



Validation of a landslide inventory map and of landslide risk assessments using event inventory maps

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In the years between 1999 and 2002 we prepared a detailed landslide inventory map for the Umbria Region, in central Italy. The inventory covers an area of 8,456 square kilometres and shows 47,414 landslides, for a total landslide area of 712.64 square kilometres, 8.4% of the entire region. The geomorphological inventory map was prepared at 1:10,000 scale through the systematic interpretation of hundreds of medium-scale (~1:33,000) aerial photographs flown in 1954-55, and by analysing large scale (~1:13,000) colour aerial photographs taken in 1977. The latter photographs were interpreted only where lake and continental deposits crop out. In the period from 2000 to 2001 we further determined qualitative levels of landslide risk in 79 areas in Umbria. These areas range in size from 1 to 7 square kilometres, and are located chiefly around towns and villages where mass movements were known to have caused direct damage to structures or the infrastructures, or where damage to the population was expected. In these areas we assessed landslide risk using a geomorphological approach, combined with the analysis of site-specific and historical information. In the periods from March to April 2004 and from December 2004 to mid January 2005, prolonged rainfall caused new and reactivated landslides in Umbria. Some of these landslides occurred inside the areas where the geomorphological evaluation of landslide risk was performed, providing a unique opportunity to validate the inventory map and our prediction of the landslide risk levels. We mapped the new rainfall induced landslides in two distinct field campaigns conducted in April-May 2004 and in January 2005. The new landslides were recognized directly in the field and mapped at 1:10,000 scale, producing two separate event landslide inventory maps. A total of 522 landslides were identified. For the March to April 2004 event landslide inventory map, a total of 172 landslides were identified, with areas ranging from 45 m² to 60,035 m².

(mean value = 3,926 m², standard deviation = 6,188). For the December 2004 to mid January 2005 event landslide inventory map, a total of 380 landslides were identified, with areas ranging from 12 m² to 44,000 m² (mean value = 1,763 m², standard deviation = 3,035). We used the two recent event inventories to test the geomorphological landslide inventory map and the validity of our risk assessment. We performed two separate sets of tests. In the first set we compared in a GIS the new (event) and the old (geomorphological) inventories, and we determined a degree of special persistence of the recent slope failures with respect to the old landslides. In a second set of tests, we checked the type and abundance of the new landslides in some of the hazard domains used to perform the geomorphological landslide risk assessment. We examine the results of the tests and we discuss possible improvements to the geomorphological risk zoning.