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Landslide and flood hazard assessment in a climate change environment

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The warning that the hydrological cycle may be altered in a warmer climate is a common finding drawn by several studies dealing with climate change analysis [1, 2, 3 to cite a few]. The increase in atmospheric concentration of greenhouse gases due to the anthropogenic activities leads to enhancement of the greenhouse effect, resulting in the global warming. The moisture-holding capacity of the atmosphere is increasing with temperature, with a rate of about 7% per 1°C, with the consequence for instance to make more severe the geo-hydrological risk. Indeed, it is well-known that warmer air temperature is linked to increasing atmospheric water vapour content, which in turn may increase the potential for more frequent and intense precipitation events [4]. As a consequence, in some regions, the occurrence of extreme events, such as floods and landslides, is surmised to change.
Based on that, the objective of this work is to assess the climate change impact on landslide and floods occurrence in Umbria Region, Central Italy. After the application of downscaling and stochastic generation procedures [5], rainfall and temperature data provided by five General Circulation Models (GCMs) are used as input into an early warning system [PRESSCA, 6] to obtain the expected occurrence of landslide events for present (1990-2013) and future (2040-2069) periods. Similarly, the downscaled GCMs data are used to force a continuous rainfall-runoff model [MISDc, 7] for estimating the impact on floods occurrence and magnitude. The comparison between present and future period results suggests a general increase both in landslide events occurrence (up to more than 40%) and on annual maximum discharge (up to 40%) for the Umbria territory in the future period, with an important implications in terms of economic impact. The results also reveal that identifying the effect of climate change on floods and landslides is not straightforward and the close interaction between rainfall magnitude/intensity, temperature and soil moisture should be analysed in-depth.

Keywords: Climate change, extreme events, flood, landslide
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