Advances in the near-real time estimation of seismic damage generated by intermediate-depth earthquakes occurring in the Vrancea (Romania) Region

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Earthquakes are one of the most difficult natural hazards to manage by emergency situation actors – they are unpredictable and can cause widespread damage in a matter of seconds, lead to multi-risks and communication black-offs. Immediate response is necessary – giving that for people caught under debris or fire outbreaks the useful time of intervention is in minutes. This is one of the main reasons why quick estimations of the seismic damage are important; they can provide a fast image of the potential damage extent (how severe the situation could be and which the mobilization dimension should be) and reveal hotspots for interventions (which however need to be validated on field). Also, seismic loss estimates are very important for emergency management resource planning or the business and insurance sector.

In Romania it is expected that a seismic event occurring in the Vrancea source, at intermediate-depths between 60 and 180 km, with magnitude greater than 7, could happen at any time; at moment-magnitudes greater than 7.5 (up to 8.1), they could generate peak ground accelerations higher than 0.2 g, on more than 50% of Romania's territory, with high values not only in the epicentral area. The exposure of nowadays society is much greater than it was at the time of past destructive events (on 10 Nov. 1940 and 4 Mar. 1977), and seismic vulnerability and risk is highly considerable, as the results of the recently completed Ro-Risk project shows. In this context we present which are the actually implemented (at the National Institute for Earth Physics – the official institution in charge of seismic monitoring and earthquake notification in Romania) tools dedicated to the fast automatic determination of earthquake parameters, ground motion parameters and loss estimates. These tools are the Romanian Earthquake Early Warning System, the Antelope and ShakeMap Systems and the Near-real time system for estimating the seismic damage in Romania (SeisDaRo). Due to the specific characteristics of the Vrancea earthquakes, each of these systems had to be customized in order to better reflect local specificity. This chain of near real-time systems is described in terms of characteristics, progress and lessons learned, also revealing the impact of the generated products within the society and the limitations. The advances and foreseen future developments are analyzed, revealing that the actual applicative research level can highly contribute to risk reduction, although validation during major events is required for systems to boost much needed mitigation actions at building level.