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The Geo-morphotypes Map of the Friuli Venezia Giulia Region (NE Italy): a tool for the evaluation of the local seismic amplification

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The seismic motion can be subjected to amplification because of the occurring of particular local morphological conditions (Di Bucci et al., 2005). The Geo-morphotypes Map was developed to represent on a large scale the local seismic response recognizing on a wide area the geomorphological scenarios which can be responsible of amplification.
The Friuli Venezia Giulia Region can be subdivided into: a mountain region (about 3200 km2), a foothill region (about 1400 km2), the plain (about 2800 km2), the coast and lagoon areas (about 160 km2) and, in the Southeast, the Karst (about 200 km2). In the Region outcrop rocks belonging to a stratigraphic succession spanning in time from 460 MY to present. Rocks are mostly sedimentary and their thickness is over 15 km. Limestones and dolostones prevail over terrigenous rocks such as sandstones, argillites, siltites and conglomerate or breccias. Soils are represented by recent moraines, often overfed detrital deposits and alluvial sediments.
These scenarious were defined taking into account the amplification factors as the stratigraphical, geometrical and topographical effects, defining at first the impedance contrast between rock materials (Vs > 800 m/s) and soft sediments/soil (Vs < 800 m/s) and the slope, which has been subdivided in 3 classes (< 8°, 8-15°, > 15°). The geometries were defined considering the Eurocode 8 (CEN, 2004). We propose 14 geomorphological scenarios (the "geo-morphotypes"):
1. Flat Plain in rock (slope < 8°);
2. Flat Plain in soil (slope < 8° and soil thickness > 30 m);
3. Moderate Slope in rock (slope between 8° and 15°);
4. Moderate Slope in soil (slope between 8° and 15° and soil thickness > 30 m);
5. Steep Slope in rock (slope >15)°;
6. Steep Slope in soil (slope > 15° and soil thickness > 30 m);
7. Foothill zone (slope < 8° and soil thickness < 100 m);
8. Edge of Scarp in rock (elevation (H) > 10 m and distance from the edge < 3H);
9. Alluvial Terrace (soil thickness > 30 m, elevation (H) > 10 m and distance from the edge < 3H);
10. Valley in rock (sides slope > 15° and width < 250 m);
11. Shallow Valley (in soil; sides slope > 15°, width < 250 m and thickness of soil < 30 m);
12. Deep Valley (in soil; sides slope > 15°, width > 250 m and thickness of soil > 30 m);
13. Crest (in rock; sides slope > 15°, flat area on the top Slope < 15°, width between 100 and 250 m and elevation > 30 m);
14. Alluvial Fan (in soil).
The Geo-morphotypes Map was carried out in order to represent the whole region using the 14 geo-morphotypes. The map was developed using ArcGIS 9.x and was obtained from the overlapping of different layers: the slope map obtained from the Digital Terrain Model, the geological maps of the region at different scales, the subsurface structures map and the database of the regional wells.

For each geo-morphotype has been worked out the average relative amplification factors in order to classify the more hazardous scenarios (Grimaz, 2008).
The geomorphological scenarios not only describe the territory from a geological and geomorphological point of view, but also provide a good description of sites affected by the seismic action and consequently define a useful zonation to recognize the local seismic response. Therefore, the potential effects of geo-morphologic scenarios should be taken into account in the risk assessment because they could change substantially the intervention priorities.