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The 2009 L'Aquila earthquake sequence: technical and scientific activities during the emergency and post-emergency phases

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The Central Apennines of Italy is an area characterized by significant seismic activity. In this area, individual earthquakes and prolonged seismic sequences produce a variety of ground effects, including landslides. The L'Aquila area, in the Abruzzo Region, was affected by an earthquake sequence that started on December 2008, and continued for several months. The main shock occurred on April 6, 2009, with local magnitude m = 6.3, and was followed by two separate earthquakes on April 7 and April 9, each with a local magnitude m > 5.0. The main shocks caused 308 fatalities, injured more than 1500 people, and left in excess of 65,000 people homeless. Damage to the cultural heritage was also severe, with tens of churches and historical buildings severely damaged or destroyed. The main shocks and some of the most severe aftershocks triggered landslides, chiefly rock falls and minor rock slides that caused damage to towns, individual houses, and the transportation network.

Beginning in the immediate aftermath of the event, and continuing during the emergency and post-emergency phases, we assisted the Italian national Department for Civil Protection in the evaluation of local landslide and hydrological risk conditions. Technical and scientific activities focused on: (i) mapping the location, type, and severity of the main ground effects produced by the earthquake shaking, (ii) evaluating and selecting sites for potential new settlements and individual buildings, including a preliminary assessment of the local geomorphological and hydrological conditions; (iii) evaluating rock fall hazard at individual sites, (iv) monitoring slope and ground deformations, and (v) designing and implementing a prototype system for the forecast of the possible occurrence of rainfall-induced landslides. To execute these activates, we exploited a wide range of methods, techniques, and technologies, and we performed repeated field surveys, the interpretation of ground and aerial photographs taken at different times, the analysis and processing of optical and SAR satellite images, and the statistical analysis of rainfall measurements and quantitative weather forecasts.