

Research and Civil Protection in Friuli-Venezia Giulia regarding seismic risk

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ABSTRACT This is a short report of the main research activity in the field of seismic risk in the last twenty years performed in Friuli-Venezia Giulia (NE Italy) with funding from the Universities of Trieste and Udine, the National Institute of Oceanography and of Experimental Geophysics, and the Regional Direction of the Civil Protection.

1. Foreword

The Civil Protection was set up in Friuli - Venezia Giulia thanks to a regional act (no. 64, December 31, 1986). I would like to mention a few points which, in my opinion, are particularly significant:

- Art.10, paragraph d), entitles the Region to carry out research, scientific studies, to devise plans and to programme interventions, to seek professional advice either directly or by appointing external, qualified experts as well as to meet expenses derived from the employment of researchers and experts working individually or in group as stated in art. 24;
- Art.13 appoints the Scientific and Technical Service and the Scientific and Technical Board for the Civil Protection Service chaired by the Councillor responsible for the area and by two regional managers plus a large number of experts (16 belonging to the former board);
- Art.18 entrusts the Scientific Technical Service with several tasks among which the identification of sources of risk and vulnerability also by drawing up a series of risk maps within the first two years;
- Art. 24 authorizes the Regional Department of Civil Protection to make use, by the drawing up of special agreements, of teams of researchers especially involved in activities of civil protection working in the universities as well as in other research centres of the region.

2. First activities

On May 30, 1988, the Scientific Technical Board was set up and the theme "Risk" entered the agenda at its third meeting (October 1988).

On a previous occasion the Region had already given financial support for the construction of two networks for monitoring the seismic activity and slow deformations, but only in July 1992 did the Region enter into a formal agreement with the two universities of the region and the Institute of Oceanography and of Experimental Geophysics (OGS) regarding the constitution of groups of researchers. In October of the same year, the group of researchers of the University of Udine was established and was given a financial support of about 52,500 € covering a three year period (1992-1995). The group accomplished the task of analysing and computerizing the data

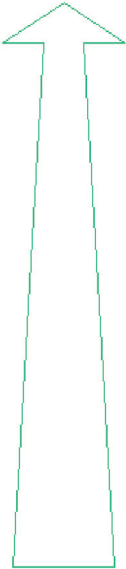





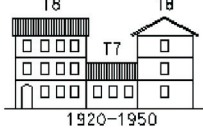
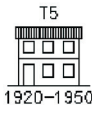




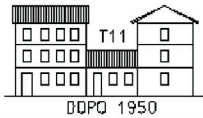

<p style="text-align: center;">HIGH VULNERABILITY</p>  <p style="text-align: center;">LOW VULNERABILITY</p>	TYPOLGY A	 <p style="text-align: center;">T1 ANTE 1920</p>	 <p style="text-align: center;">T2 ANTE 1920</p>	 <p style="text-align: center;">T3 ANTE 1920</p>	 <p style="text-align: center;">T4 ANTE 1920</p>
	TYPOLGY B		 <p style="text-align: center;">T6 1920-1950</p>	 <p style="text-align: center;">T7 1920-1950</p>	 <p style="text-align: center;">T8 1920-1950</p>
	TYPOLGY C	 <p style="text-align: center;">T5 1920-1950</p>			
	TYPOLGY D		 <p style="text-align: center;">T10 DOPQ 1950</p>	 <p style="text-align: center;">T12 DOPQ 1950</p>	 <p style="text-align: center;">T12 DOPQ 1950</p>
	TYPOLGY E			 <p style="text-align: center;">T11 DOPQ 1950</p>	 <p style="text-align: center;">T11 DOPQ 1950</p>
	TYPOLGY F	 <p style="text-align: center;">T9 DOPQ 1950</p>			

Fig. 1 - The six different types of buildings (Carniel *et al.*, 2001) that can be grouped on the basis of the General Census (Istat, 1991).

contained in the files of the earthquake damages (see regional law no. 17 of 1976) and, using this database, to calibrate the relationship of seismic activity with damage in order to compare the vulnerability of the Friulian real estate both at a prognostic and at an “a posteriori” stage. The study (Carniel *et al.*, 2001) allowed us to use the relatively poor data of the General Census of Population (Istat, 1991) to evaluate the vulnerability of the real estate in the whole region and to extend the results of the detailed analysis to the shaken area and to group the buildings into six classes with different indexes of vulnerability (Fig. 1).

3. Seismic risk map

On April 21, 1988 a formal agreement was finally signed and the drawing of the map of the seismic risk started. A second working group of researchers belonging to the Universities of Trieste and Udine and to the OGS was also set up. The research coordinators were G.B. Carulli for the University of Trieste, D. Slejko for the OGS, and M. Riuscetti for the University of Udine. The financial support worth 890,000 € was provided entirely by the Regional Department of

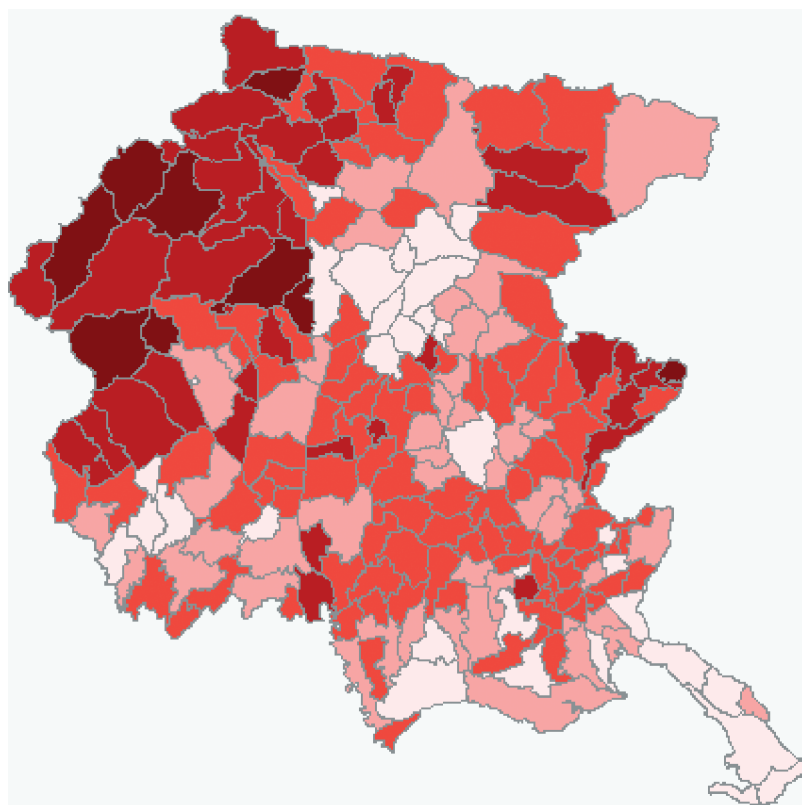


Fig. 2 - Distribution of seismic risk in terms of €/inhabitant. The lower risk in the northern central part (light pink) is due to the reconstruction after the 1976 earthquake (PCRAFGV, 2006).

Civil Protection. The final document drawn up at the end of the fourth year was considered somewhat imbalanced in various areas by the authors themselves. While in fact, it could have been considered abreast with the most advanced state-of-the-art procedures as concerned seismic hazard and vulnerability, it actually turned out to be only approximately valid - quite rough to tell the truth - for what concerns 'risk'. Istat (Italian Institute of Statistics) 2001 data were not in fact available and so one had to rely on those collected in 1991 which were actually considered not particularly reliable in a later study (Bernardini, 2008), for what concerns buildings, while for the aspects concerning the economic evaluation even today studies in this area still suffer enormous delays (but the problem is generalized).

On the whole important conclusions and suggestions on the state of the seismic risk of the region and on its evolution consequent to the 1976 earthquake may anyway be drawn (Fig. 2).

I would like to point out a few that are not necessarily in hierarchical order.

1. It is impossible, I would say useless, to condense the risk into a numerical value for practical aims. In fact, the public administrator needs to know whether a certain assessment derives from a high probability of earthquake in settlements of little value or from a low probability of such an event in urban concentrations of high value (either monetary or artistic). Consequent

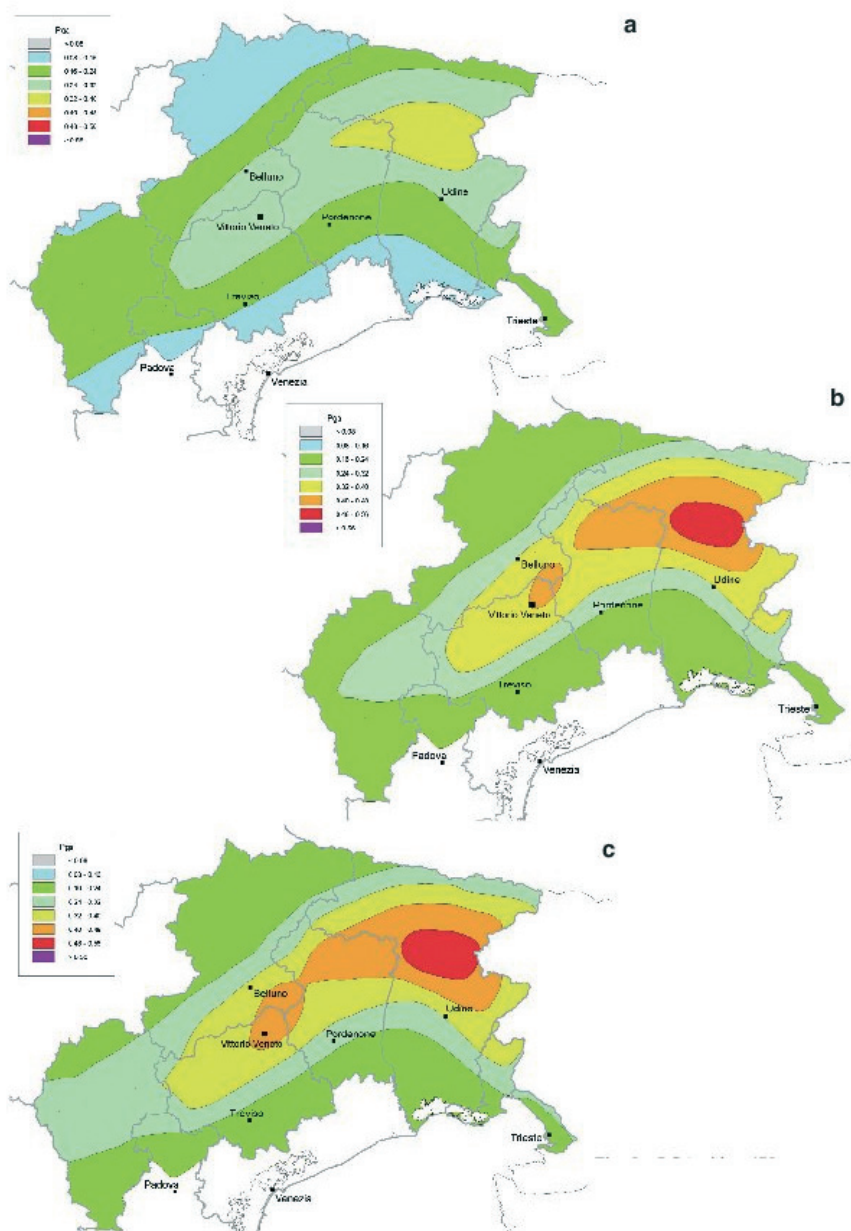


Fig. 3 - Horizontal peak ground acceleration with a 475-year return period for rock (a), stiff soil (b) and soft soil (from Slejko *et al.*, 2008).

- intervention policies cannot be neutral at least in terms of priorities of time and resources.
2. The reconstruction process has somehow reassured the people stricken by the earthquake but the situation of risk in the other areas of the region is exactly the same as before.
 3. The hazard is mainly linked to the 1976 event (Fig. 3). Had our research studies been finished

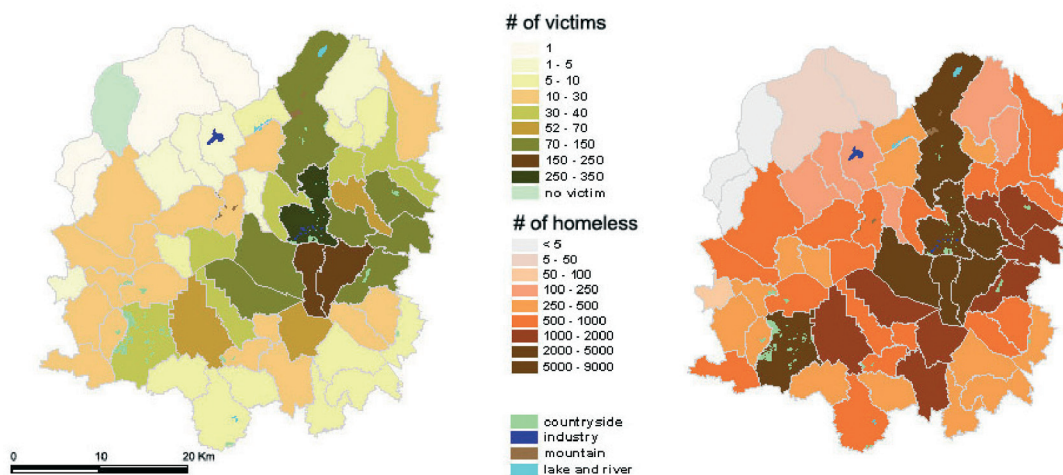


Fig. 4 - Maps of victims (left) and homeless (right) in the Montello area (from Meroni *et al.*, 2008).

by 1975, our conclusions would have certainly been different. This suggests that both the statistic treatment of rare events and the dogmatic use of the Gutenberg - Richter law should be dealt with great care (Carulli *et al.*, 2003).

4. Seismic zonation

Further to the P.C.M. (President of Ministers Council) injunction no. 3274/2003, the Regional Department of Civil Protection appointed the same working group to carry out the task of the seismic reclassification of the region. Once again the formal agreement covered three years involving almost the same researchers except some substitutions due to the progressive impoverishment of the university structures of research. The 1,200,000 € supplied were spent mainly to detect the site effects which are particularly relevant in the Alpine valleys and in the hilly areas. The present classification seems to be, on the whole, less strict than necessary but stresses, in any case, the need for a careful evaluation of the overall vulnerability of the structures and of the sites in case of high exposed values.

5. Seismic vulnerability of the schools of the region

This is what the same group is actually doing, carrying out a formal agreement which is under way. The three regional scientific institutions are in fact dealing with a survey of the seismic vulnerability of all the schools of the region (ASSESS Project). The driving idea is to give each school building a document delineating the points of vulnerability of the building and the related surroundings together with an indication of the necessary checks and suggested interventions plus a rough evaluation of the costs involved. Once again the three-year financial support which amounts to 1,800,000 € comes from the Regional Civil Protection. The coordinator is S. Grimaz

(University of Udine).

6. Seismic scenarios

I would also like to mention that, between 2000 and 2003, the OGS and the University of Udine took part in a very important national programme supported by the National Department of Civil Protection with a grant of 413,000 €; two seismic scenarios for the town of Vittorio Veneto were investigated together with the researchers of the University of Padua, of the INGV (National Institute of Geophysics and Volcanology) of Milan and the CNR (National Research Council) of Rome. That research study has improved the knowledge of the seismic risk of the western area of the region still further (see Riuscetti, 2008). As an example of the results, we show the scenarios in Fig. 4, in terms of victims and homeless, after a possible magnitude 6.7 earthquake linked to the Montello (Conegliano) thrust which was obtained by a deterministic approach (Laurenzano and Priolo, 2008).

7. Summer school

With a further regional financial support of 30,000 € a postgraduate course in Seismic Risk Management was started in September 2008. It is devoted particularly to those who are faced, in their profession or in administrative offices, with the crucial problem of defence against earthquakes. The lessons are distributed over a period of three years: the first devoted to seismic action, the second to the effects of earthquakes and the third to the management of emergency situations and reconstruction. The courses, open to engineering and geology graduates are tailored to the needs of the officials of the Regions and Municipalities called to control the application of the seismic code and planning of the use of the territory.

8. Conclusions

As one can easily understand, during these twenty years, a very large amount of work to increase the knowledge of the regional seismic risk has been accomplished. The way has been rational and quite comprehensive and, at the moment, there are no signs of fear, with regard to continuity, for the future.

I would like to draw some concise conclusions.

1. Without the massive and continuous support of the Region the knowledge of seismic risk in Friuli-Venezia Giulia would certainly not be enough to adopt any kind of policy that can reduce the risk itself.
2. A decisive factor has been for sure the setting up of a working group which was stable and co-operative and which united the limited staff available in each institution, giving continuity of policy and approach over a period of two decades marked by fundamental changes both at political and administrative levels.

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