INGV terremoti vulcani ambiente
ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

Report B3R1

Web-GIS of Roncovetro Landslide

Emanuele Tataranni, Luca Nannipieri, Alessandro Fornaciai and Massimiliano Favalli

The web GIS of the Lavina di Roncovetro landslide has been developed for sharing maps and monitoring activities among partners and of the Lavina di Roncovetro landslide.
The Web GIS of Wi-GIM project has been developed using LizMap. (http://www.3liz.com/lizmap.html) open source application. Lizmap allows to a web GIS in a GIS desktop environment. It is composed by two components: Lizmap plugin and Lizmap Web Client (Figure 1).
Lizmap Web Client is built with Jelix (a PHP framework), Jquery (a Javascript framework) and OpenLayers (a javascript set of tools to create and display maps in a browser). It uses HTML5, which allows to navigate also on tablets e smartphones. Lizmap Web Client allows easily synchronize via FTP all the files needed to QGIS map (project data, configuration) with the server. Lizmap requires also QGIS Server and QGIS Web Client. QGIS Server provides a Web Map Service using the same libraries as QGIS Desktop and it displays QGIS projects on web browser. QGIS Web Client provides additional features such as print and metadata.
Figure 1 shows the architecture of LizMap. For developing a web GIS, the first step has been to create a QGIS project. Then the LizMap Plugin has been used for publishing the maps on the web. After you do access to Lizmap Web Client to create a repository and configure it, finally the web GIS can be displayed on the web browser thanks to QGIS Server.

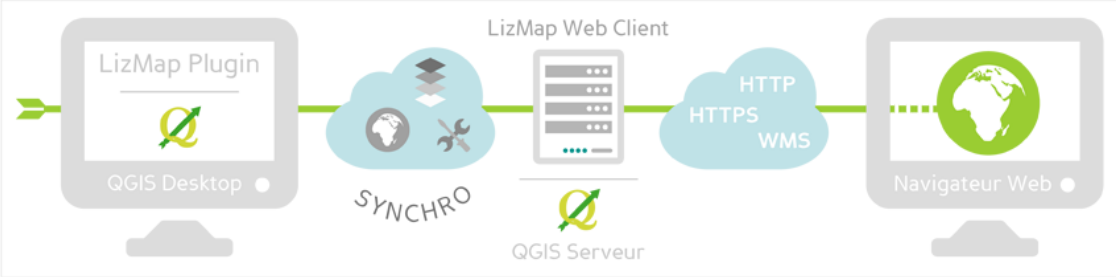

Figure 1. Architecture of LizMap

The Coordinate reference system of the QGIS behind the web GIS is Google Mercator (EPSG:3857) with “on the fly” re-projection enabled. Open street map (OSM) has been chosen as base layer because it is an opensource tools. On OSM the Lavina di Roncovetro landslide is mapped. The layer toggled the Hill Shading of the LIDAR-derived DEM. The web GIS (Figure 2) is accessible at:

http://wi-gis.pi.ingv.it/lizmap-web-client-2.10.0/lizmap/www/index.php/view/map/?repository=webgis&project=roncovetro.

When the user enters the Web GIS the initial map extent is located on the main scarp of the landslide. There are lots of cartographic features. On right side of the map there are pan and zoom controls: zoom on area drawn by the user, zoom more selecting a zoom level with a level bar, zoom less. On the left bottom there is a scale bar.
On the right on the screen there is the box with the list of the layers. Each layer can be turned on or turned off. The triangle, left the layers title, can be used to bring up the legend of the layer. On the top there is a horizontal bar with title and menu. The Wi-

Sezione di PISA
Via della Faggiola, 32
56126 PISA | Italia
Tel.: +39 050 8311920/27
Fax: +39 0508311942
aoo.pisa@pec.ingv.it
www.pi.ingv.it

INGV
terremoti
vulcani
ambiente
ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA

GIM website is linked. In menu bar there is also possible use search addresses, hide the panel management layers, go to the map information and use the measurement tools
In the map information page there are a brief description of Wi-GIM project and of the Lavina di Roncovetro landslide. In addition, in the section Consorium there are all the Institutions involved in the project followed by the team of working group. In detail, in the paragraph Map Proprieties all technical information about map and decoding of acronyms are described. User can also find a direct link to the Web Map Service (WMS) of Web GIS and find a contact to have information about the Wi-GIM project.

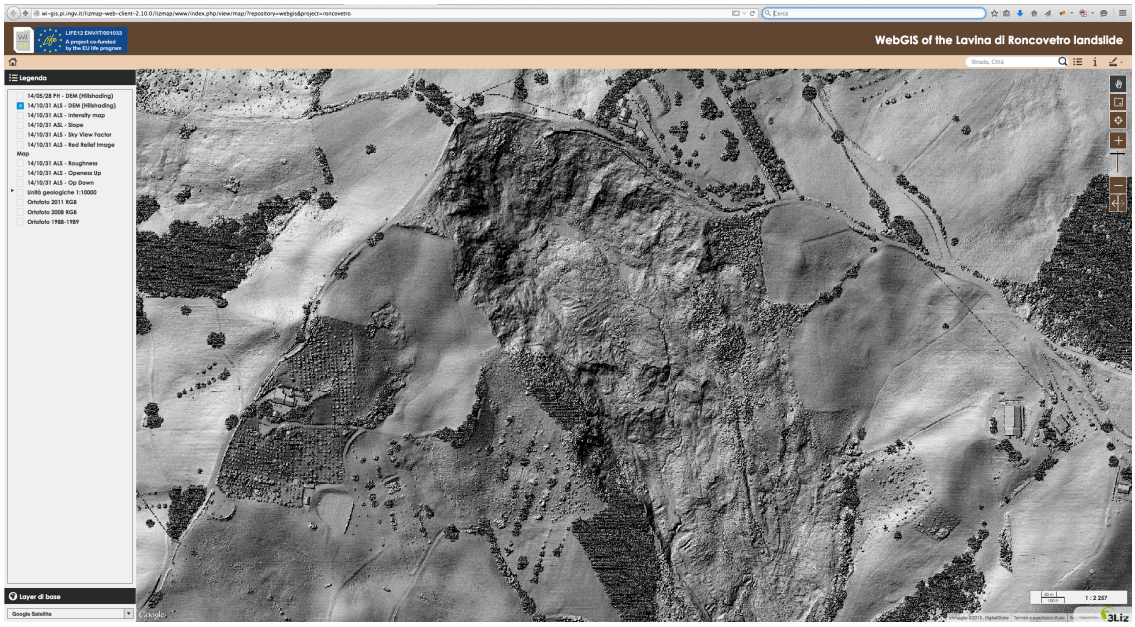

Figure 2. Screenshot of the Web-GIS page of Lavinia di Roncovetro.

The maps included in the Web-GIS are:

- Hill-shading of DEM-derived LIDAR;
- Hill-shading of DEM-derived UAV-Sony NEX5 (first flight);
- Intensity of DEM-derived LIDAR;
- Slope of DEM-derived LIDAR;
- Roughness of DEM-derived LIDAR;
- Openness Up of DEM-derived LIDAR;
- Openness Down of DEM-derived LIDAR;
- Sky View Factor of DEM-derived LIDAR;
- Red Relief Image map of DEM-derived LIDAR;
- Geological Units;
- Aerial photo 2011;
- Aerial photo 2008;
- Aerial photo 1988.

In addition to DSM and DTM, the intensity map (Figure 3) and several DEM-derived maps were created. In particular, slope, aspect, roughness and curvature (Figure 4) maps and Sky View Factor and openness down (Figure 5) maps have been created.
The red relief image technique produces a “red image” by adjusting the chrome value of red to the topographic slope and its brightness to the openness value, which in turn is the mean value between the positive and negative openness. Negative and positive openness are local indicators of the concavity and convexity of a surface, respectively. RRIM is then a multi-layered image, which is able to give information about slope, concavity and convexity of the surface and to represent topographic details (Fig. 5b). The slope is the first derivative of the DEM calculated by applying the Sobel filter as:

$$S = \arctan\left[\sqrt{\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2}\right]$$

Sezione di PISA

Via della Faggiola, 32

56126 PISA | Italia
Tel.: +39 050 8311920/27
Fax: +39 0508311942
aoo.pisa@pec.ingv.it
www.pi.ingv.it

INGV
terremoti
vulcani
ambiente
ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA

The positive and negative openness has defined respectively as:

$$\Phi_L = \frac{1}{n}\sum_{i=1}^{n}\phi_i$$

$$\Psi_L = \frac{1}{n}\sum_{i=1}^{n}\psi_i$$

where ϕ i is the zenith angle along the i-th direction the subscript L refers to the maximum horizontal search radius considered. Both positive and negative openness are always positive quantities. The positive openness measures the "openness of the terrain to the sky" while the negative openness is the "below-ground" openness. The negative openness takes high values inside valleys, gullies and craters while the positive openness takes high values on crests and ridges. Openness parameter were then defined and calculated as:

$$Openness = \frac{1}{2}\left(\Phi_L - \Psi_L\right)$$

The openness is dependent on the chosen search radius L and is positive when the surface is locally, at the scale L, upwardly convex (i.e. crests and ridges) and negative when the surface is upwardly concave (i.e. in valleys, gullies and craters).

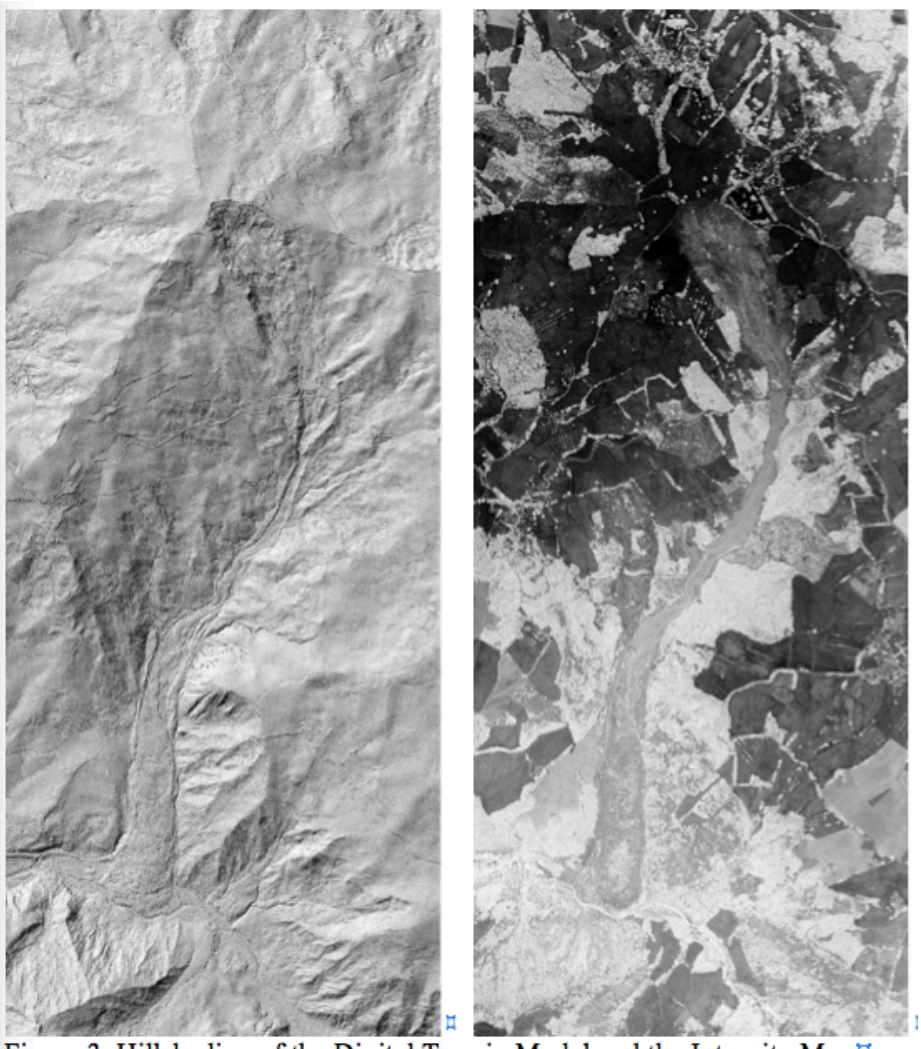

Figure 3. Hillshading of the Digital Terrain Model and the Intensity Map

Sezione di PISA

Via della Faggiola, 32

56126 PISA | Italia
Tel.: +39 050 8311920/27
Fax: +39 0508311942
aoo.pisa@pec.ingv.it
www.pi.ingv.it

INGV
terremoti
vulcani
ambiente
ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA

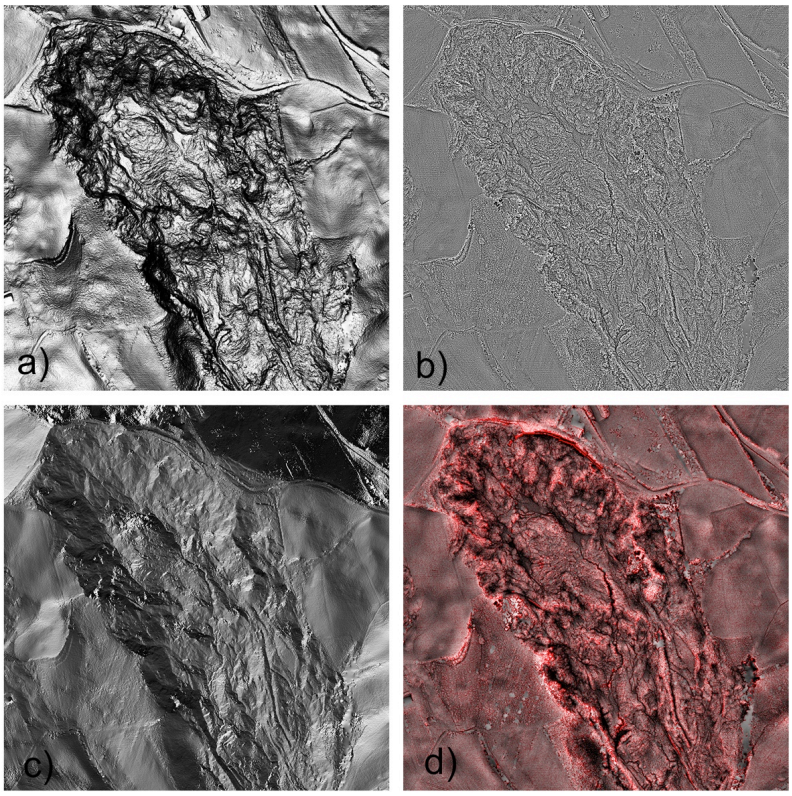

Figure 4. a) Slope; b) Curvature; c) Aspect; d) Roughness

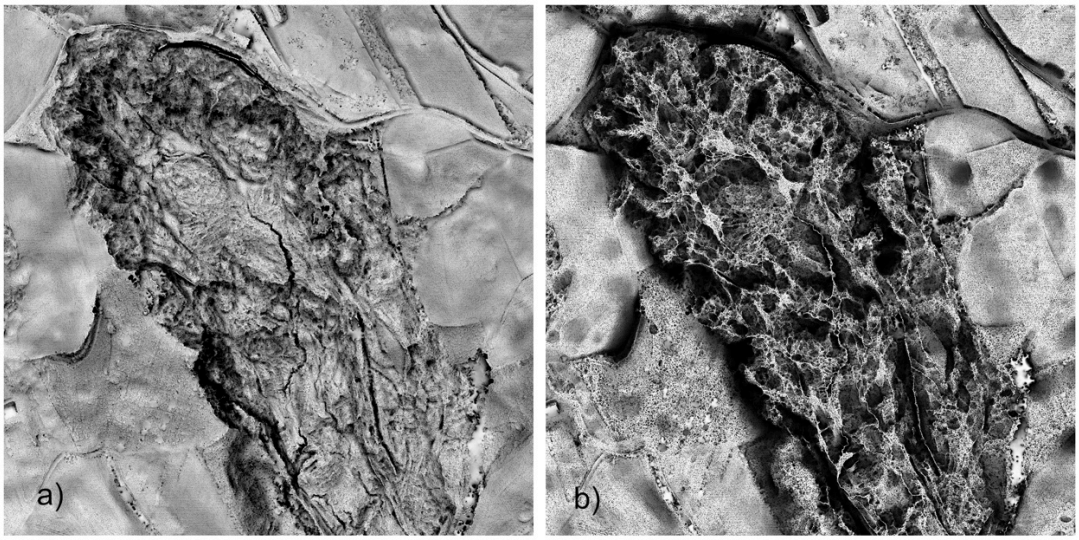

Figure 5. a) Sky View Factor; b) Openness down.

The WEB-GIS of Sallent site is based on INSTAMAPS platform (http://www.instamaps.cat). Instamaps is a platform built up to create, edit and share maps on the web by combining your own data with public and private data sources available online or offline. The main goal of the platform is to provide a set of tools that can be used without prior knowledge for non-expert users to pinpoint information on top of a choice of different base map layers and thus easily create a map out of plain data. The ready-made standard maps can be further edited and styled to achieve a greater visual impact, and can be enhanced with a series of predefined styles to provide the most usual cartographic visualizations. These user produced maps are stored on the private map gallery for each registered user, who has the choice of keeping them private or sharing them publicly. All these authoring tools work on a standard modern web browser with no special requirements.
The web GIS of Sallent Village (Figure 6) is accessible at:

http://www.instamaps.cat/geocatweb/visor.html?businessid=6905955fa657e025932a38a6fbcf5485&embed=1#19/41.81538/1.89811

Sezione di PISA

Via della Faggiola, 32

56126 PISA | Italia
Tel.: +39 050 8311920/27
Fax: +39 0508311942
aoo.pisa@pec.ingv.it
www.pi.ingv.it

INGV
terremoti
vulcani
ambiente
ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA

In this WEB-GIS is shown the area of main subsidence and configuration of the Wi-GIM system:
The components of the conventional monitoring network:
- Location and identification of topographic benchmark points (leveling network)
- Location and identification Leica prisms for TCA monitoring
The Wi-GIM components:
- Location and identification of Master Nodes
- Location and identification of Super Master Nodes
- Location and identification of Slave Nodes.

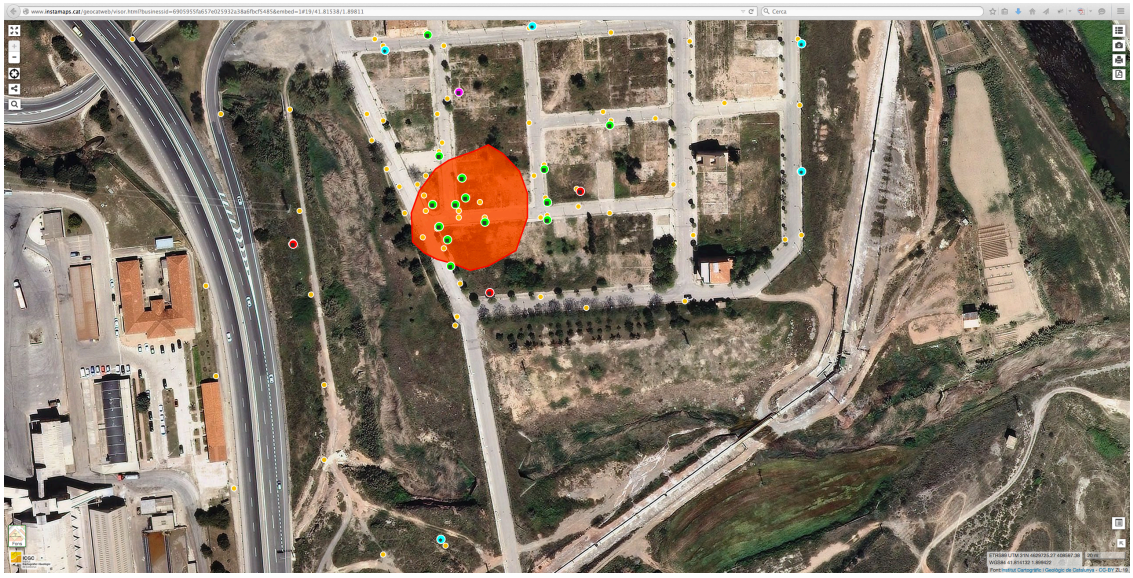

Figure 6. Screenshot of the Web-GIS page of Sallent Village.

Sezione di PISA

Via della Faggiola, 32

56126 PISA | Italia
Tel.: +39 050 8311920/27
Fax: +39 0508311942
aoo.pisa@pec.ingv.it
www.pi.ingv.it