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PREFACE TO THE SPECIAL ISSUE ON «*INNOVATIVE APPROACHES FOR EVALUATING LANDSLIDE HAZARD AND RISK*»

In Italy, landslides kill people almost every year, as a combined effect of high susceptibility to slope movements of the territory, and large proportion of population exposed to the risk (Guzzetti, 2000). In the last decades, analyses of individual landslides, as well as monitoring of instrumented phenomena, undoubtedly reached great results, as scientific knowledge on landslides notably progressed. However, a number of issues still need to be properly addressed, including (but not limited to) landslide forecasting (both in spatial and temporal terms), risk quantification and mapping, risk reduction and mitigation, and the assessment of suitable thresholds of acceptable risk levels either imposed on society or individuals (Brabb & Harrod, 1989; Fell, 1994; Fell & Hartford, 1997; Guzzetti, 2000; Fell & *alii*, 2008).

The occurrence of slope movements and the management of the territory, mostly in terms of civil protection policies, are always in the Italian headlines. With respect to landslides, Italy has the highest cumulative number of deaths or missing people and the highest expected yearly losses of life in Europe, and the second (after Japan) highest risk among the industrialized countries (Guzzetti, 2000). At the time we write (February 2009), a large part of the Country is coming out from the effects of severe rainfall events that caused hundreds of slope movements throughout the territory, and again casualties – the latest in the January 25th event that took place near Cosenza, at the 283 km of the A3 «Salerno-Reggio Calabria» highway. As usual, controversies and discussions on the possibility of forecasting similar events hit the news for many days, with large coverage by the mass media.

This special issue developed from the Thematic Session T34 «*Innovative approaches for evaluating landslide hazard and risk*», convened in September 2007 in Rimini, within the framework of the 6th Italian Forum of Earth Sciences «*Geoitalia 2007*». The intent of the meeting was to assemble experts, working in Italy and abroad on the problem of slope instability from different points of view, to discuss through case studies and methodological examples about open issues and innovative approaches to the problem of landslide hazard analysis and risk mitigation.

The session obtained a very good success, as also testified by the large number (48) of abstracts received, which were organized in a one-day lasting oral session (including 19 interesting presentations), plus a poster session. Overall, the presented abstracts covered a wide range of types of slope instability, from extremely rapid (rock falls, debris avalanches) to deep-seated gravitational phenomena, from shallow to «classical» slope movements. More than a quarter of presentations (13) dealt with examples of slope movements located outside the boundaries of the Italian territory, thus conferring an international character to the symposium.

Despite the declared purpose of the session, most of the received contributions (in some cases, of high scientific level) were actually more along the line of «usual» researches on landslides, rather than concerning true innovative approaches. Perhaps this was also due to the need for Italian researchers to attend the main meetings on the subject, in a time of increasing registration fees at conferences and scarcity of funds for research. This trend was confirmed later on: when the call for papers for this special issue was issued, the response was not along the line of the successful session held in Rimini, and only ten manuscripts were finally submitted. A thorough and time-consuming work of reviewing therefore

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started: each paper was object of reviews in at least two phases (most of the manuscripts experiencing even three or four phases). Seven manuscripts successfully managed to pass the reviewing process, and could be included in the present special issue. They were arranged starting from the solicited lecture, then moving thematically from shallow landslides (a theme which encompasses the highest number of contributions, including a small group devoted to the May 5th, 1998, debris flows in Campania) to GIS-based studies at the catchment scale, to large flows in the Italian Apennines.

In the solicited lecture, with an example of application to an area in central Umbria, Guzzetti & *alii* presented interesting considerations on the assessment of landslide hazard, the estimation of vulnerability, and the evaluation of risk related to slope instability phenomena. In particular, to ascertain landslide hazard, the Authors adopted a probabilistic model (multi-temporal analysis of aerial photos, field surveys, statistics, Poisson probability model) and used vulnerability curves available for the Umbria region to establish information on landslide damage to buildings and roads caused by landslides. Eventually, through an integrated analysis of the products obtained in the previous phases, the landslide risk to the road network was evaluated for different scenarios. According to their study, landslide risk could be determined quantitatively over large areas, when adequate forecasting models are adopted and if reliable landslide and thematic information is available.

Fonte & Masciocco proposed a simplified approach for evaluating the hazard related to shallow landslides. The approach takes into account the infiltration of rainfall in the soil, according to the Green-Ampt method that considers the downward advancement of a saturation front from the ground surface as a consequence of a given rainfall. The Authors tested the method in a valuable vineyards territory of the Monferrato and Langhe Hills in Piedmont, thus linking the scientifically-based study to real economic and societal interests.

Peronace & *alii* examined the history and decadence of the Cistercian Sambucina Abbey, founded in the 12th century in the Crati Valley of Calabria, through a combination of historical and geological data.

Other contributions dealt with shallow slope movements in volcaniclastic materials overlying carbonate bedrocks in Campania, in the aftermath of the many researches started soon after the catastrophic event of May 5th, 1998. Two of these contributions were submitted for the special issue, and they passed successfully the reviewing phase.

Andriola & *alii* presented an interesting comparison between physically-based models and a statistical approach by using a semi-quantitative model. By illustrating the advantages and the drawbacks of each method, the Authors pointed out to the difficulties in predicting some features relevant to slope instability analyses, which in turn determine the attribution of high levels of susceptibility over large areas.

Perriello Zampelli performed a detailed analysis of the source areas of the 1998 landslides, and discussed a method for evaluating the susceptibility to rainfall-induced debris slides. The method is based on the concept that, for spatially-homogeneous soil cover and triggering rainfall sequences, different values of threshold slope gradients exist for limit equilibrium conditions, depending on continuity and planform curvature of the soil cover.

It should be noticed that landslides that occurred in 1998 in Campania soon became object of tens of scientific studies, at the national and international levels, and were described by means of a variety of terms (to provide just some examples, «*debris flows*» by Calcaterra & *alii*, 2000; Celico & *alii*, 2001; Iovine & *alii*, 2005; Revellino & *alii*, 2004; «*soil slip - debris flows*» by Crosta & Dal Negro, 2003; «*flowslide*» by Di Crescenzo & Santo, 1999; Cascini & Sorbino, 2003; «*debris avalanches*» by Revellino & *alii*, 2004; Guadagno & *alii*, 2005; «*mudflows*» by Iovine, 2008). It is not surprising, therefore, that even in this special issue different terms were adopted: Andriola & *alii* termed the slope movements as flowslides, whilst Perriello Zampelli refers to them as debris flows. As Guest Editors, we decided not to prefer one or the other term, starting from the consideration that in the literature many other terms have also been used for the same type of phenomena. However, this shows the difficulty of analysing slope movements, starting from the description of the study cases to the understanding of the main failure mechanisms, to the assessment of possible evolution. A further effort would undoubtedly be necessary for the Italian community of scientists working on landslide phenomena (that includes many expertise, from geologists, to geomorphologists, applied geologists, civil and geotechnical engineers, etc.) toward the adoption of a common, clear terminology for describing slope movements and related risk issues. Such a nomenclature may easily be derived from those widely accepted internationally (e.g., the rheological classification of water-continuum sediments by Pierson & Costa, 1987, the landslide classifications by Cruden & Varnes, 1996, and by Hungr & *alii*, 2001), which are too often disregarded.

Coming back to the brief summary of the papers of this Special Issue, Hernandez & *alii* presented a study concerning slope instability of the Isola catchment, located in the Maritime Alps of France. The adopted deterministic methodology is based on the limit equilibrium theory and combines with a dynamic hydro-geological model.

Mandrone & *alii* finally analyzed a classical earth flow movement, the Signatico landslide in northern Italy. This approximately 3 km-long landslide showed many historical reactivations, with documented events dating back to the Middle Age. The most recent movements threatened several anthropogenic facilities, including an important communication route. A multi-temporal analysis of aerial photos is presented, integrated by an ongoing monitoring, in the attempt of forecasting future reactivation of the landslide.

We are grateful to Gian Gaspare Zuffa, President of the Italian Federation of Earth Sciences (FIST), and to the FIST Scientific Committee for having accepted our proposal to convene the Thematic Session T34. The support by Paolo Canuti is here particularly acknowledged. To all the participants to the Rimini Symposium - and especially to those who stimulated the interesting discussions during both the oral and the poster sessions - we must offer a sincere thank you. We are also extremely grateful to all the Authors and Referees of the manuscripts that were submitted for this Special Issue, and particularly to those colleagues that fully understood the importance of the review phase, and collaborated with the due humbleness and the necessary expertise to provide the final paper. Last but not least, we sincerely thank Geografia Fisica e Dinamica Quaternaria for having accepted to publish this Special Issue.

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