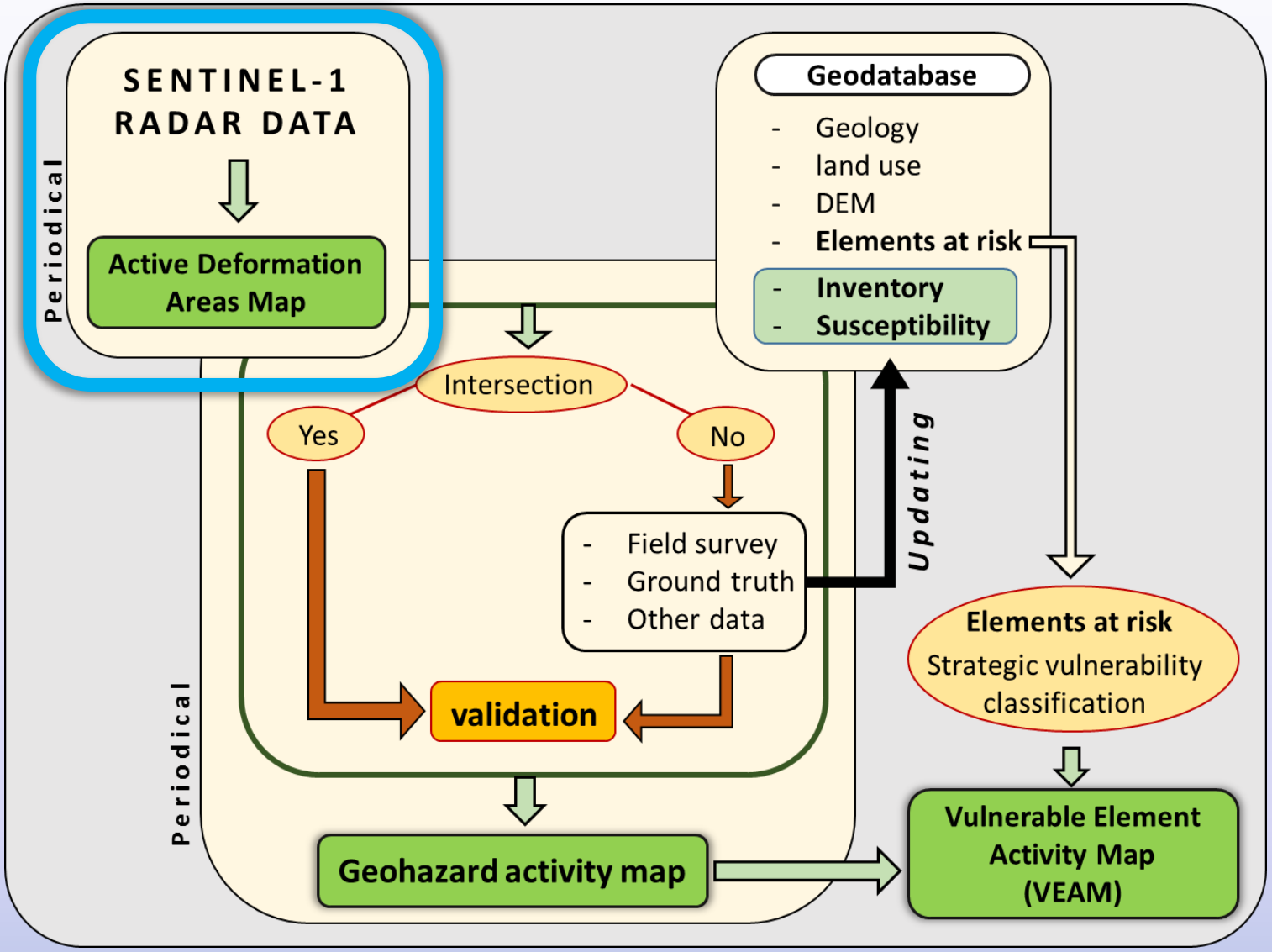
Safety Project

Developed procedure



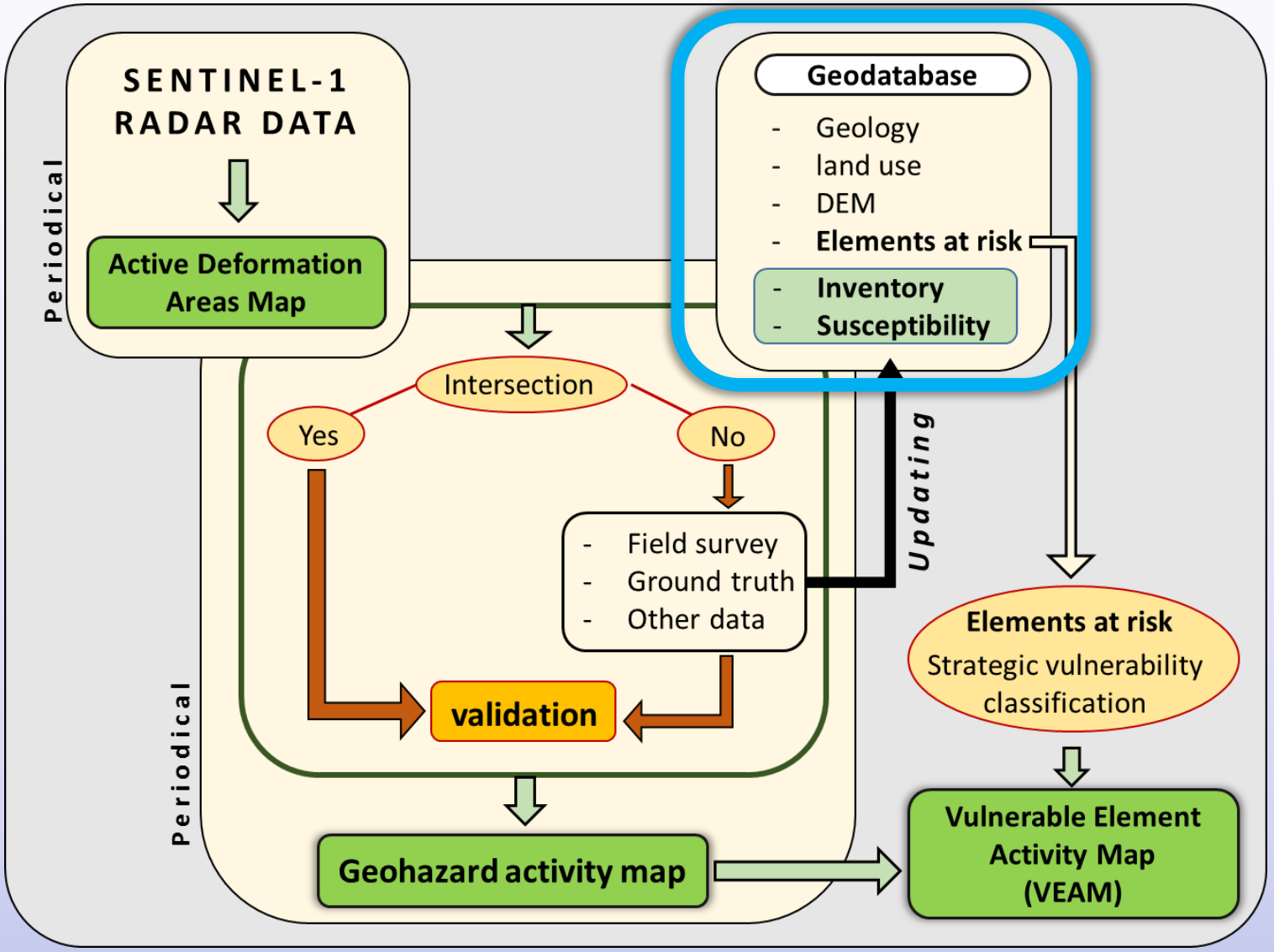
Safety Project

Developed procedure



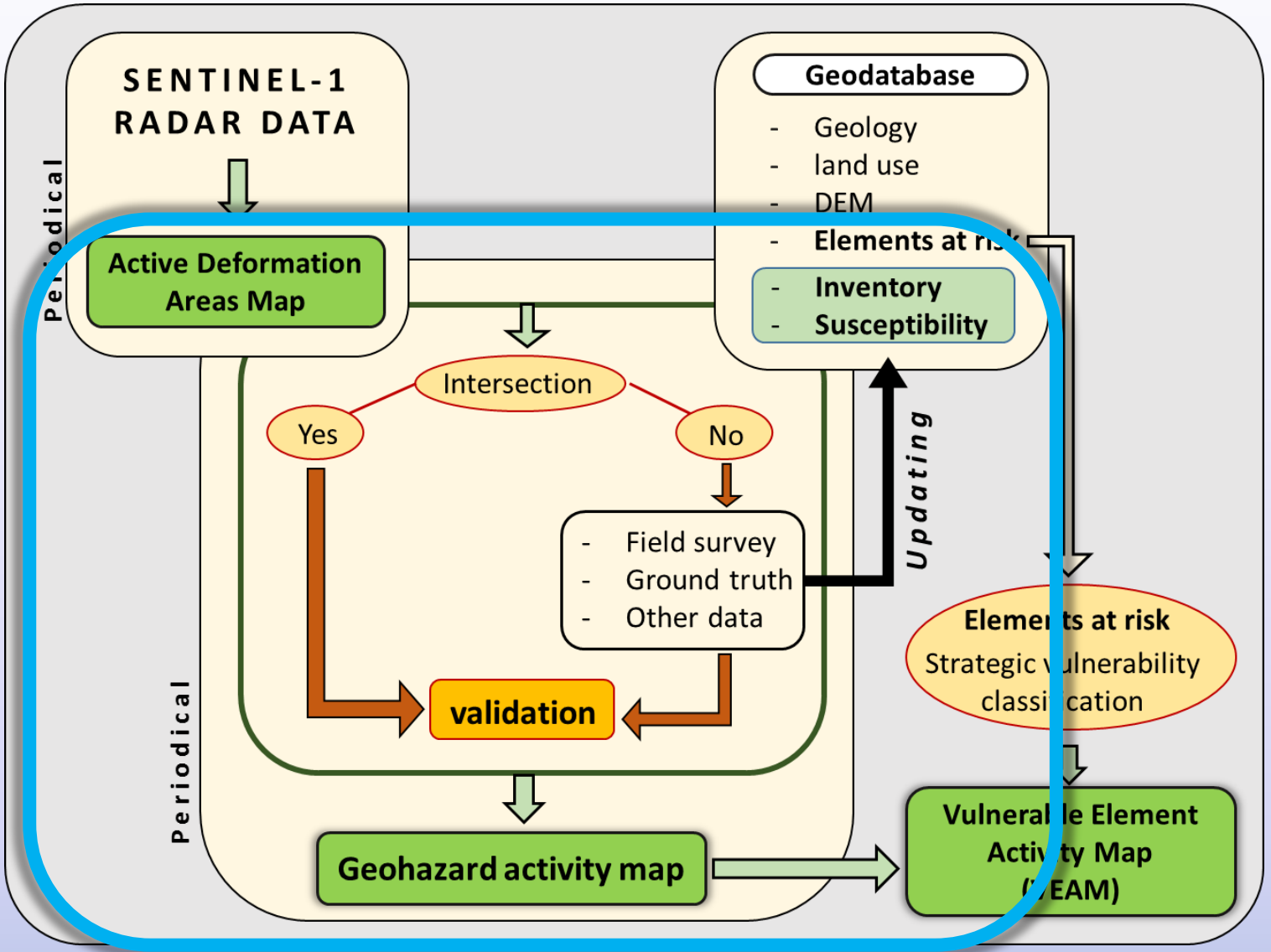
Safety Project

Developed procedure



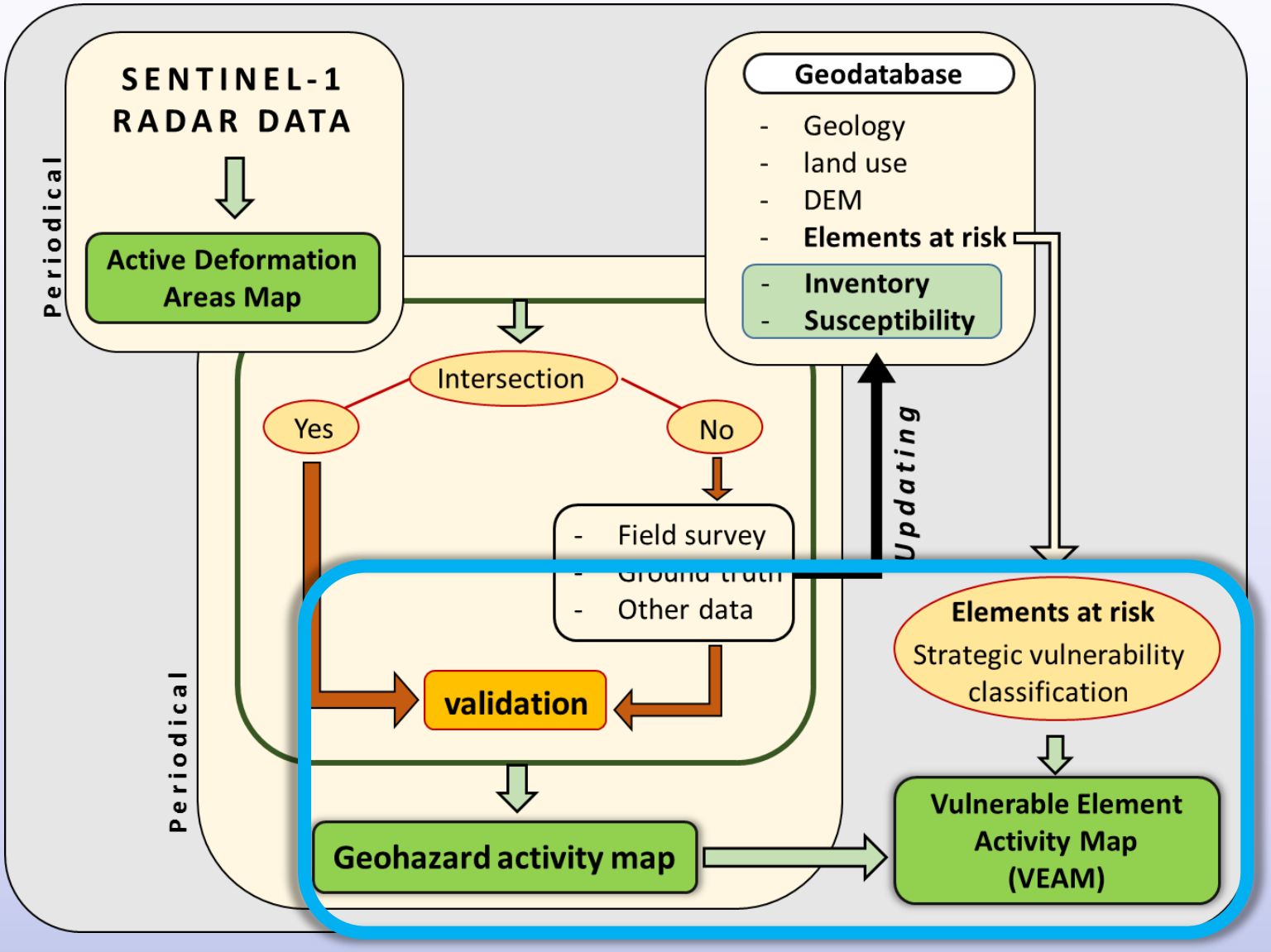
Safety Project

Developed procedure



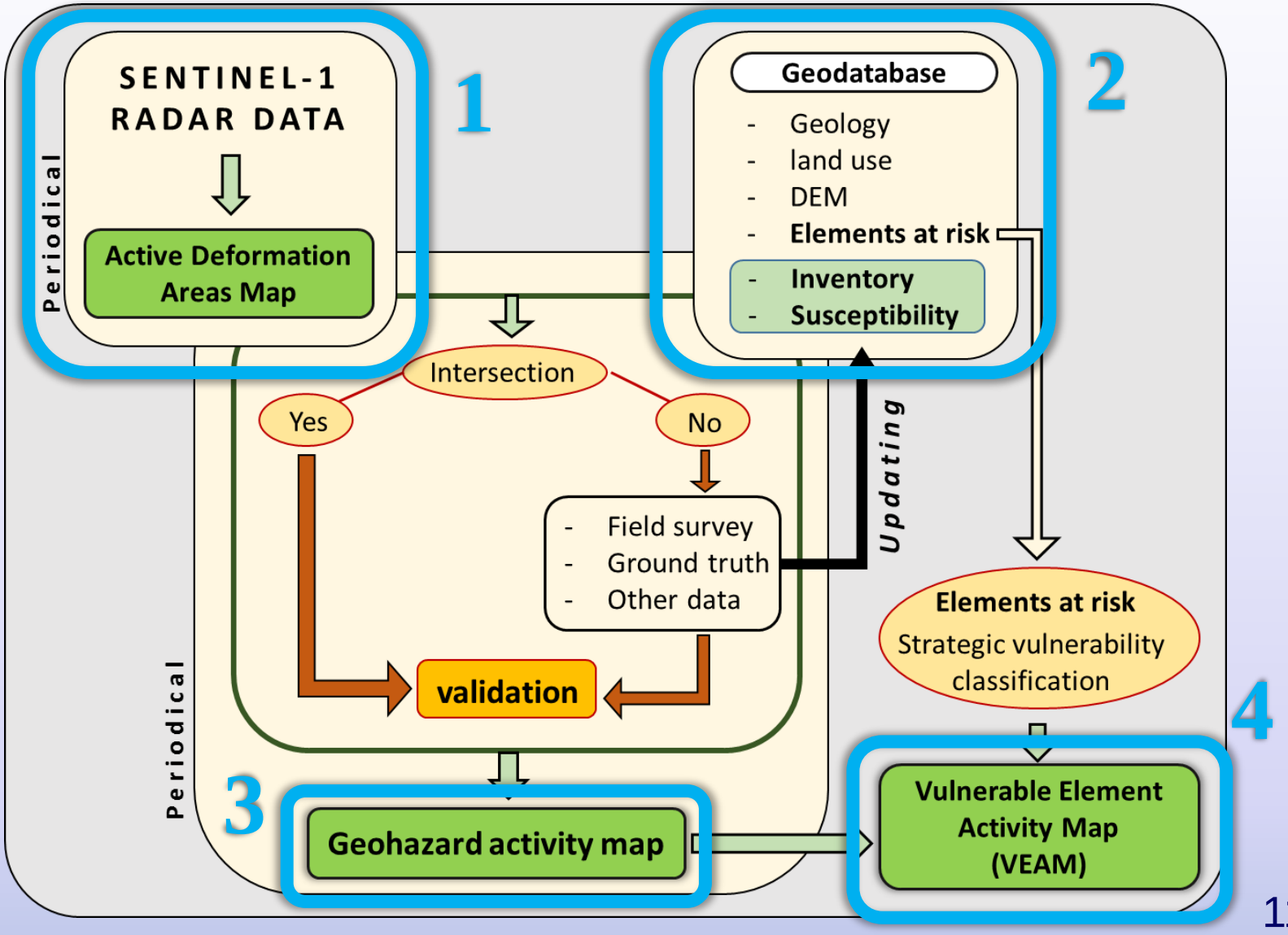
Safety Project

Developed procedure

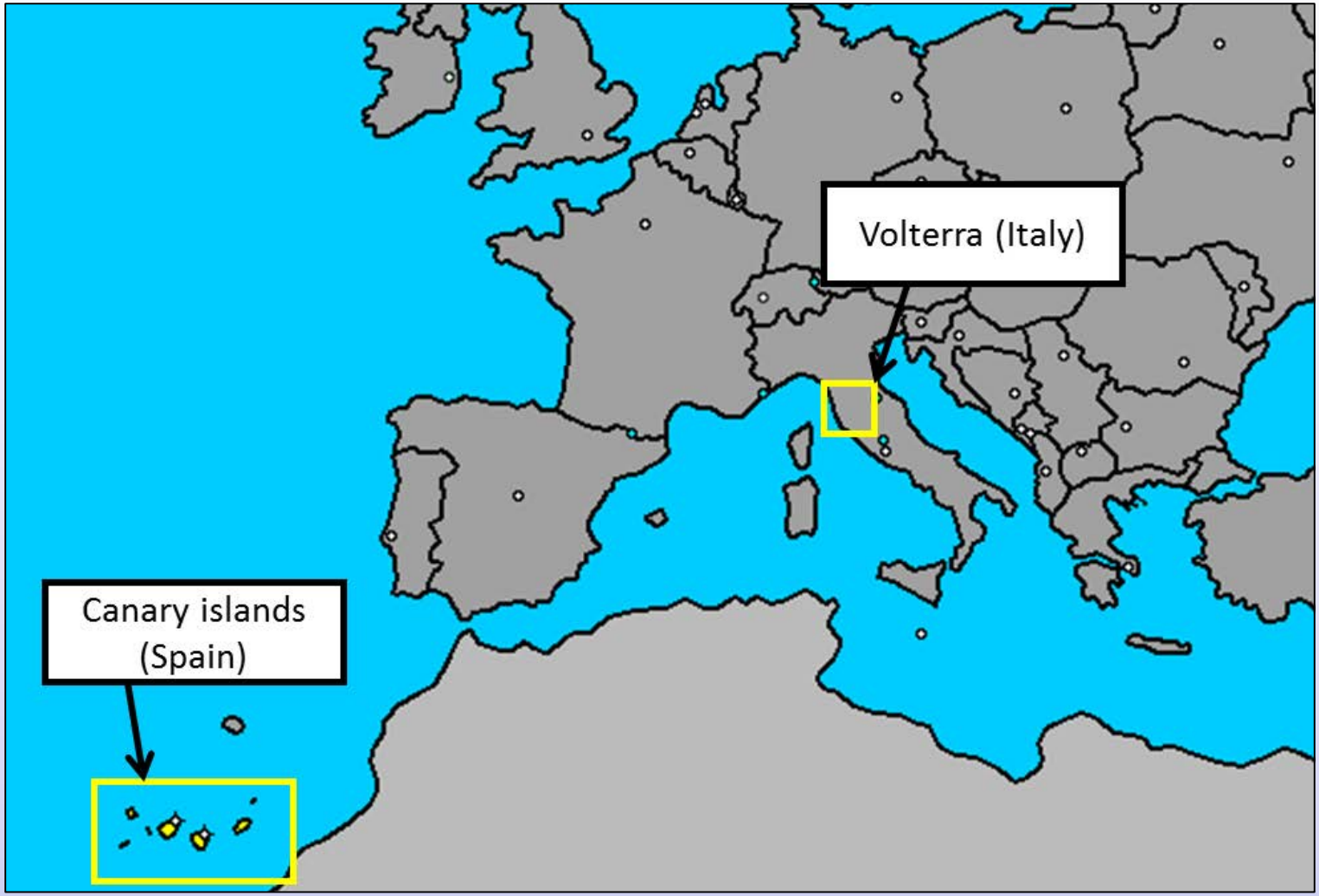


Summary of Presentation

Main activities and results

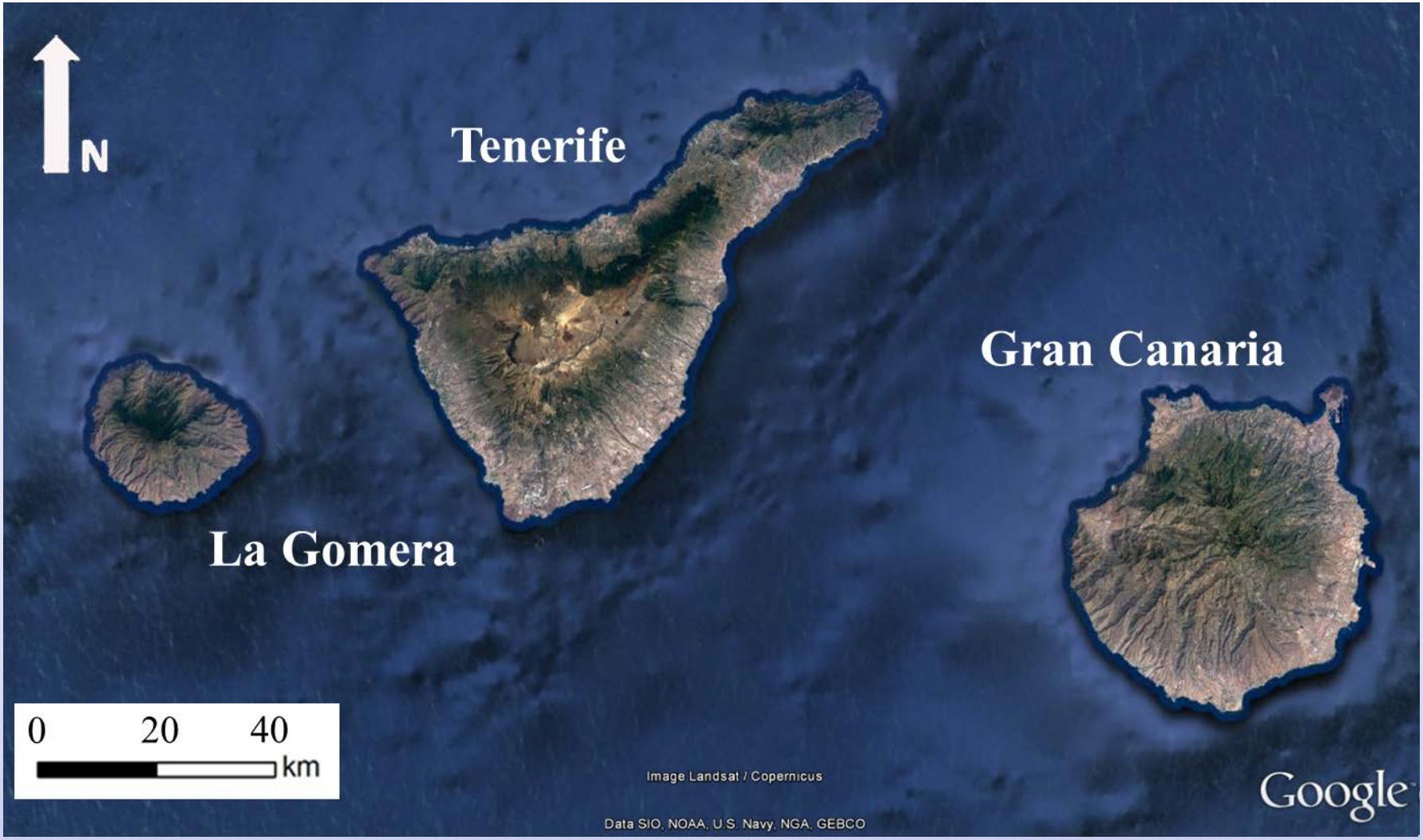


Test Sites



Study Areas

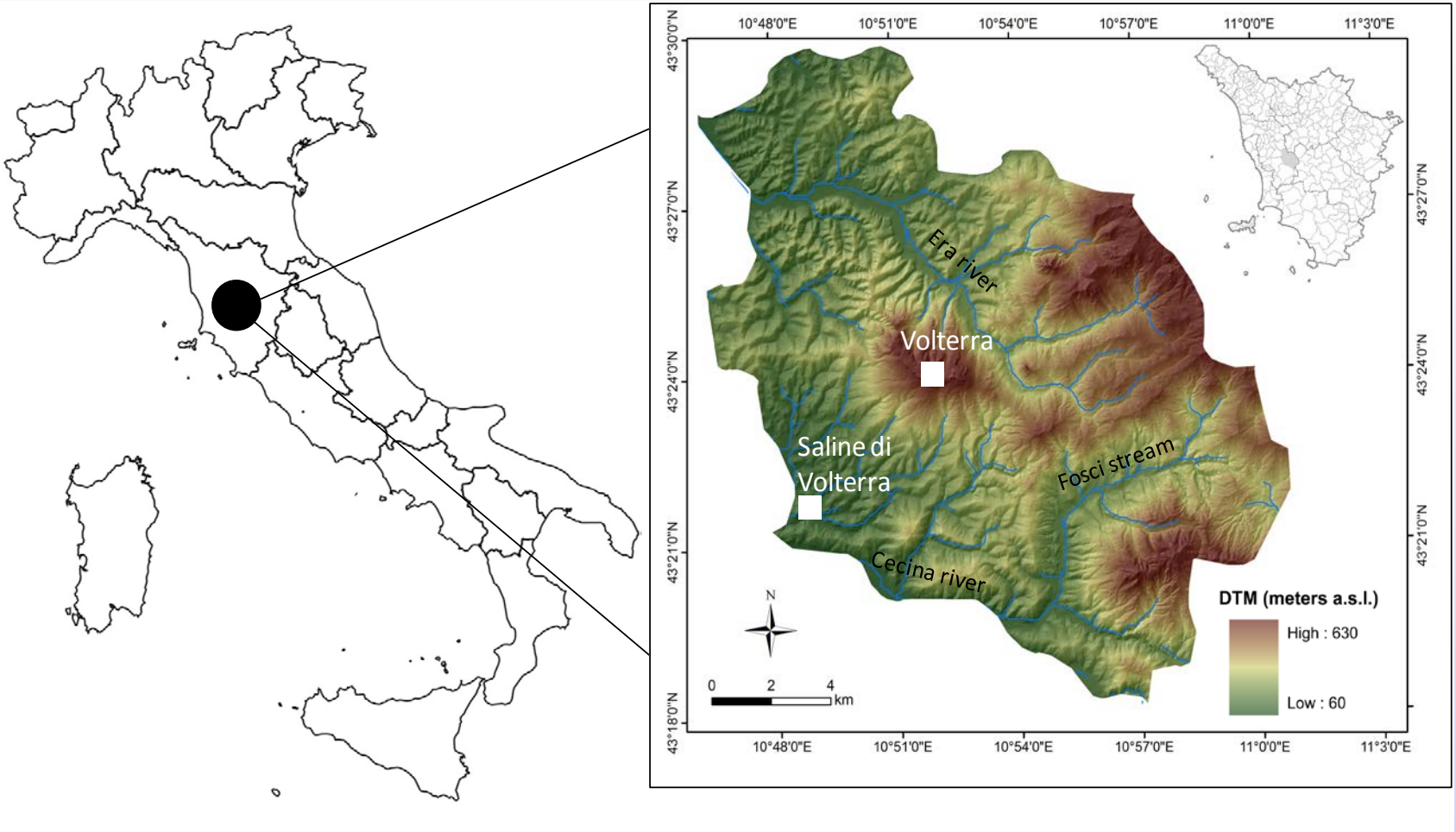
Canary Islands



Total land area around 5.000 km^2

Study Areas

Volterra municipality (Tuscany Region, Italy)



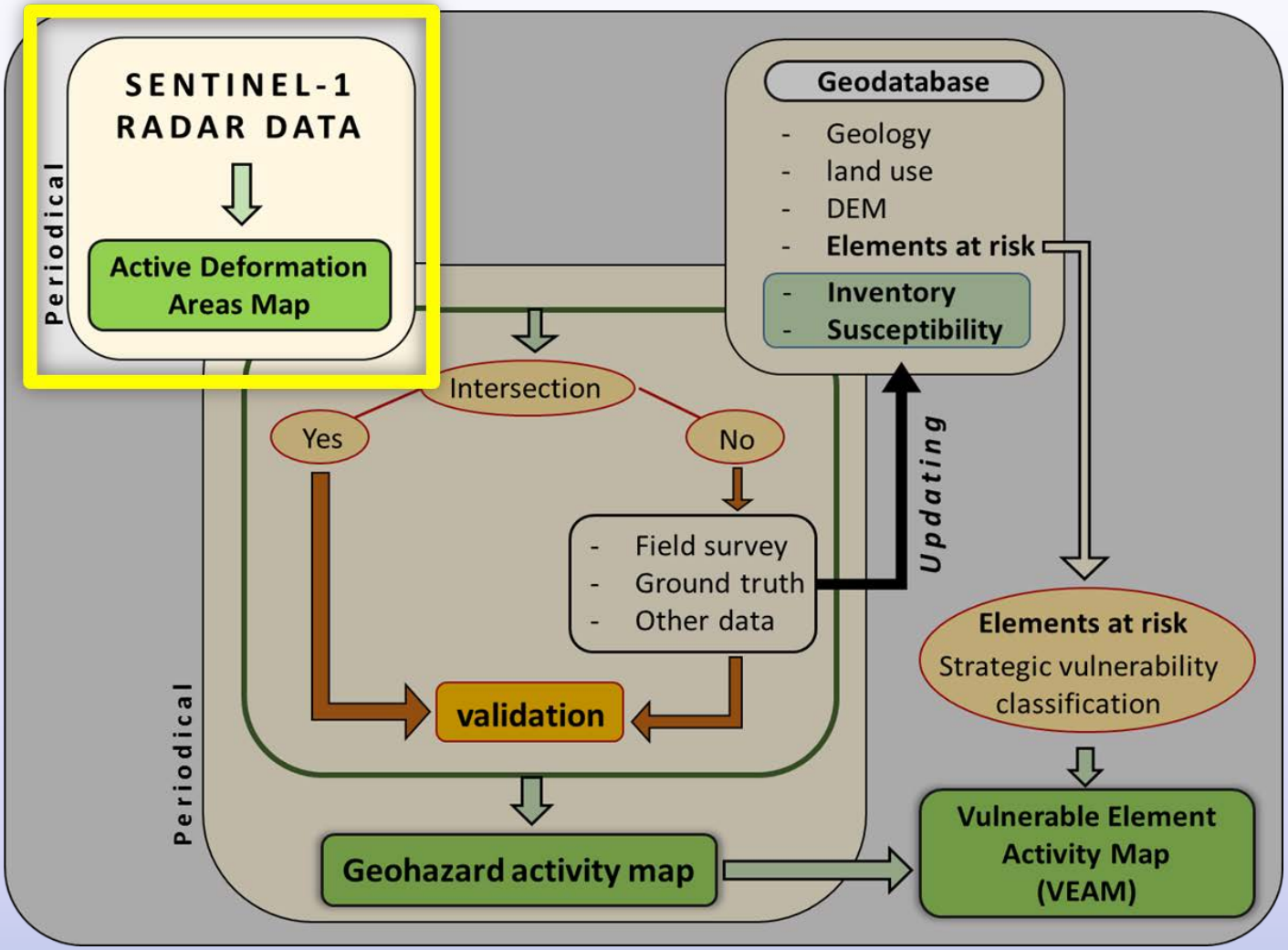
Municipality area of about 250 km^2

Study Areas

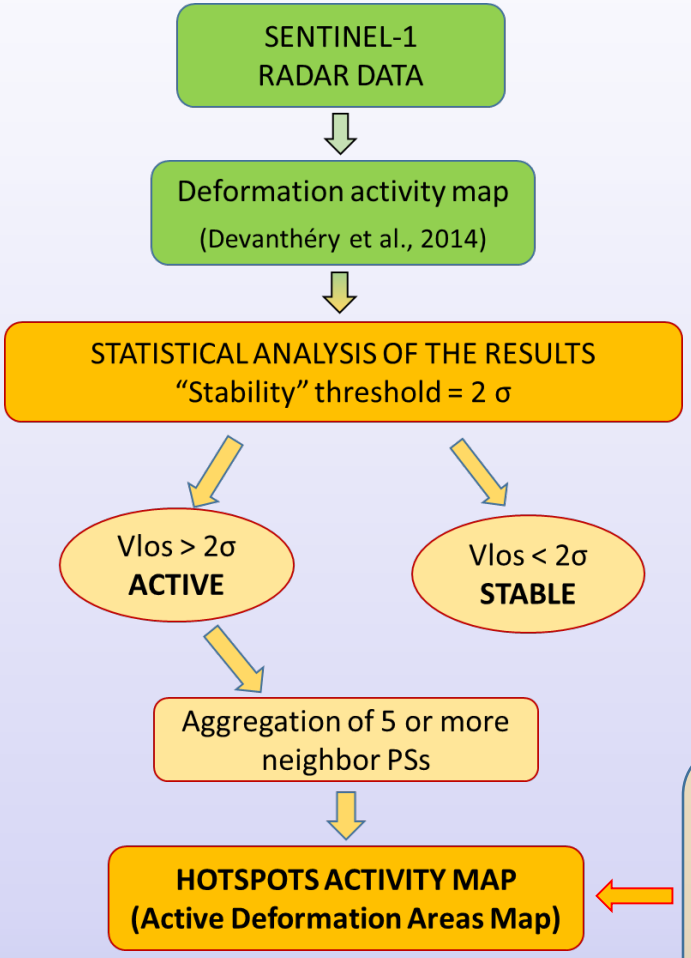
Canary Islands	Volterra Municipality
Main Hazards: Volcanic, Rockfall	Main Hazards: Landslide
Main Lithologies: Lavas, Pyroclastics	Main Lithologies: Clays, Sands
Main Land Coverage/use: Sparse vegetation, Bare soil/lava	Main Land Coverage/use: Agriculture/Pasture, Forest
Data availability: Low	Data availability: High
Radar Response: High coherence	**Radar Response: Low coherence**

Safety Project

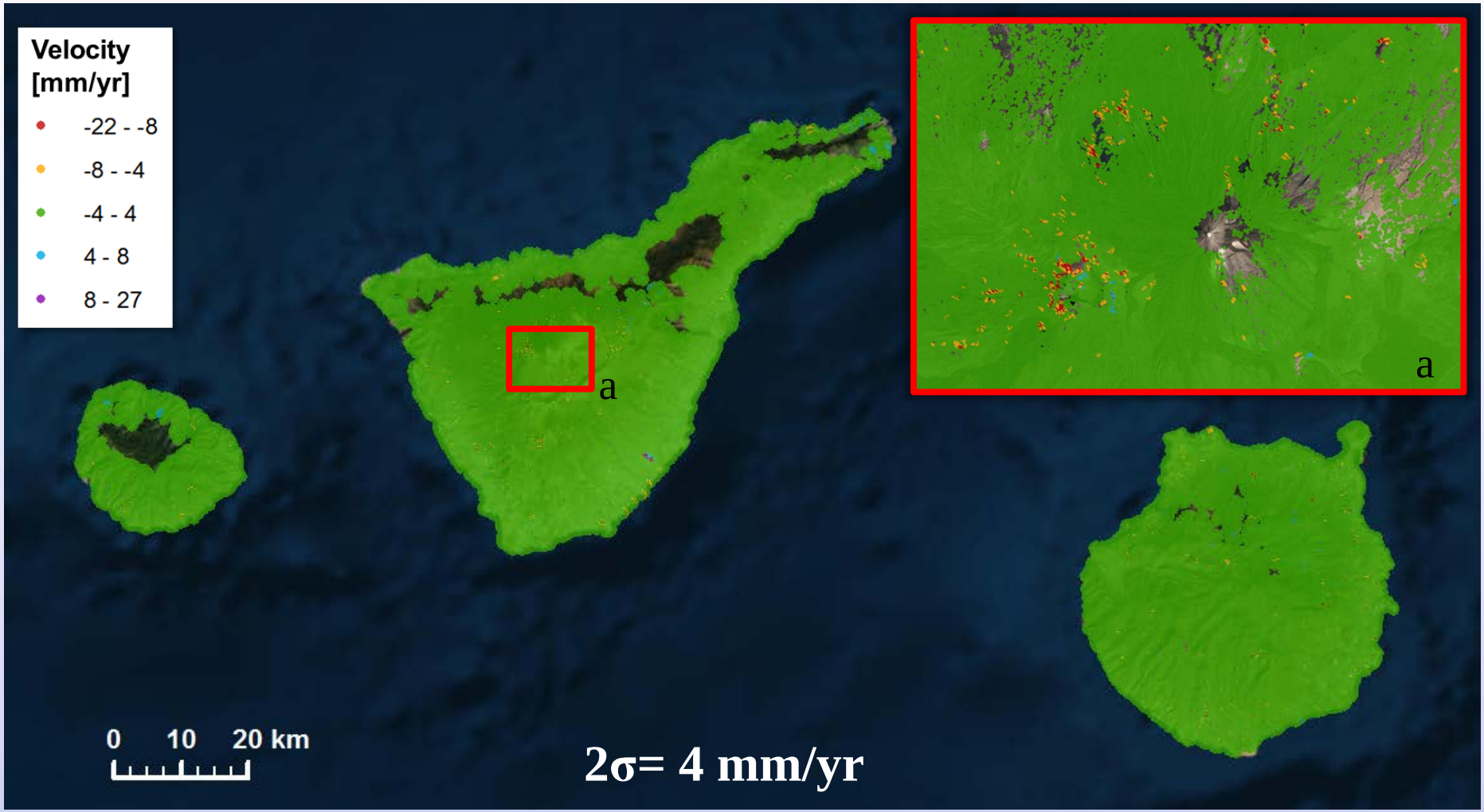
Deformation Activity Map and HotSpots Map



Deformation Activity Map
Active Areas (HotSpots) Extraction

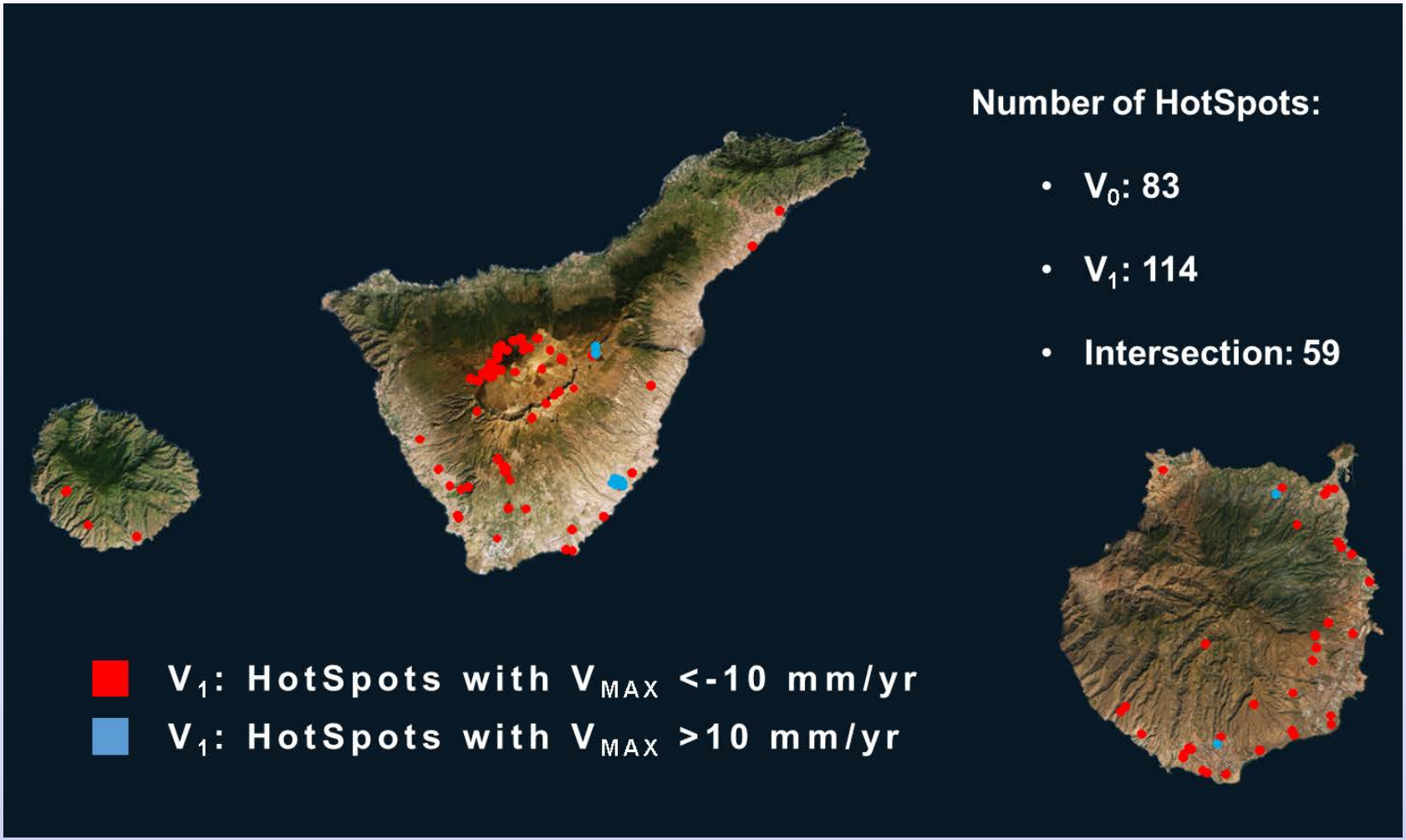


Deformation Activity Map
Canary Islands

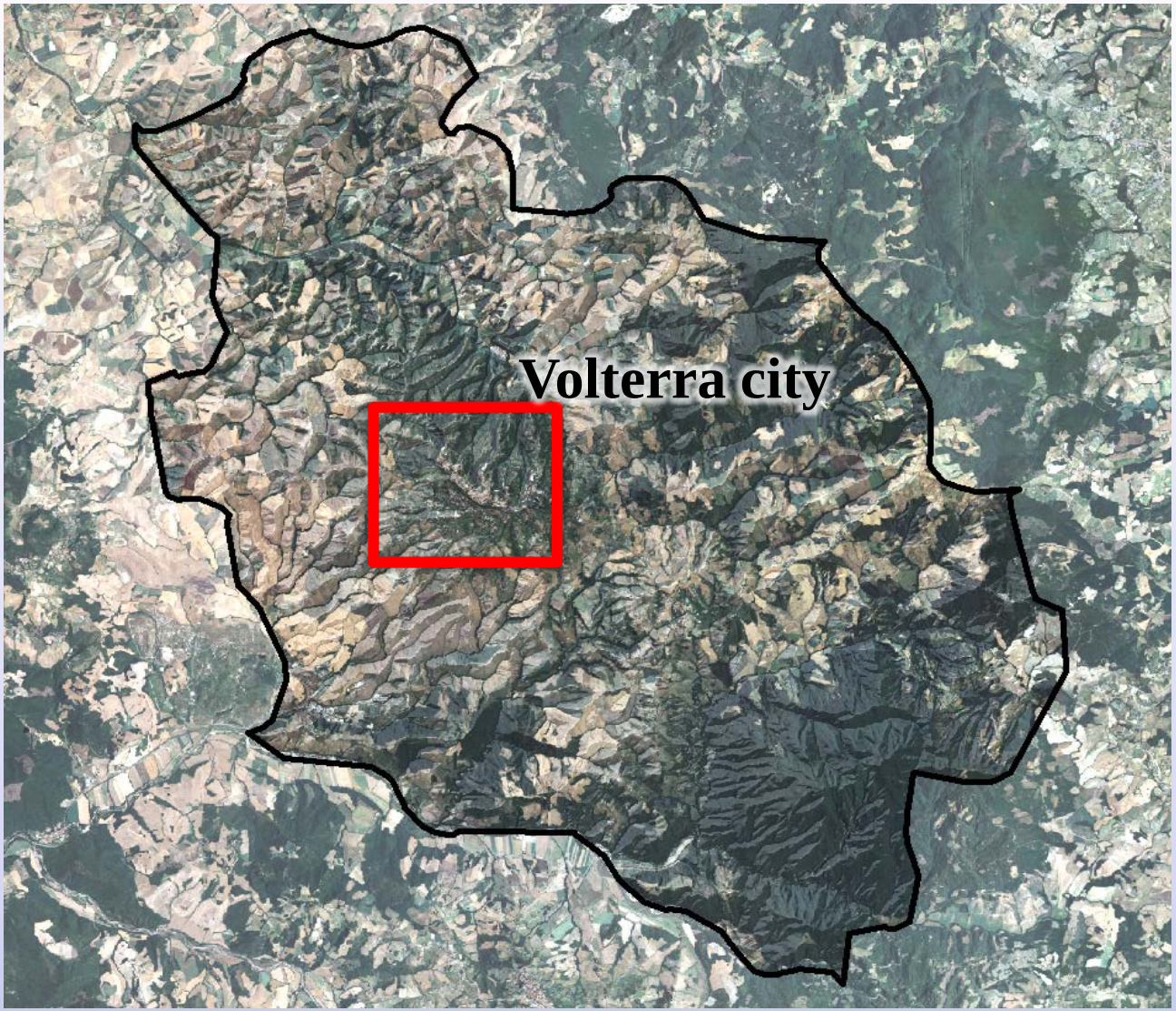


Active Deformation Areas (HotSpot) map

Canary Islands



Deformation Activity Map
Volterra



Deformation Activity Map
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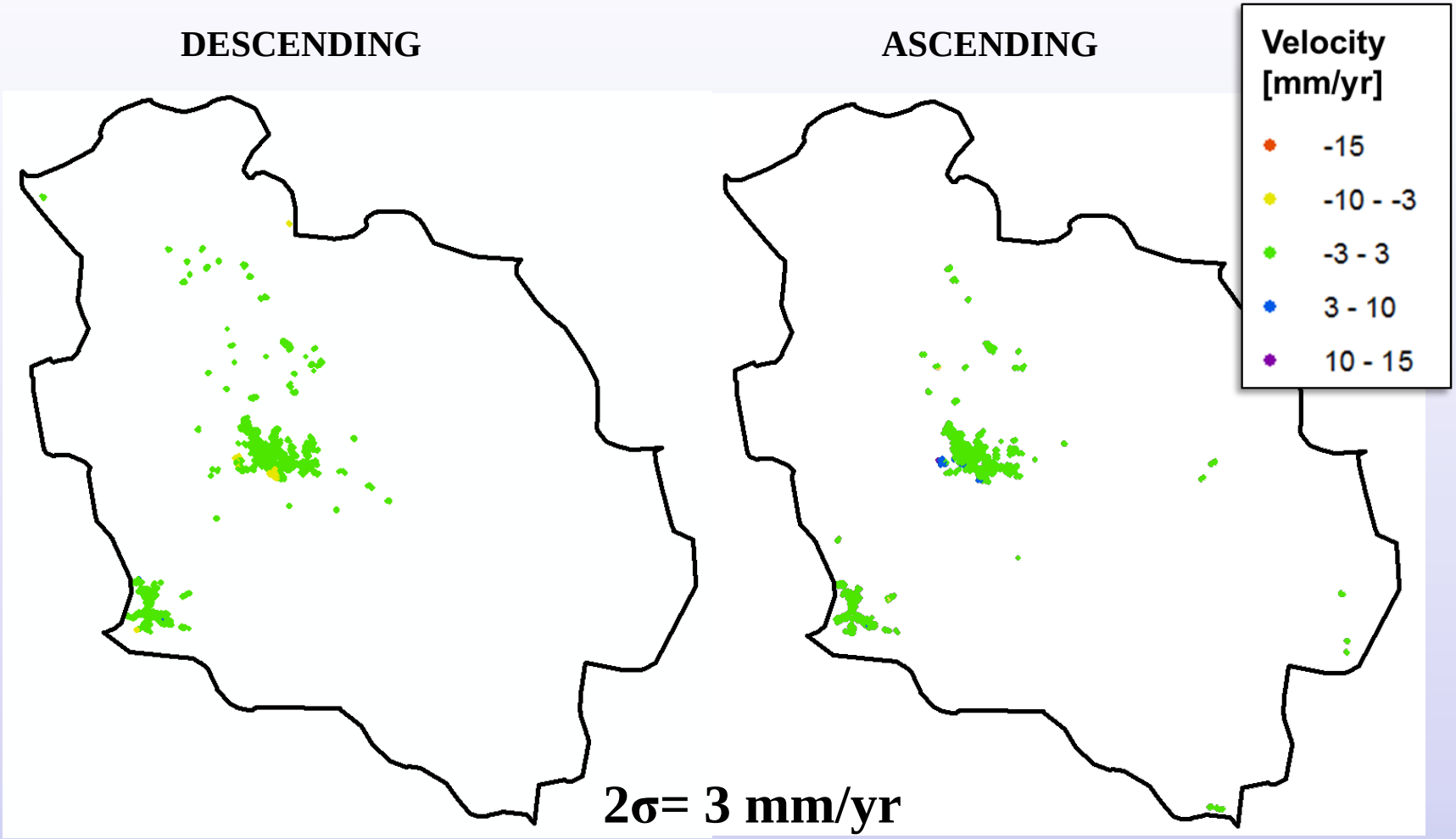
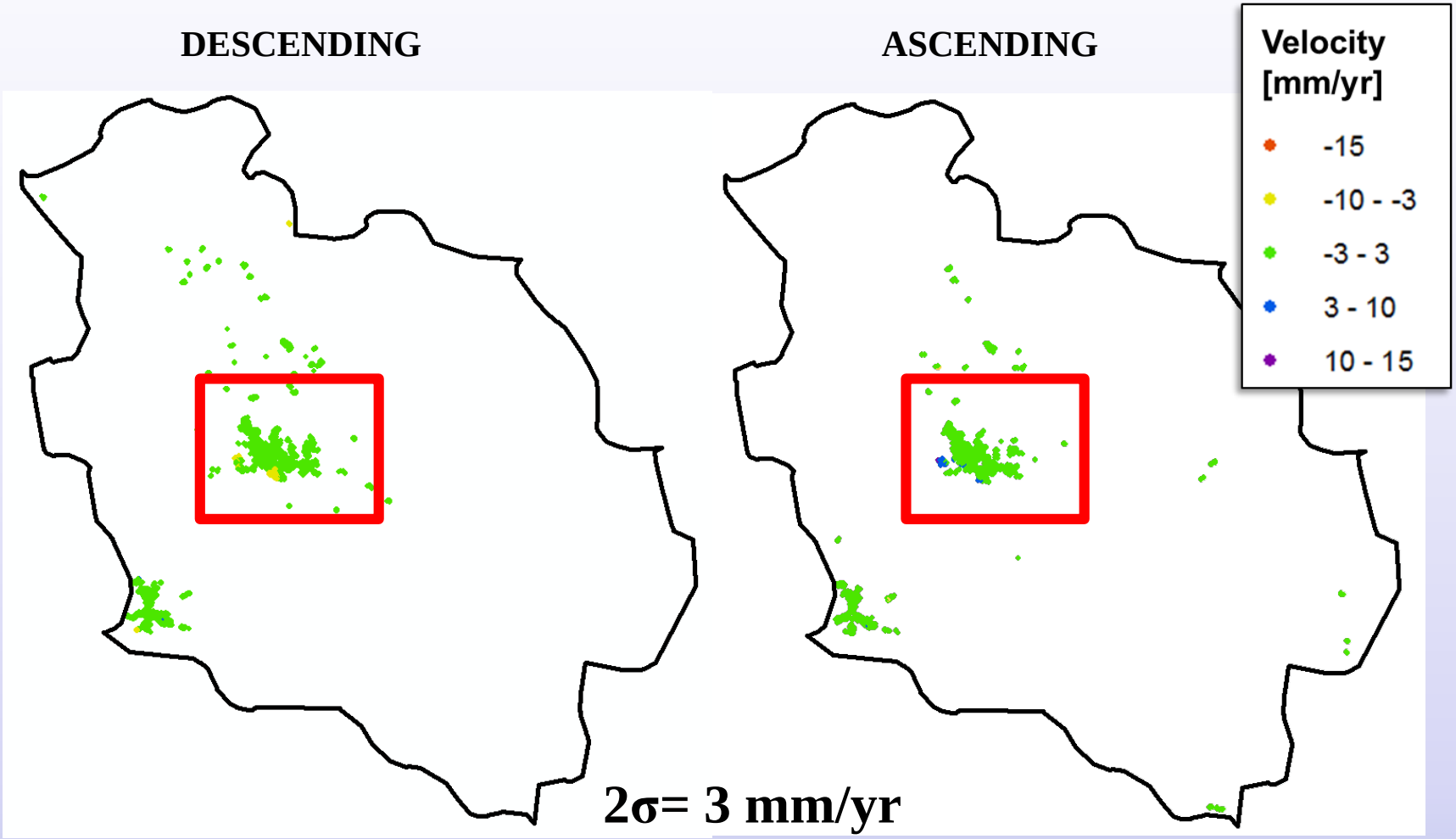
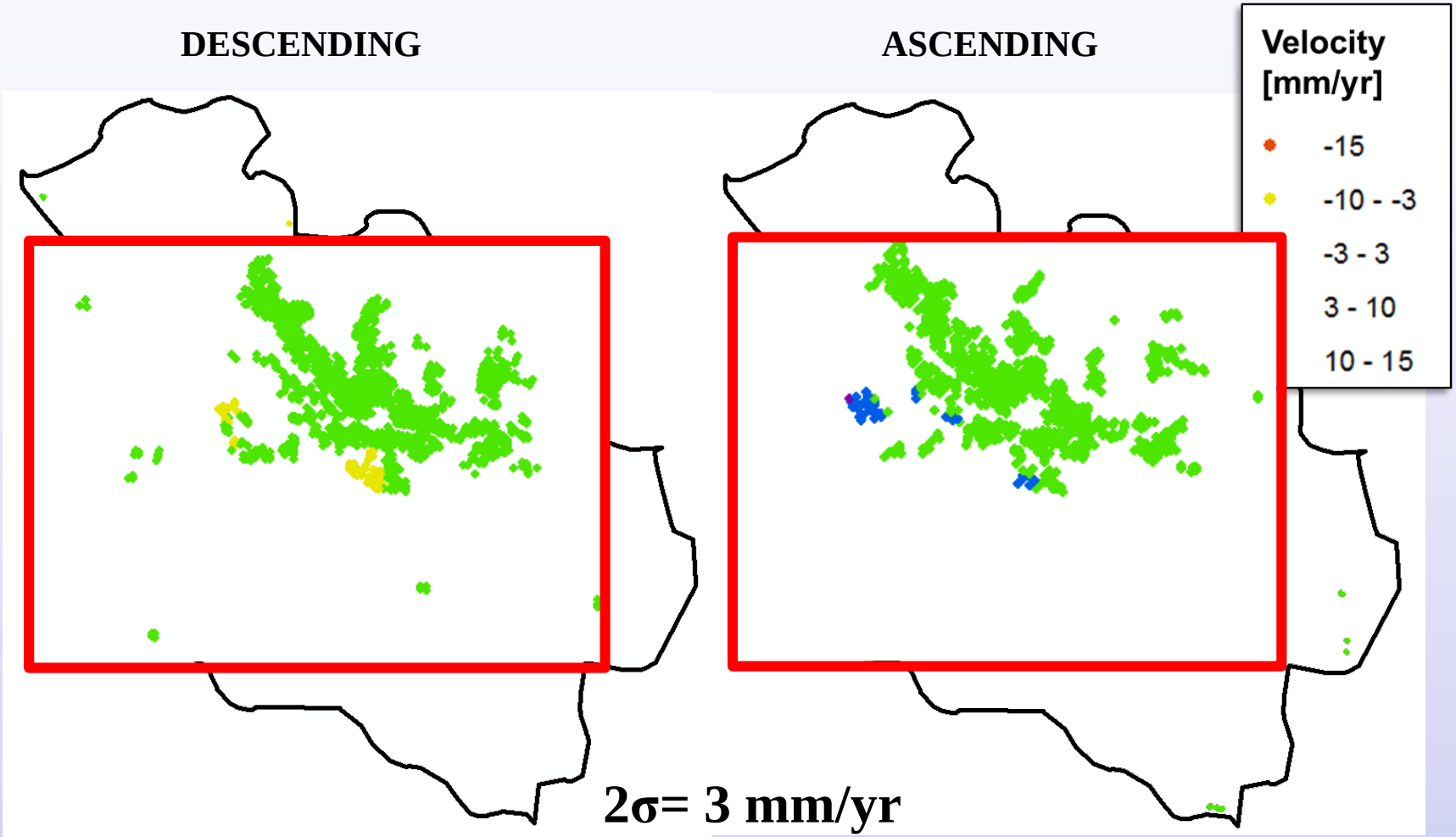


Deformation Activity Map
Volterra



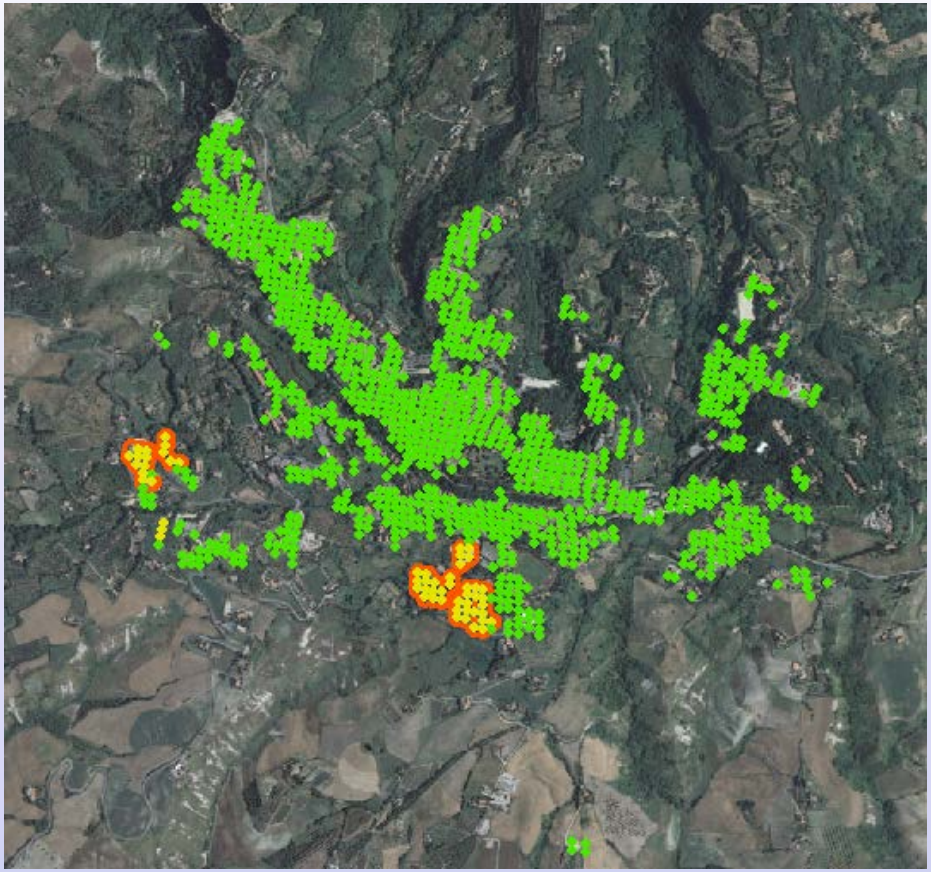
Deformation Activity Map
Volterra



Active Deformation Areas (HotSpot) map

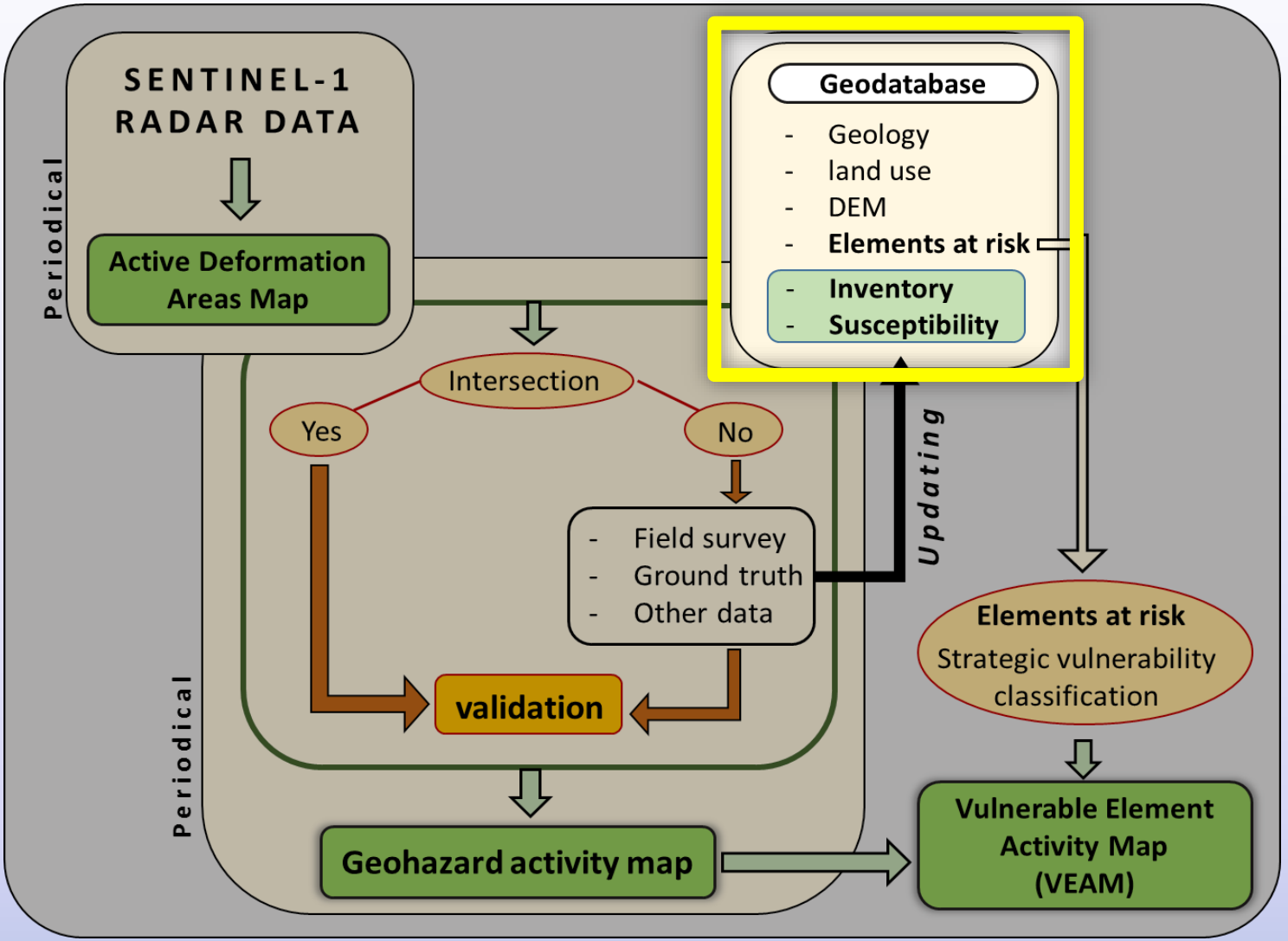
Volterra

DESCENDING



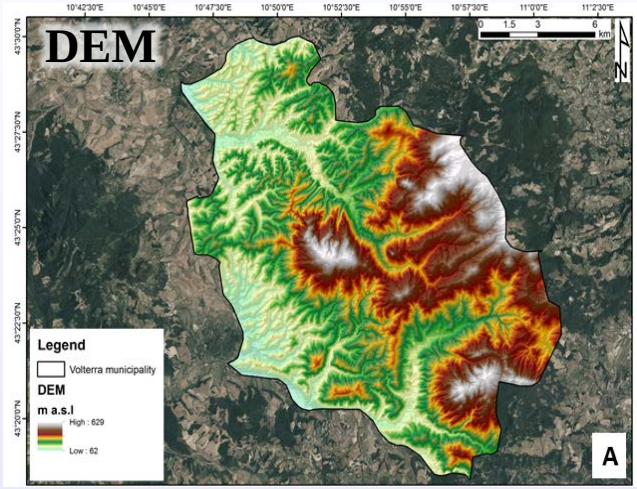
Safety Project

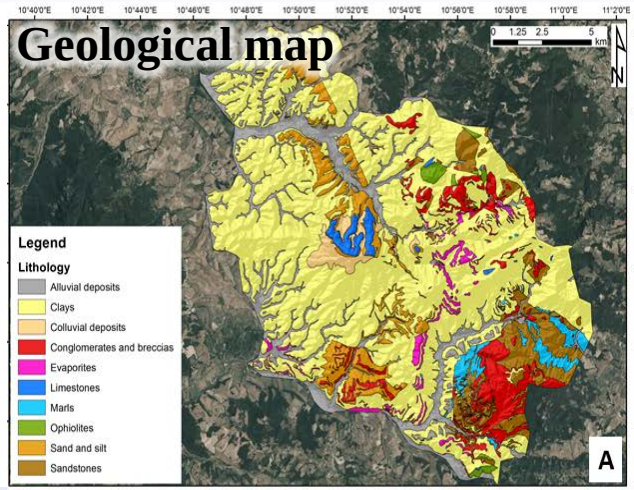
Geodatabase and Susceptibility Analysis

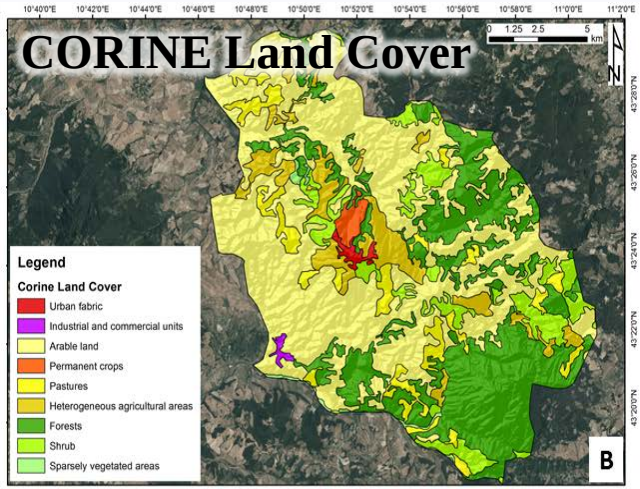


Geodatabase

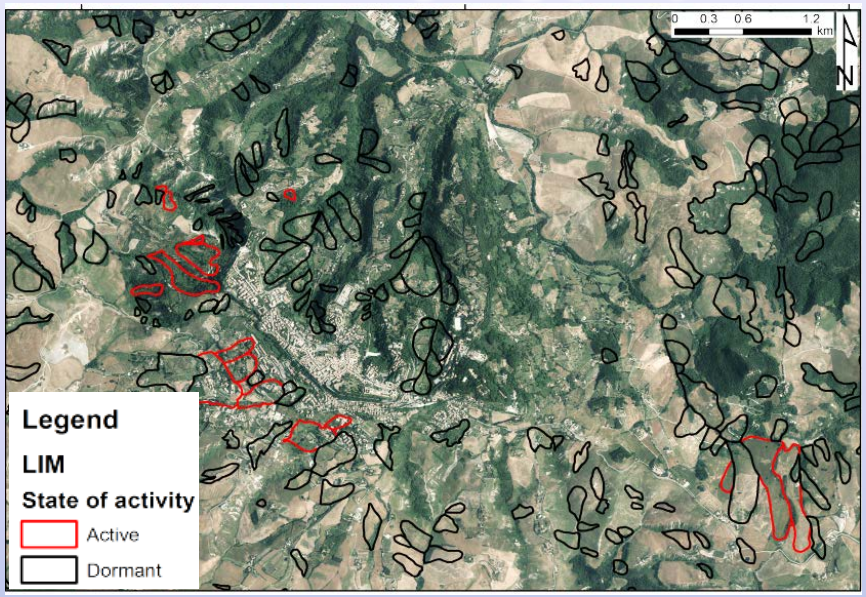
Volterra



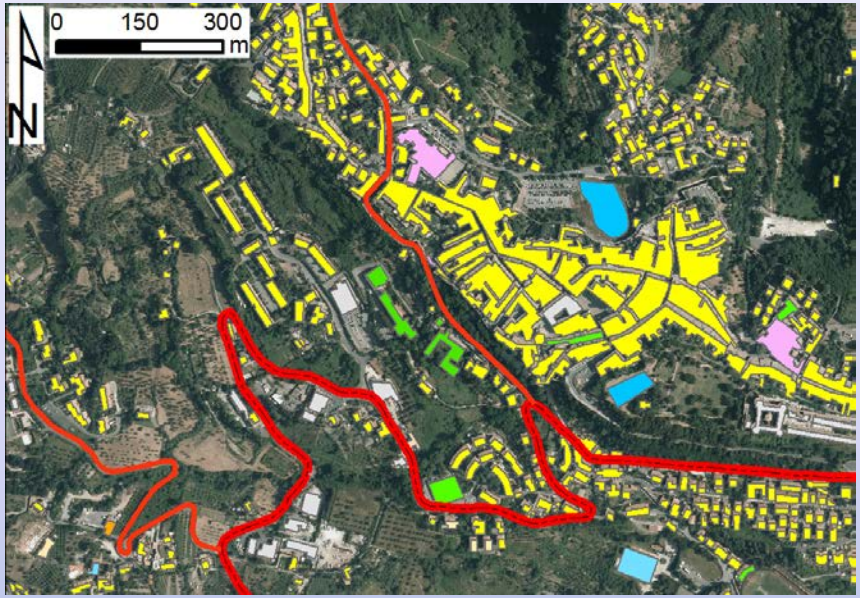




Landslide Inventory Map (LIM)



Elements at risk catalogue



Landslide Susceptibility Map

Volterra

Pixel based → LAND-SE

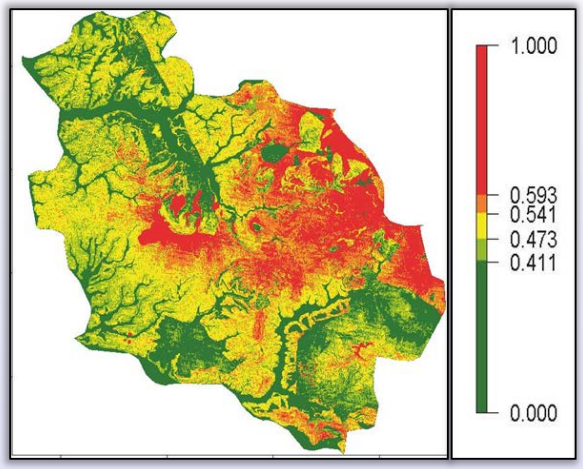
Geosci. Model Dev., 9, 3533–3543, 2016
www.geosci-model-dev.net/9/3533/2016/
doi:10.5194/gmd-9-3533-2016
© Author(s) 2016. CC Attribution 3.0 License.

Geoscientific Model Development — Open Access — EGU

LAND-SE: a software for statistically based landslide susceptibility zonation, version 1.0

Mauro Rossi and Paola Reichenbach
CNR IRPI, via Madonna Alta 126, 06128 Perugia, Italy

Susceptibility maps



Polygon based → r.slopeunits

Geosci. Model Dev., 9, 3975–3991, 2016
www.geosci-model-dev.net/9/3975/2016/
doi:10.5194/gmd-9-3975-2016
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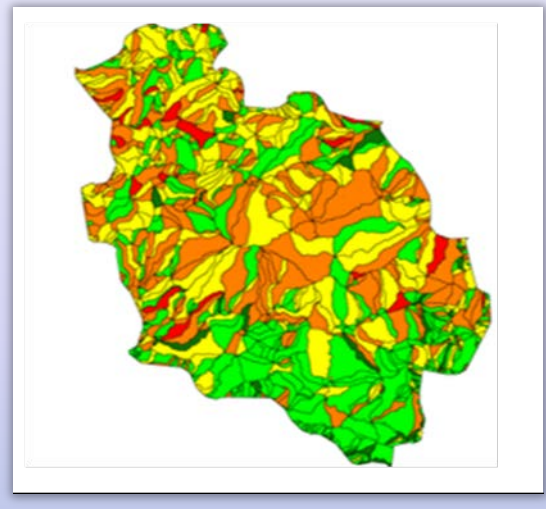
Geoscientific Model Development — Open Access — EGU

Automatic delineation of geomorphological slope units with `r.slopeunits v1.0` and their optimization for landslide susceptibility modeling

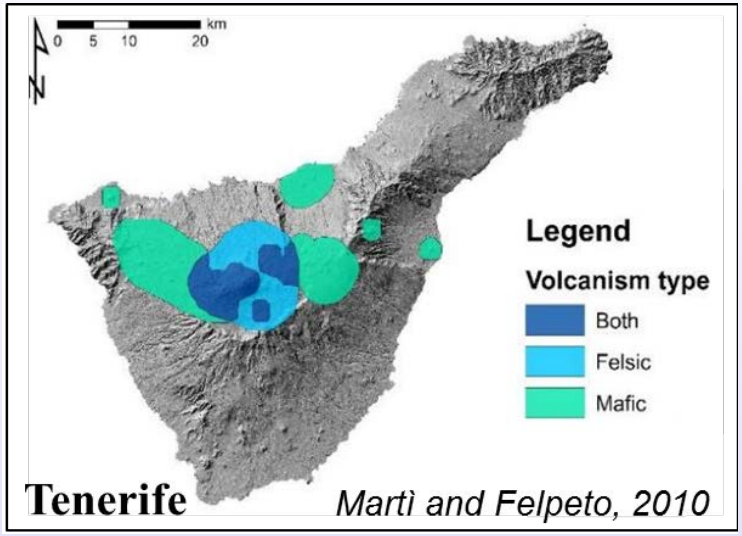
Massimiliano Alvioli, Ivan Marchesini, Paola Reichenbach, Mauro Rossi, Francesca Ardizzone, Federica Fiorucci, and Fausto Guzzetti



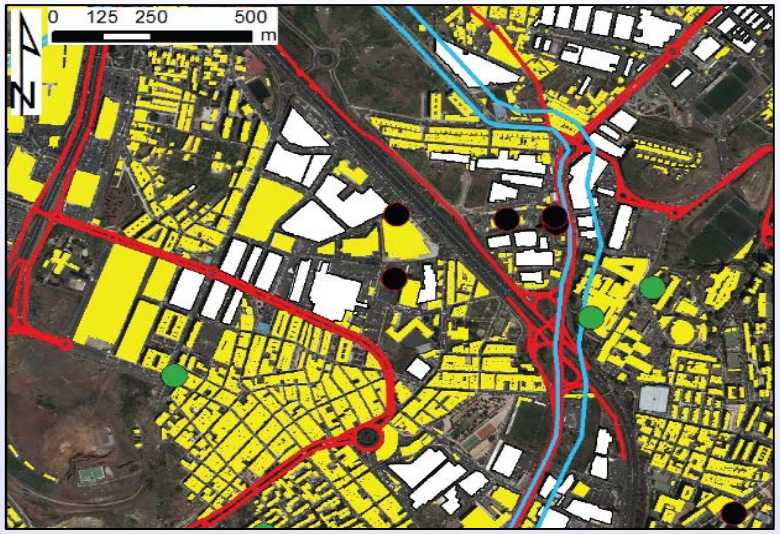
Geodatabase

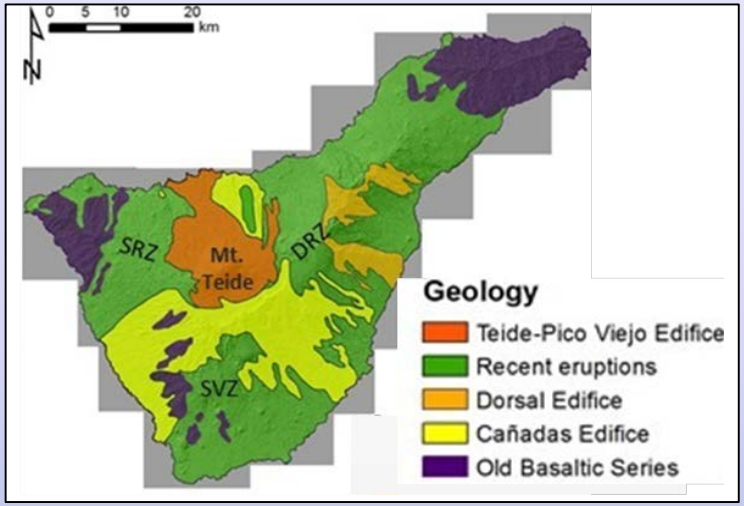
Canary Islands

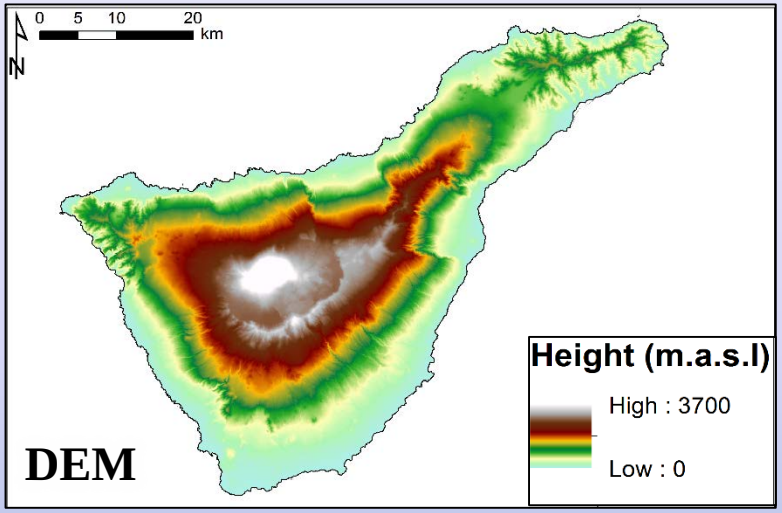
Volcanic susceptibility contours



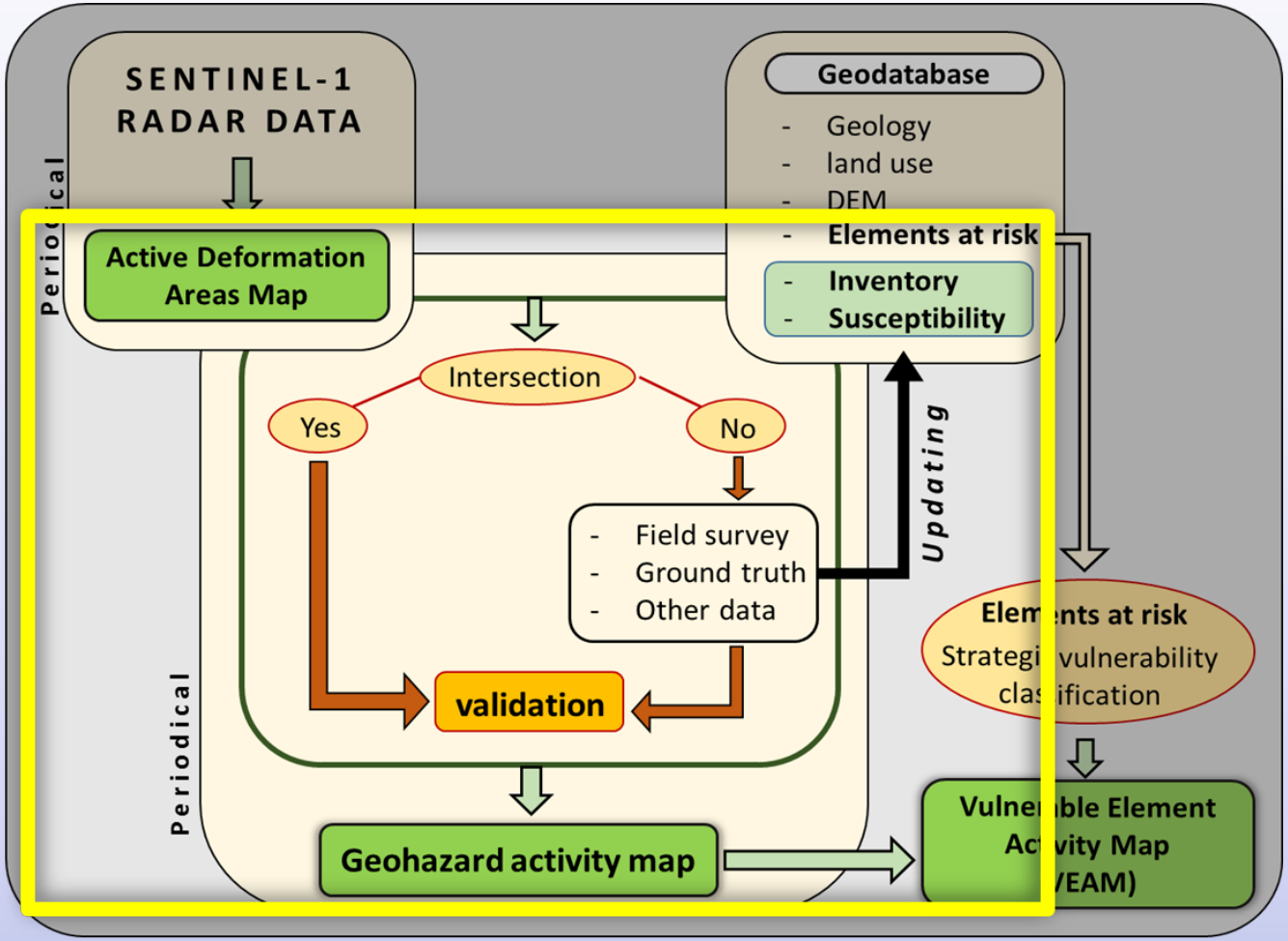
Elements at risk catalogue







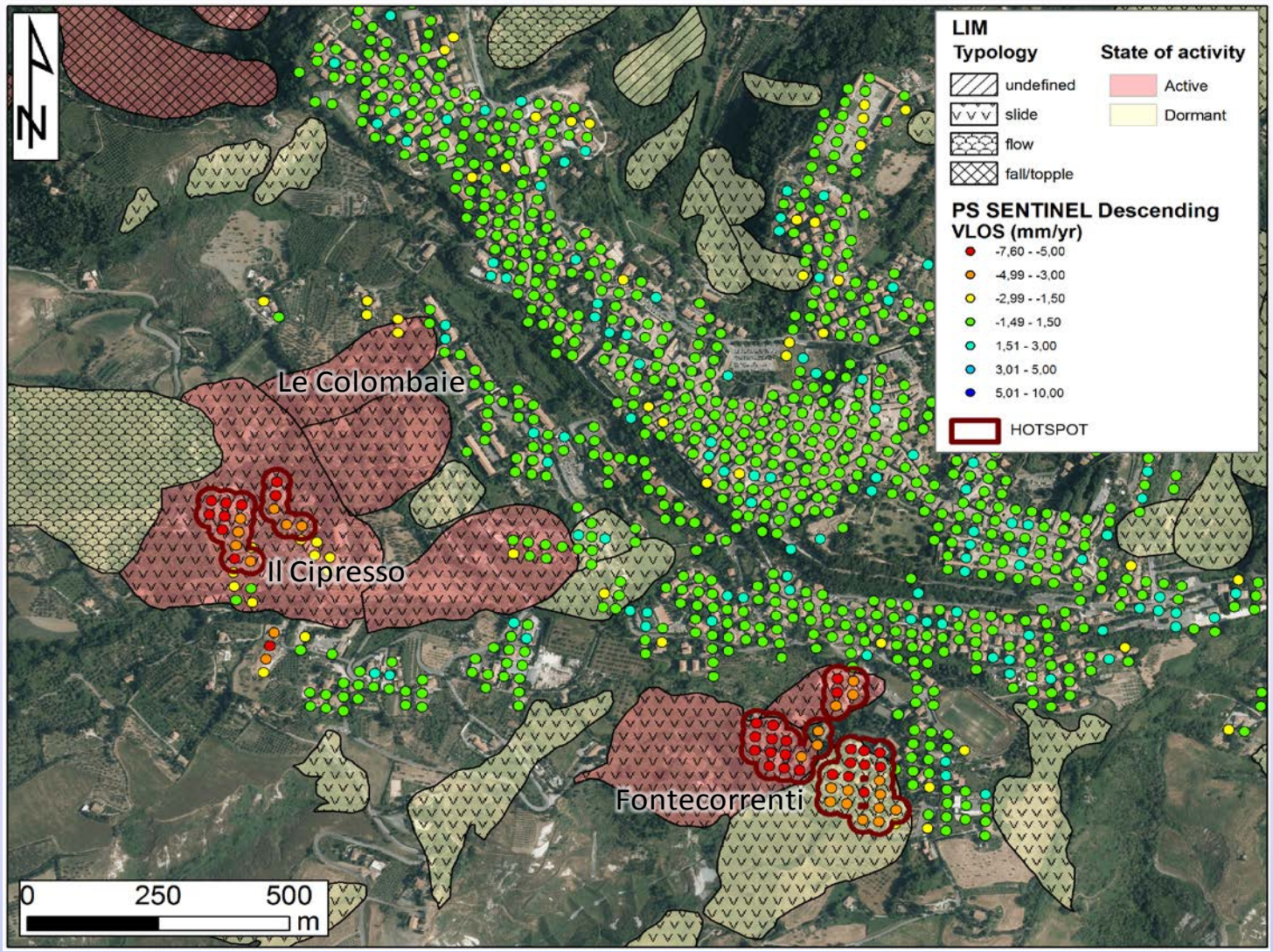
Geohazard Activity Map: HotSpots + Geohazard inventory



Geohazard activity map:

HotSpots + Landslide Inventory (LIM)

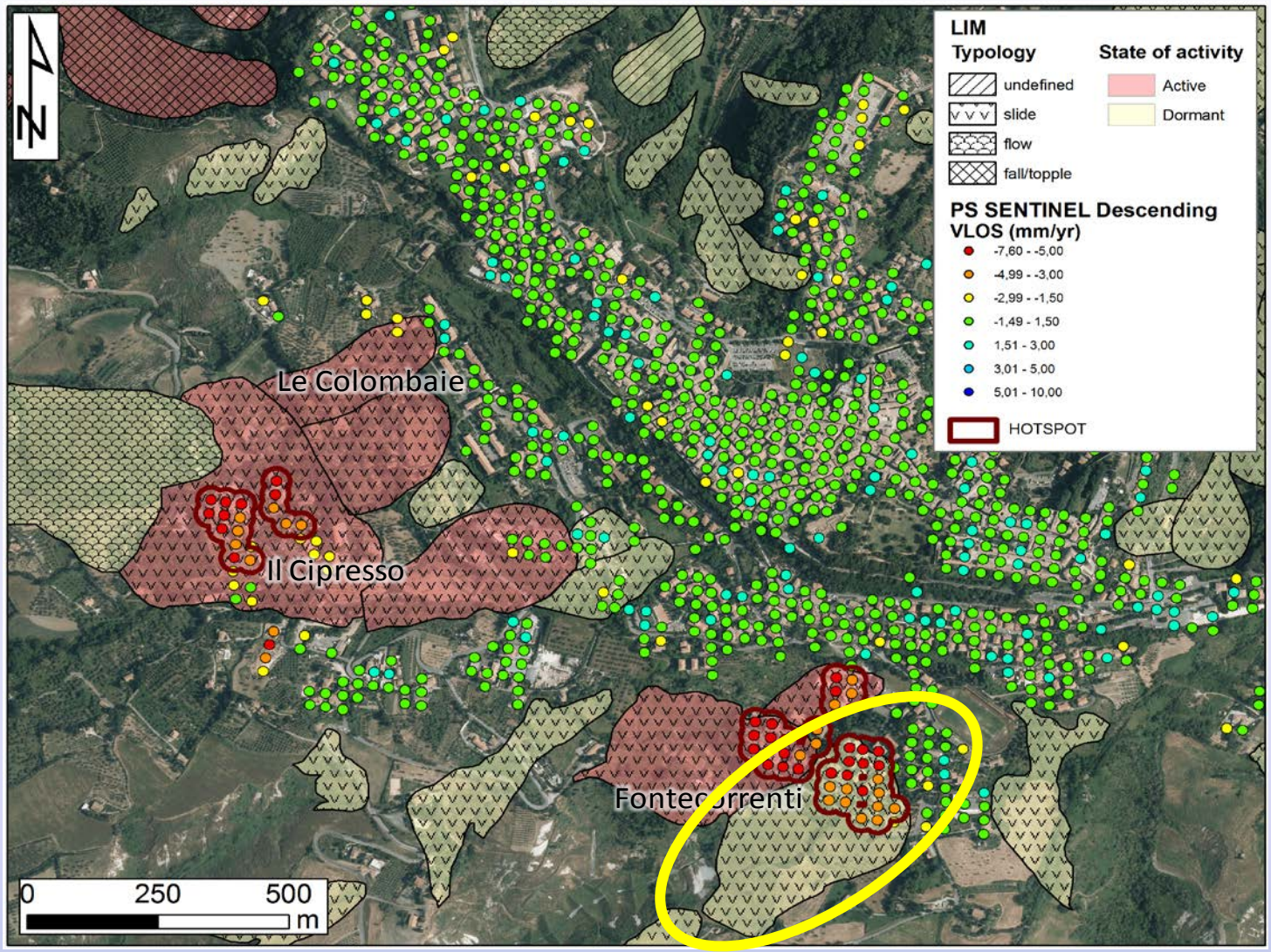
Volterra - Landslide



Geohazard activity map:

HotSpots + Landslide Inventory (LIM)

Volterra - Landslide

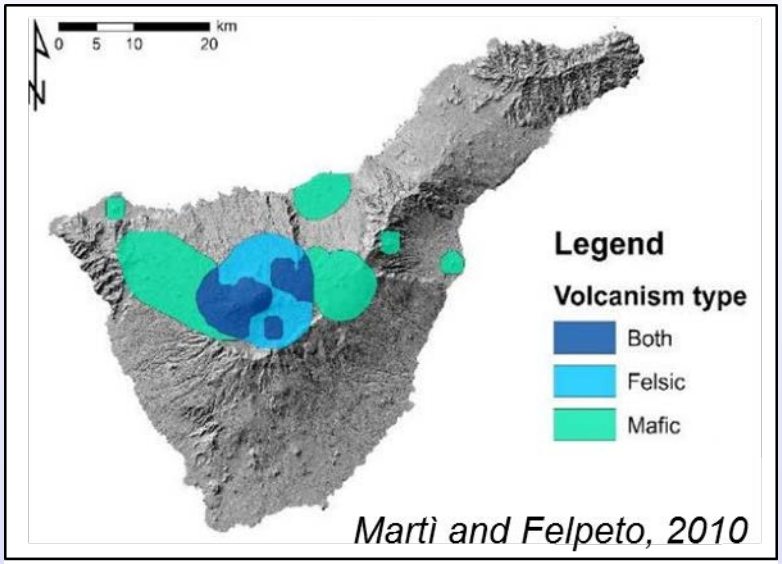


Geohazard activity map:

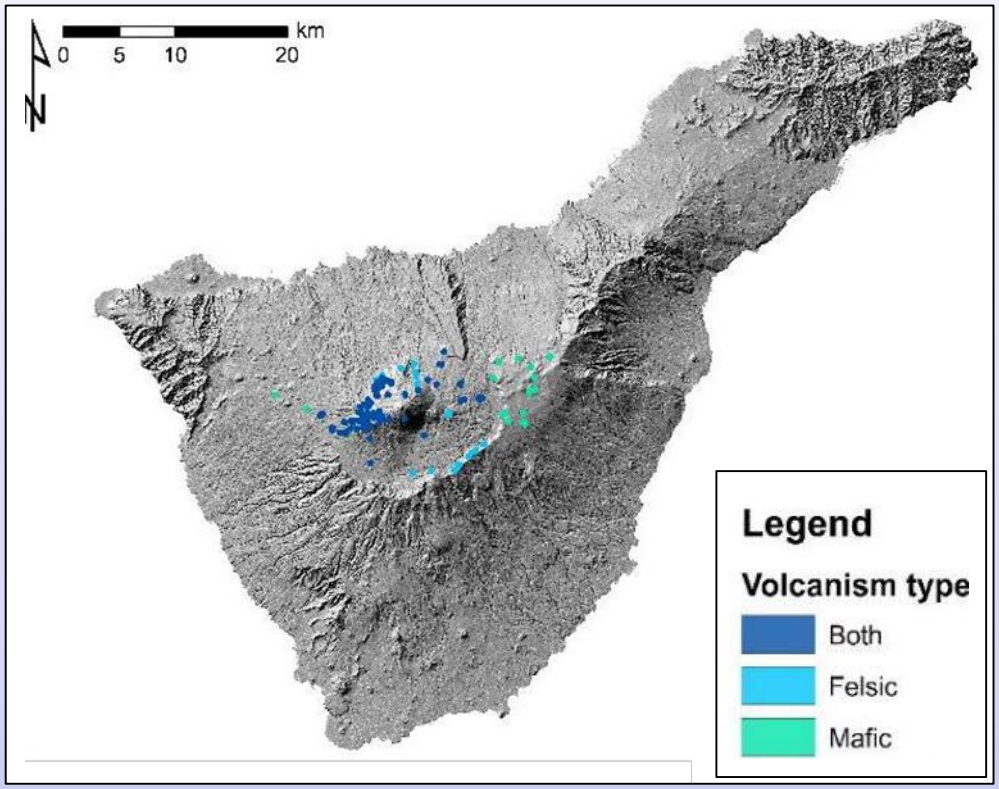
HotSpots + Vulcanic susceptibility

Tenerife - Vulcanic

Spatial probability of hosting a volcanic vent



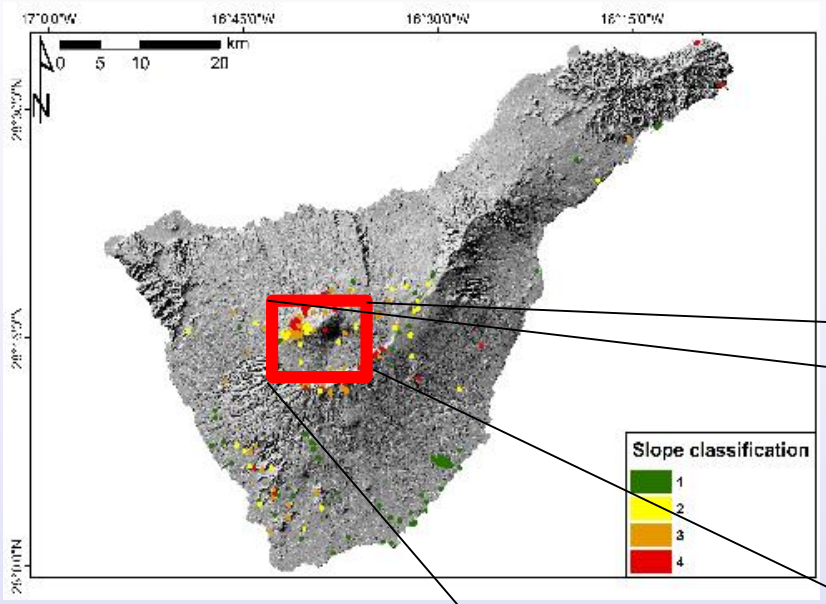
Geohazard Activity Map



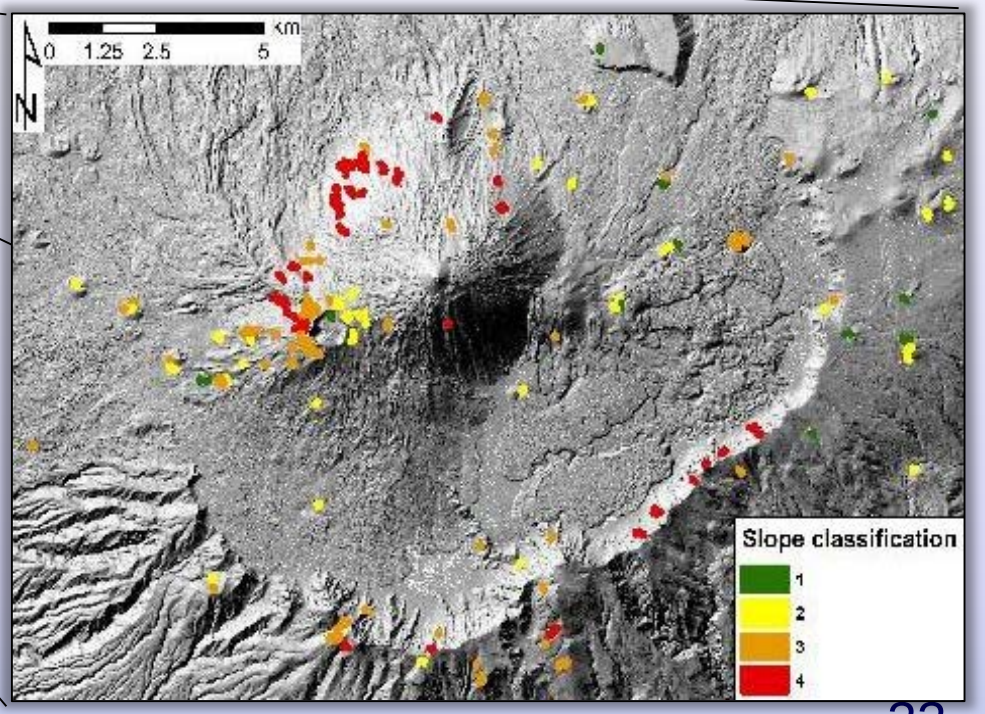
Geohazard activity map:

HotSpots + Slope classification

Tenerife - Landslide



Teide and Pico Viejo

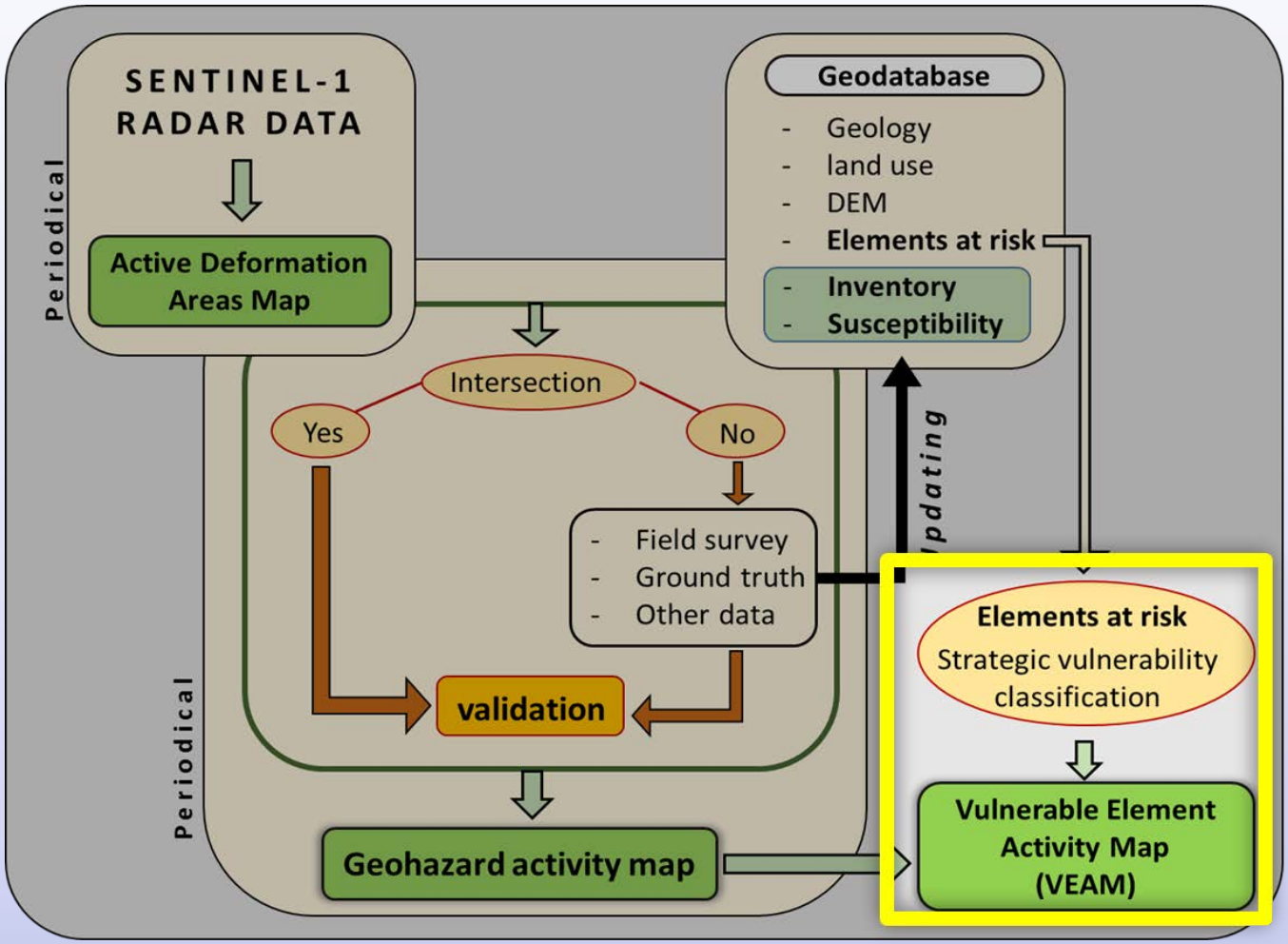


Legend

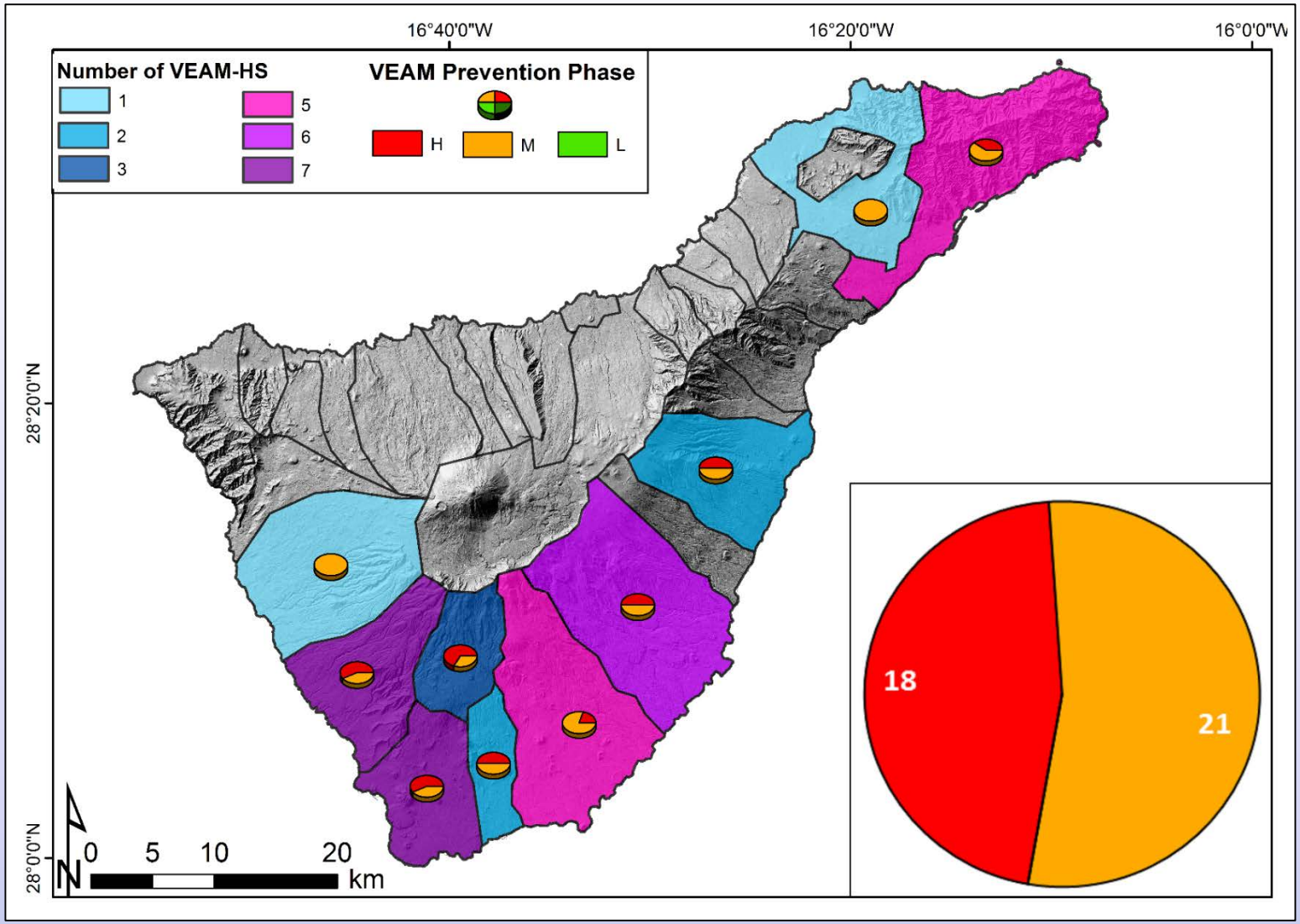
Slope classification

- 0 (0º-10º)
- 1 (10º-20º)
- 2 (20º-30º)
- 3 (> 30º)

Vulnerable Element Activity Map: HotSpots map + Vulnerability map

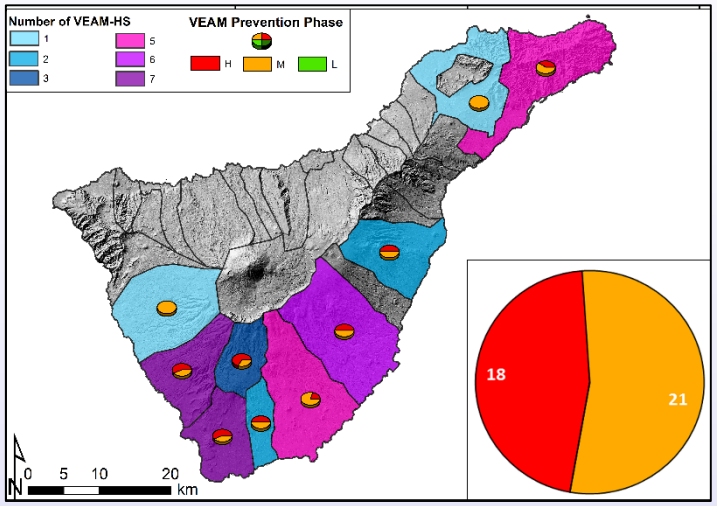


Vulnerable Element Activity Map: VEAM - Prevention

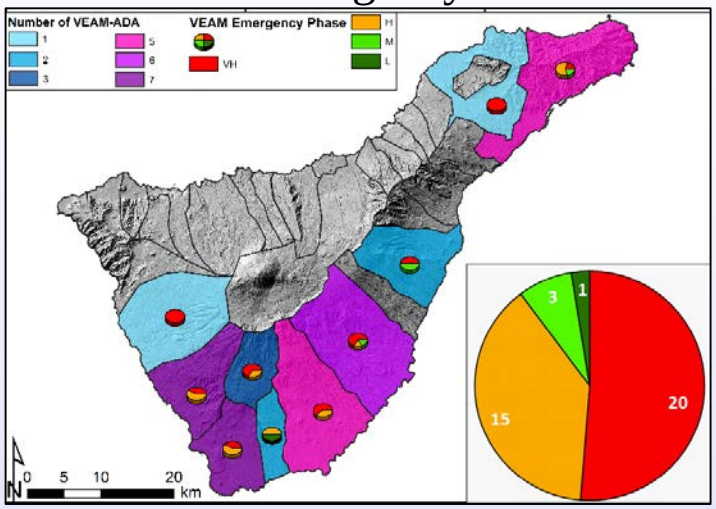


Vulnerable Element Activity Map: VEAM

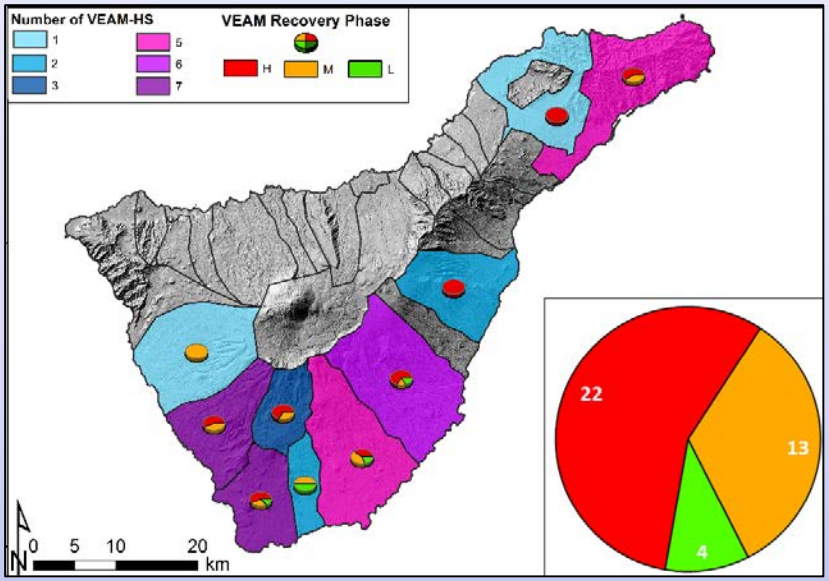
Prevention



Emergency

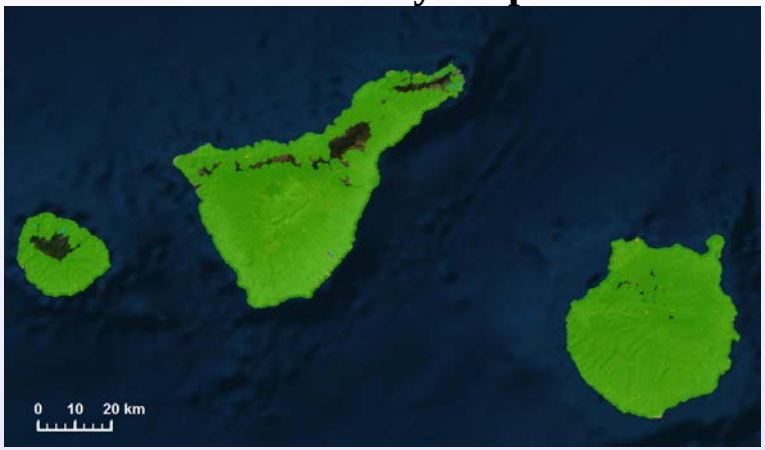


Recovery

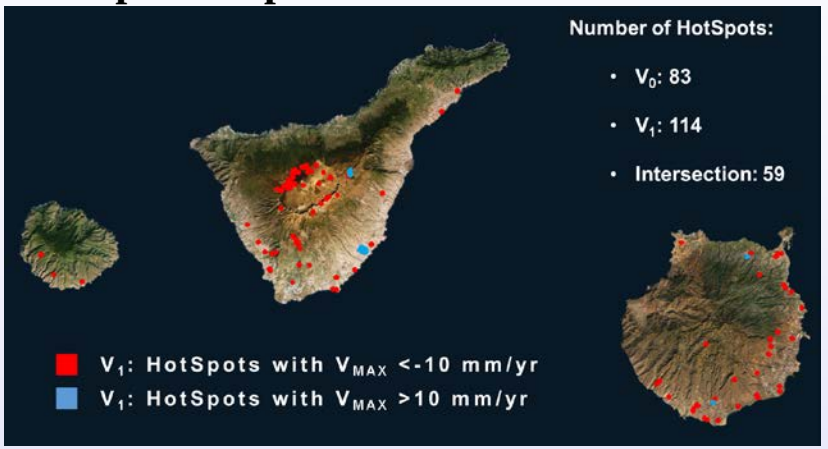


Summary &…
work in progress

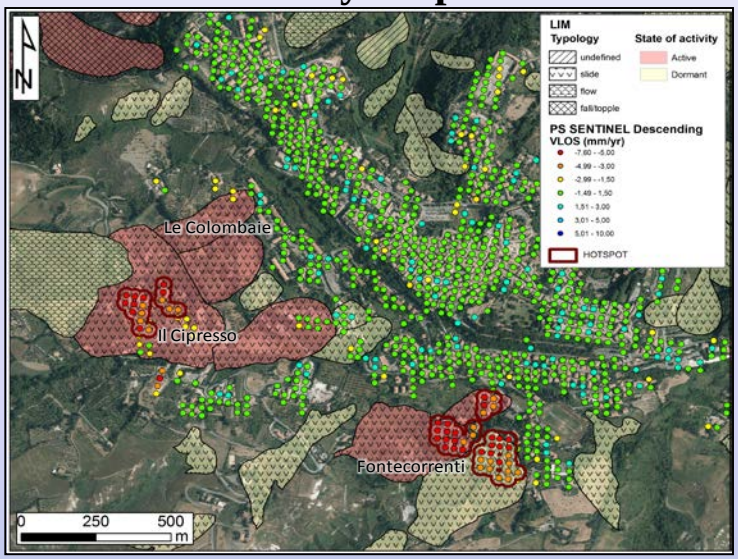
Deformation Activity Map



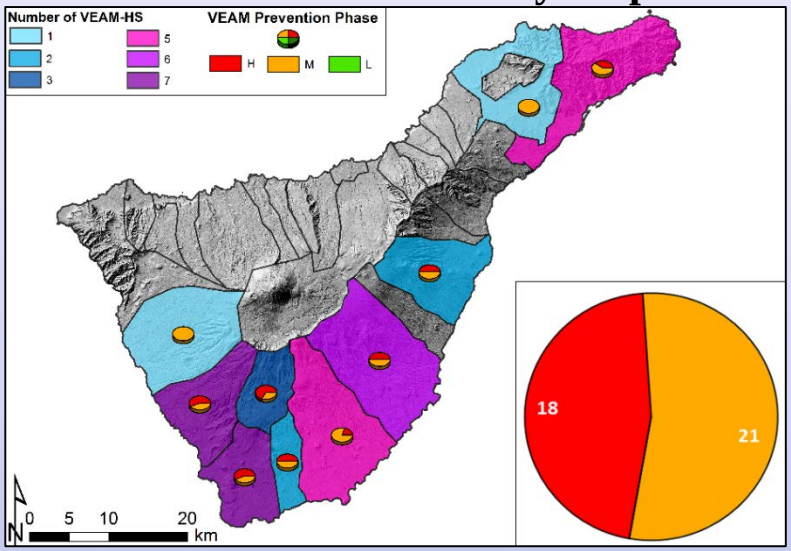
HotSpots Map



Geohazard Activity Map



Vulnerable Elements Activity Map



Safety

Safety Dissemination

http://safety.cttc.cat/

Contact: Anna Barra, E-mail: anna.barra@cttc.cat, Tel.: (+34) 93 645 2900

SAFETY TRAINING

- 27 – 28 November 2017
- Escuela Nacional de Protección Civil, Madrid (Spain)

SAFETY WORKSHOP

- 29 November 2017
- Instituto Geográfico Nacional, Madrid (Spain)

Paper under preparation:
Barra, A., Solari, L., Bejar, M., Monserrat, M., Bianchini, S., Herrera, G., Crosetto, M., González-Alonso, E., Mateos, R. M.. Geohazard activity map generation based on Sentinel 1 images

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Thanks for your kind attention!

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HR EXCELLENCE IN RESEARCH

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