RECORDED MICROSEISMICITY DUE TO SEISMICALLY-INDUCED CRACKS AND COLLAPSES WITHIN A KARSTIFIED ROCK MASS

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Abstract

Seismometric arrays have been widely applied during the last decades to record controlled collapses in mines and caves due to explosions. Nevertheless, most hypogeous collapses are natural and spontaneous events and, as a consequence, they can occur unexpectedly and represent a high geological hazard. A research activity is carrying on in order to experience the use of accelerometric arrays for monitoring earthquakes as well as cracks and collapses within the strongly karstified rock mass, hosting the Peschiera Springs drainage plant of the Rome's acqueduct (Italy). The Peschiera Springs slope, composed of Mesozoic limestones, is located about 80 km far from Rome. During the last seismic sequence of L'Aquila, started with the M6.3 mainshock on April 6, 2009, 665 records were recorded until July 31, 2009 including earthquakes, cracks and collapses occurred within the slope. The four accelerometric stations of the Peschiera Springs plant are equipped with triaxially arranged accelerometers (EPISENSOR Kinemetrics) connected to a digital data logger (K2 Kinemetrics); these devises were installed on September 4, 2008, within the drainage and the collecting tunnels of the plant, but only some tens of records were collected until the April 6, 2009. The recorded events were processed by use of a specifically implemented SAC-Fortran software capable to automatically distinguish the different kinds of records (i.e. earthquakes, cracks, collapses) as well as to compute energy, spectral (FFT) and kinematic (horizontal and vertical PGAs) parameters. The results obtained by analysing the whole dataset demonstrate that:

1) a seismically-induced sequence of rock mass hypogeous instabilities (i.e. cracks and collapses) was triggered by the seismic sequence of L'Aquila;
2) a trigger threshold for the seismically-induced rock mass instabilities was fixed at about 5E-4 g^2s by use of the cumulative Arias intensity computed for the recorded earthquakes;
3) the different values of the cumulative Arias intensity derived at the four accelerometric stations for the recorded rock instabilities show their possible location within the slope (i.e. closer to the GA station).

Moreover, the rate of the cumulative Arias intensity of the rock mass instabilities, recorded within the slope, shows different trends in the considered March-July time interval: an increasing rate-trend was observed during the first 5 days after the L'Aquila mainshock (until 10 April), a constant rate-trend was observed during the following three weeks (until 30 April), a decreasing rate-trend was observed in the following period (until the end of July). These different trends have been proposed as criteria to respectively adopt proceedings of awareness, alert and alarm by the manager office of the plant (ACEA-ATO2 agency) (Figure 1).

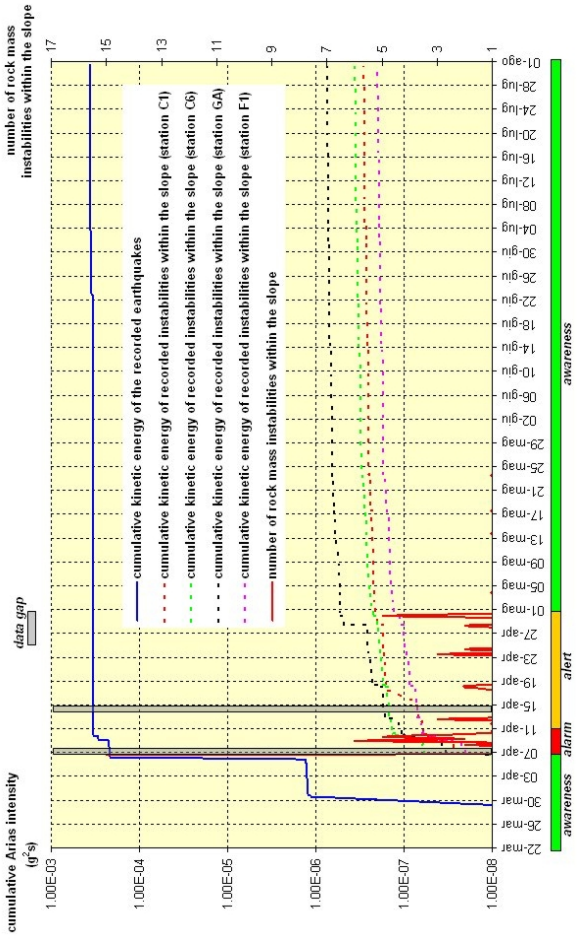

Figure 1: Cumulative Arias intensity computed for the recorded earthquakes and rock mass instabilities within the Peschiera Springs slope.

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