



Agricultural terraces and slope instability at Cinque Terre (NW Italy)

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Cinque Terre, located in the eastern Liguria, are one of the most representative examples of terraced coastal landscape within the Mediterranean region. They are the result of a century-old agricultural practice and constitute an outstanding example of human integration with the natural landscape. For this highly unusual man-made coastal landscape, the Cinque Terre have been recognized as a World Heritage Site by UNESCO since 1997 and became National Park in 1999. The complex network of retaining dry stone walls and drainage networks ensured through times the control of shallow water erosion and therefore, indirectly, favoured debris cover stability. The lack of maintenance of terracing due to farmer abandonment since the 1950s led to widespread slope erosion phenomena. The effects of such phenomena culminated during the 25 October 2011 storm rainfall event, when slope debris materials charged by streams gave rise to debris floods affecting both Monterosso and Vernazza villages. As the analysis of the relationships between geo-hydrological processes and land use in the Vernazza catchment highlighted, abandoned and not well maintained terraces were the most susceptible areas to shallow landsliding and erosion triggered by intense rainfall. As a consequence, the thousands of kilometres of dry stone walls retaining millions of cubic metres of debris cover at Cinque Terre currently constitute a potential menace for both villages, that are mainly located at the floor of deep cut valleys, and tourists. Given the increasing human pressure due to tourist activities, geo-hydrological risk mitigation measures are urgently needed. At the same time, restoration policies are necessary to preserve this extraordinary example of terraced coastal landscape. In this framework, the detailed knowledge of the response of terraced areas to intense rainfall in terms of slope instability is a topic issue in order to identify adequate land planning strategies as well as the areas where interventions should be focused primarily. In this study, with the aim to contribute to a better understanding of geo-hydrological hazards at basin scale, the main types of slope instability phenomena that occurred on agricultural terraces at Cinque Terre following the 25 October 2011 rainfall event are presented in relation to different geological and geomorphological conditions. In particular, selected examples of shallow landslides and erosive slope processes due to running water affecting abandoned or cultivated terraces for vineyards and olive grooves will be shown.