RESEARCH FIELD:
Slope stability

RESEARCH TOPIC:
Problems and perspectives in the analysis and mitigation of landslides risk with analytic tools, innovative measurement and calculation methods

PARTICIPANTS AND COLLABORATIONS:
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RESEARCH DESCRIPTION:
The research evaluates issues related to the analysis of hazard, vulnerability and risk-mitigation in slopes stability. The study is intended to develop the different phases necessary in these cases: construction of a geological and geotechnical model, geomechanical and petrophysical characterization; monitoring of microseismicity, of slow deformation processes and of triggering mechanisms due to dynamic ruptures are also considered; the evaluation of detachment and propagation mechanisms for unstable volumes and possible mitigation of risk are studied.
The characterization is carried out on-site, by using monitoring and geophysical measurements both with traditional and advanced techniques, such as photogrammetry and laser scanner. The technical-geological model is represented with 2D and 3D models in a GIS environment. Detachment and propagation are analyzed by numerical modeling methods with continuous or discontinuous approaches (Distinct Element Method and Finite Element Method) depending on the nature of the slope.
With regard to the studies of vulnerability and risk in our territorial reality, the morphology typical of rock slopes (with marked steepness) and the high evolution speed have important consequences; in rocks the probability of detachment is assumed (but the volume is estimated) and the sloping paths are studied (e.g. falling rocks and debris flow). Therefore involved volumes and propagation velocities become fundamental parameters for risk assessment. The steepness instead mainly affect the propagation paths and the areas at high risk based on the definition of the of arrest zone. These aspects have led to the development of innovative calculation criteria for the design of protective barriers and the development of monitoring systems of physical and mechanical parameters aimed at risk mitigation. In particular, the results that are obtained by the combination of advanced monitoring and interpretive modeling also allow the development of systems "early warning".

LABORATORIES OF THE DST IN USE:
On site and laboratory geological-technical characterization

RESEARCH PRODUCTS:

- Bonetto S., Comina C., Giuliani A. and Mandrone G. “Geological And Geophysical Aid To Model A Small Landslide In Heterogeneous Rock Masses Of The Langhe Hills (Nw Italy)”– proceedings of The Second World Landslide Forum Abstracts WLF2 - 2011– 0375 Rome, 2011.
- L. Canelli, A.M. Ferrero, M. Migliazza, and A. Segalini (2012) Debris Flow Risk mitigation by the means of rigid and flexible barriers. Experimental tests and impact analysis. Natural Hazard and Earth System Sciences
- Chelli A., Mandrone G. & Truffelli G. (2006) – “Field investigations and monitoring

as tools for modelling the Rossena castle landslide (northern Apennines - Italy)". Landslide, 3, 252-259, Springer-Verlag Germany.

- A.M. Ferrero, G. Forlani, R. Roncella, H.I. Voyat (2008) Advanced geo structural survey methods applied to rock mass characterization. Rock mechanics and Rock Engineering. Springer Wien New York. Available on line DOI 10.1007/s00603-008-0010-4.
- Filipello A., Giuliani A. And Mandrone G. (2010) - Rock slopes failure susceptibility analysis: from remote sensing measurements to geographic information system raster modules. Am. Jour. Env. Sc. 6 (6), 489-494.
- Giuliani A., Bonetto S., Castagna S., C. Comina and Mandrone G. (2010) "A Monitoring System For Mitigation Planning: The Case Of "Bagnaschino" Landslide In Northern Italy" Am. J. Environ Sci., vol 6: pp 516-522. DOI: 10.3844/ajessp.2010.516.522.
- Mandrone G., Buratti L., Chelli A., Leopardo L., & Tellini C. (2009) – A large, slow moving earth flow in the northern Apennines: the Signatico landslide (Italy). Geografia Fisica & Dinamica Quaternaria, 32 247-253.
- Tiranti D, Bonetto S, Mandrone G (2008) – "Quantitative basin characterization to refine debris-flow triggering criteria and processes: an example from the Italian Western Alps". Landslides, 5:45–57. Springer.
- Ventura G., Vinciguerra S., Moretti S., Meredith P., Heap M., Baud P., Shapiro S.A., Dinske C., Kummerow J., Understanding slow deformation before dynamic failure, *Geophysical Hazards,* International Year of Planet Earth,*, Ed. Beer T (Editor)., Springer* 229 pp, DOI 10.1007/978-90-481-3236-2_14, 2010Schubnel A.J.; Nielsen S. B., Taddeucci J.
- Vinciguerra S.; Rao S., Photo-acoustic study of subshear and supershear ruptures in the laboratory, *Earth and Planetary Science Letters*, doi:10.1016/j.epsl.2011.06.013, 2011

Planar Slope in Piedmont

Rock collapses in Valle d’Aosta

Complex slope in Val Parma (Corniglio)

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