Landslide hazard in the Abruzzo area (Central Italy): case studies of different types of landslides in different environments and morphostructural domains.

Giorgio Paglia, Cristiano Carabella, Carmela Epifani, Gianluca Esposito, Massimiliano Fazzini, Vania Mancinelli, and Enrico Miccadei

1Department of Engineering and Geology, Università degli Studi “G. d’Annunzio” Chieti-Pescara, Via dei Vestini 31, 66100 Chieti Scalo (CH), Italy
2Department of Physics and Earth Sciences, Università degli Studi di Ferrara, Via Saragat 1, 44122 Ferrara, Italy

The Abruzzo Region (Central Italy) is largely affected by landslide phenomena, widespread from the mountainous to the coastal areas. The area is located in the central-eastern part of the Italian peninsula and it is framed in a complex geological and geomorphological framework, closely connected to the combination of endogenous (morphotectonics) and exogenous processes (slope, fluvial, karst and glacial processes). Landslide phenomena are linked to the interaction of geological, geomorphological, and climatic factors (instability factors) in response to trigger mechanisms, mostly represented by heavy rainfall events, seismicity, or human action. This work illustrates the results of multidisciplinary analyses carried out in the Abruzzo area in recent years, in different physiographic and geomorphological-structural contexts (chain, foothills, fluvial, and coastal areas). These analyses are based on the combination of classic and advanced methods, including morphometric analysis of the topography and hydrography, detailed geological and geomorphological field mapping, geostuctural analysis, photogeological analysis, supported by stability analysis and 2D/3D numerical modeling. Five case studies are representative of the main active geomorphological processes affecting different environments and morphostructural domains, with reference to the predisposing and/or triggering factors. The main landslide cases analyzed and discussed in this work consist of: debris flow and rockfalls in a mountain area, widely altered by wildfire events (Montagna del Morrone case); complex landslides systems in the foothills, characterized by a very rough topography documenting the activity of long-term landslide processes (Ponzano and San Martino sulla Marrucina cases); sliding and complex landslides (topples and rockfalls) in fluvial and coastal areas, following a heavy snow precipitation event and a moderate seismic sequence (Castelnuovo di Campli case) and induced by episodic and localized cliff recession processes combined with wave-cut and gravity-induced slope processes (Abruzzo rock coast cases). The work outlines the importance of combining geological and geomorphological approaches with integrated detailed analysis of field and laboratory data to characterize morphology, bedrock features, structural features and jointing, superficial continental deposits, and landforms distribution. This allows supporting large-scale analyzes to evaluate hazard and risk posed by different types of landslides with different magnitudes in different
environments. This work could represent an effective integrated approach in geomorphological studies for landslide hazard modeling at different spatial scales, readily available to interested stakeholders. Furthermore, it could provide a scientific basis for the implementation of sustainable territorial planning, emergency management, and loss-reduction measures.