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The use of IFSAR data in GIS-based landslide susceptibility evaluation

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GIS-based landslide susceptibility evaluation is based on the spatial relationships between landslides and their related factors. The analyses are highly conditioned by precision and accuracy of input factors, in particular landslides identification and characterization. Factors influencing landslide spatial hazard consist of geological, geomorphological, hydrogeological and tectonic features, geomechanical and geotechnical properties, land use and management, and DEM-derived factors (elevation, slope, aspect, curvature, superficial flow). The choice of influencing factors depends on: method of analysis, scale of inputs, aim of the outputs, availability and quality of the input data. Then, the choice can be made a priori, on the bases of an in-deep territorial knowledge and experts' judgements, or by performing statistical analyses, finalized to identify the significance of each of the influencing factor.

Due to the large availability of terrain data, spatial models often include DEM-derived factors, but the resolution and accuracy of DEMs influence the final outputs. In this work the relationships between landslides occurred in the volcanic area of the Euganean Hills Regional Park (SE of Padua, Veneto region, Italy) and morphometric factors (slope, aspect and curvature) will be examined through a simple probability method. The use of complex and time consuming mathematical or statistical models is not always recommended, because often simple models can lead to more accurate results. Morphometric input factors are derived from DEMs created from vector elevation data of the regional cartography at 1:5.000 scale and with NEXTMap® data (http://www.intermap.com).

NEXTMap® Digital Surface Model (DSM) and Digital Terrain Model (DTM) are generated using Intermap's IFSAR (Interferometric Synthetic Aperture Radar) technology mounted on an aircraft at a flight height of 8500 m above Mean Sea Level and under a side viewing angle of about 45°. The DSM represents the first reflective surface as illuminated by the radar. IFSAR sensors retrieve the mean height of the main scattering elements in a grid cell, known as the scattering phase centre height. The radar return from vegetation usually penetrates to some extend lower than the 'first' tree canopy height. The DTM is derived from DSM applying a semi-automated process that classifies areas as obstructed (buildings and vegetation) and unobstructed , where the obstructed areas are processed to approximate bald earth. DSM and DTM data present a post spacing of 5 m and a vertical accuracy of 1 m (RMSE) or better in areas of unobstructed flat terrain.

IFSAR elevation models are compared with photogrammetrically derived models (topographic map of Veneto Region) for the following aspects:

Every elevation point of IFSAR models is derived through a direct measure of the terrain surface, while photogrammetric elevation models are usually compiled through digitalization and interpolation of contour lines. Frequent seam lines are evident in vector maps derived DEMs, compiled during many years, with different specifications and tools.

IFSAR 5 m posted DEM's generate a much more detailed description of terrain features.

Seamless and homogeneous IFSAR elevation models pave the way to accurate applications like landslides study and risk assessment.

The results obtained using the two DEM sources will be compared. The contribution of IFSAR data to the GIS-based spatial analysis of the study area will be tested and discussed.