ESC2016-55-2, 2016
35th General Assembly of the European Seismological Commission

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4–10 September 2016 Trieste

Strong ground motion spatial patterns generated by the intermediate-depth earthquakes of Vrancea region, Romania

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The Vrancea region, the most dangerous seismogenic zone in Romania, is located in the subcrustal lithosphere (in the depth range 60 - 200 km) at the bending of the Eastern Carpathians. Due to the relatively low occurrence rate of strong earthquakes, and, on the other hand, to the poor seismic instrumentation before the last decade of the XXth century, only a small number of analogue strong motion records of Vrancea events with magnitude Mw > 6.0 is available. The strongest digitally recorded Vrancea earthquake occurred on October 27, 2004 (Mw = 6.0).
The ground motion fields of the strongest subcrustal Vrancea events which occurred during the second half of the XXth century (seisms of March 4, 1977, Mw = 7.4; August 30, 1986, Mw = 7.1; May 30, 1990, Mw = 6.9; May 31, 1990, Mw = 6.4) exhibit a couple of common features – revealed by the detailed macroseismic data, and confirmed by the few existing instrumental records – which indicate that the level of ground shaking is strongly controlled by the local and regional geological conditions: (i) large values of ground motion parameters observed over wide areas orientated predominantly NE-SW; (ii) strong, abnormal attenuation of the seismic waves propagating towards the Intra-Carpathian zone.
As a consequence of a considerable effort carried out during the past years – mainly since 2008 – the Romanian seismic network comprises at present 118 permanent digital stations equipped with 3-component accelerometers, which cover the entire country.
Taking advantage of the significant amount of recently collected high quality data, we examine the spatial distributions of the ground motion parameters (peak ground acceleration, peak ground velocity) generated by several tens of moderate size undercrustal earthquakes (magnitude Mw $\geq$ 4.0), the strongest one having moment magnitude 5.4.
While the common features emphasized for the strong events are still noticeable, evidencing the fingerprint of the local and regional geological conditions, a significant variability of the patterns is observed, consequence of the diversity of the focal mechanisms and hypocenter locations. Since the influences of these factors are interrelated, their individual contribution to the spatial pattern variability is difficult to quantify. Nevertheless, the overall effects on the pattern of ground shaking, observed for a variety of source parameters (mechanisms and hypocenter locations), provide valuable information on the variability of the strong ground motion parameters, with important application in the assessment of the seismic hazard.