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Active tectonic deformation and associated earthquakes. A case study: South Carpathians Bend zone

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Active tectonic deformation processes are continuously shaping the landscape in the Alpine Orogenic system. Among others indicators, the earthquakes are one of the clearest proves and at the same time effects of neotectonic deformation process. In the Romanian Carpathians the most famous and well study area is the Eastern Carpathian Bend Zone. Nevertheless, the seismicity associated to Carpathians active deformation is not limited to this area. Numerous others seismic zones can be found in the Carpathian Orogen, like the South Carpathian Bend Zone. The seismicity is roughly overlapping the intra-mountainous basins such as Caransebes-Mehadia, Hateg and Petrosani basins. Our study focuses on the Caransebes-Mehadia and Hateg sedimentary basins developed over the South Carpathian, Getic and Danubian basement napes. Their evolution is related with the N-ward tectonic transport of the Carpathian Orogen in the current position during the Paleogene-Quaternary times. The N-ward and subsequent E-ward rotation of the orogeny have been accommodated in this area by right lateral strike-slip deformation, which might explain the earthquakes distribution along the elongated basins. Recently, a few significant earthquake sequences were recorded by the Romanian National Seismic Network (RSN), maintained by the National Institute for Earth Physics (NIEP), in the Caransebes- Mehadia and Hateg basins. The sequences in the Hateg Basin were recorded in 24–31 March 2011 (14 events) and 8–11 September 2013 (31 events). The sequence of March 2011 has features of a seismic swarm, with three shocks of Mw = 3.2–3.3. The sequence of September 2013 has an earthquake of magnitude Mw = 4.0 which distinguishes from the other events as a main shock. For the Caransebes-Mehadia zone, a significant sequence ran between 31 October 2014 and 6 January 2015 starting with a clear main shock of Mw = 4.1, while all the aftershocks (60 events) were unusually of small size. Because of mining exploitations (manganese, iron, hydrocarbon, rocks) in the study areas which may contaminate the background seismicity by artificial events, special processing was necessary. Hence, waveforms cross-correlation techniques, statistical methods and relative location techniques based on the double-difference algorithm have been applied to separate natural from artificial seismicity, enhancing the seismicity space-time distributions, location accuracy and to emphasize the shape of active faults in the region. The focal mechanisms determined for Hateg Basin are close each other showing a predominant strike-slip faulting component with the principal axes oriented approximately E-W (compression) and N-S (extension). These features are consistent with the extensional deformation regime in the two sedimentary basins.