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The application of INQUA Scale to the 1805 Molise earthquake

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The INQUA Scale is a new macroseismic intensity scale based only on the seismically-induced ground effects in natural environment (EEE, Earthquake Environmental Effects). Within the scope of the "INQUA Scale Project" (supported by INQUA for the period 2003-2007), numerous Regional Working Groups worldwide distributed are testing the present version of the scale with ground effects induced by seismic events occurred in their country and comparing resulting EEE intensities with those assessed with conventional scales (MM, MCS, MSK, EMS, JMA, etc.). In this ambit, we present here the evaluation of EEE intensities on the basis of coseismic ground effects induced by the July 26th 1805, Molise (Southern Italy) earthquake (M = 6.8), characterized by one main shock (21:01 GMT) and two important aftershocks occurred a few hours later, causing the loss of more than 5,000 lives. The epicentral area was centred on the Bojano plain, between Isernia and Campobasso (MCS I0 = X; Imax = XI). The earthquake caused intense damages over a larger area (about 2,000 km2 are within the MCS VIII isoseismic contour) and it was clearly felt in Naples and in a large sector of Southern Italy. The structure reactivated during the earthquake was the Bojano fault system, located between Mt. Patalecchia and Morcone. Even if two centuries later, it was recently possible to reinterpret descriptions of coseismic ground effects occurred in 60 localities as reported in manuscripts written by contemporaneous. Some description of fractures located in correspondence of this fault system have been interpreted as the local expression of surface faulting. According to this interpretation, it was possible to evaluate end-to-end surface rupture length ranging from 30 to 45 km. Vertical displacement was not lower than 80 cm up to 150 cm in some localities (Guardiaregia, Morcone) according to historical descriptions. Concerning secondary effects, the main types of landslides mentioned in the report were rock falls and rotational slides but also large earth flows (Acquaviva d'Isernia and San Giorgio

La Molara). The small number of triggered landslides (26) compared to events of similar magnitude can be explained with the waterless slopes, that is typical in July. It is noteworthy that landslides occurred even in the far field area, more than 100 km from the epicentre, in zones particularly susceptible to seismic shaking (Calitri). Significant hydrological anomalies were observed along the ruptured fault segment: a dramatic increase in the spring discharge rate in Bojano and drying up of other springs is consistent with the deformation of major tectonic blocks. In the chronicles are cited other 48 hydrological anomalies from 30 localities sited within the VI MCS isoseismic contour. At last, one case of liquefaction was mentioned in Cantalupo. Thus, the EEE scenario was characterized by a large variety of ground effects whose characteristics have been archived in a database. Based on these information EEE epicentral and local intensities were evaluated. The resulting EEE macroseismic field seems to be consistent with the energy associated to the seismic event. Integrated with the "traditional" MCS intensity field, it provides the most complete image of the earthquake.