Il Quaternario
Italian Journal of Quaternary Sciences
24, (Abstract AIQUA, Roma 02/2011), 79 - 80

Congresso AIQUA
Il Quaternario Italiano: conoscenze e prospettive
Roma 24 e 25 febbraio 2011

MAPPING THE GEOMORPHOLOGICAL SCENARIOS OF THE FRIULI VENEZIA GIULIA REGION (NE ITALY): A TOOL FOR THE EVALUATION OF THE LOCAL SEISMIC AMPLIFICATION

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ABSTRACT: Biolchi S. *et al., Mapping the geomorphological scenarios of the Friuli Venezia Giulia Region (Ne Italy): a tool for the evaluation of the local seismic amplification.* (IT ISSN 0349-3356, 2011)
The Friuli Venezia Giulia Region was affected by several destructive earthquakes over the last centuries. In order to identify the causes of the local seismic amplification, geomorphological scenarios has been proposed. They represent the site-specific geological, geomorphological and topographical characteristics (geo-morphotypes). We represent the whole region in terms of these geo-morphotypes in a map.

RIASSUNTO: Biolchi S. *et al* ., Rappresentazione degli scenari geomorfologici della Regione Friuli Venezia Giulia: uno strumento per la valutazione dell'amplificazione sismica locale. (IT ISSN 0349-3356, 2011)
La Regione Friuli Venezia Giulia è stata interessata da numerosi e disastrosi eventi simici. Anche al fine di individuare le cause dell'amplificazione sismica locale, sono stati individuati e cartografati in ambiente GIS gli scenari geomorfologici che possono generare amplificazione del moto sismico locale.

Key words: Friuli Venezia Giulia Region, geomorphological scenarios, Geo-morphotypes Map

Parole chiave: Regione Friuli Venezia Giulia, scenari geomorfologici, Carta dei Geo-morfotipi

1. INTRODUCTION

The Friuli Venezia Giulia Region was affected by several destructive earthquakes over the centuries. Locally the occurrence of the quaternary deposits covering the bedrock plays a remarkable role on the site effects.
As a matter of fact, 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 distribution of the geomorphological scenarios which can be responsible of seismic amplification.

2. STUDY AREA

The Friuli Venezia Giulia Region, in NE Italy, represents the north-eastern portion of the deformed margin of the Adria microplate, where a complex interaction between two orogenic chains occurs. The mountainous part comprises the hinge zone between the eastern sector of the Southern Alps (S and SE vergence) and the north-western part of the External Dinarides (SW vergence) (CARULLI, 2006).
The Region can be subdivided into: a mountain region (about 3200 km^2), a foothill region (about 1400 km^2), the plain (about 2800 km^2), the coast and lagoon areas (about 160 km^2) and, in the Southeast, the Karst (about 200 km^2). 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. The quaternary deposits are represented by recent moraines, often overfed detrital deposits and alluvial sediments. The lasts can be more than 500 meters thick, are gravelly upriver and mud-sandy downriver.

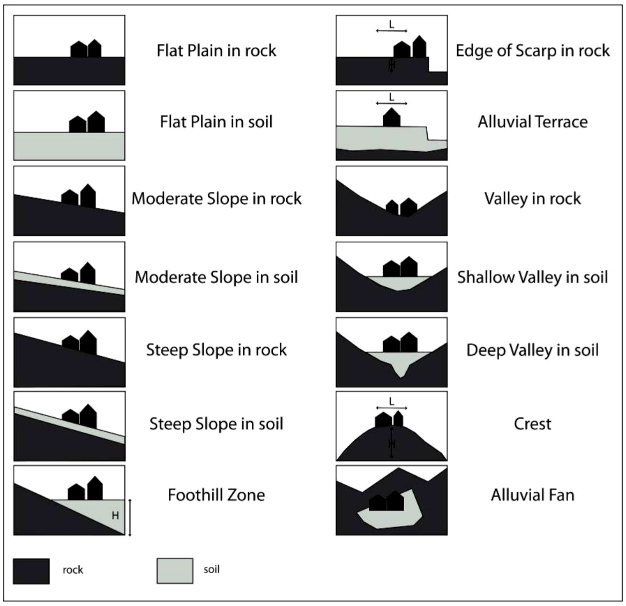

Fig. 1, The geomorphological scenarios (geo-morphotypes).
Gli scenari geomorfologici (geo-morfotipi).

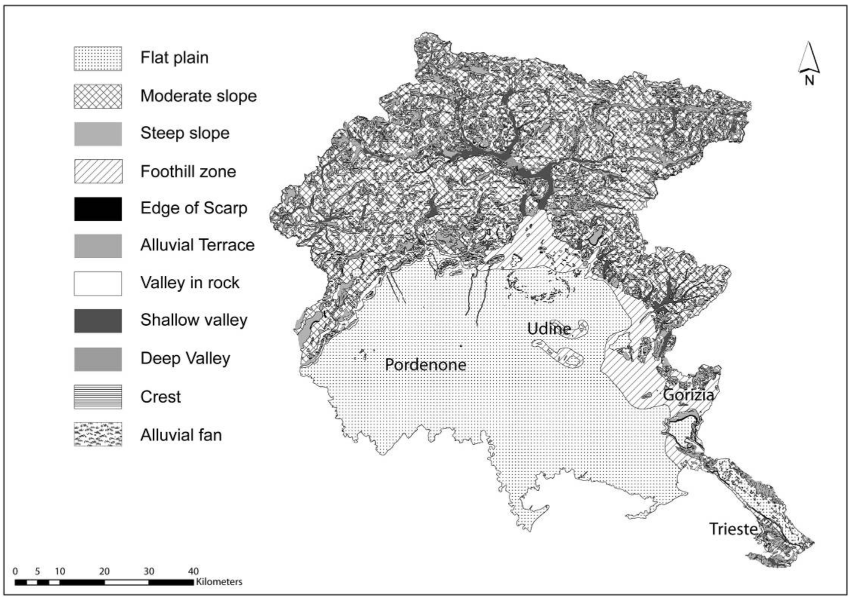

Fig. 2, The "Geo-morphotypes Map" of the Friuli Venezia Giulia Region (to simplify the representation of the map, originally at 1:150.000 scale, some geo-morphotypes were grouped).
La "Carta dei Geomorfotipi" della Regione Friuli Venezia Giulia (per semplificare la rappresentazione della carta, originariamente in scala 1:150.000, alcuni geo-morfotipi sono stati raggruppati).

3. DISCUSSION

These scenarios were defined taking into account the amplification factors as the stratigraphic, 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 (EUROCODE 8, 1998). 14 geomorphological scenarios, which are described below with their areal extension (the "geo-morphotypes", Fig. 1), were proposed:

1. Flat Plain in rock (slope <8°, 187 km^2);
2. Flat Plain in soil (slope <8° and soil thickness >30 m, 2824 km^2);
3. Moderate Slope in rock (slope between 8° and 15°,307 km^2);
4. Moderate Slope in soil (slope between 8° and 15° and soil thickness >30 m, 102 km^2);
5. Steep Slope in rock (slope >15°, 2495 km^2);
6. Steep Slope in soil (slope >15° and soil thickness >30 m, 451 km^2);
7. Foothill zone (slope <8° and soil thickness <100 m, 598 km^2);
8. Edge of Scarp in rock (elevation (H) >10 m and distance from the edge <3H, 24 km^2);
9. Alluvial Terrace (soil thickness > 30 m, elevation (H) >10 m and distance from the edge <3H, 14 km^2);
10. Valley in rock (sides slope >15° and width <250 m, 28 km^2);
11. Shallow Valley (in soil; sides slope >15°, width <250 m and thickness of soil <30 m, 187 km^2);
12. Deep Valley (in soil; sides slope >15°, width >250 m and thickness of soil >30 m, 13 km^2);
13. Crest (in rock; sides slope >15°, flat area on the top Slope <15°, width between 100 and 250 m and elevation >30 m, 428 km^2);
14. Alluvial Fan (in soil, 34 km^2).

The Geo-morphotypes Map (Fig. 2) 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.

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Ms. received: January 31, 2011
Testo ricevuto il 31 gennaio 2011