



Pre-seismic geomagnetic anomalous signals related to the M5.7 and M5.6 earthquakes generated on September 24 and December 28, 2016 in the seismic active Vrancea zone, Romania

Dumitru Stanica and Armand Dragos Stanica

Institute of Geodynamics, Electromagnetism and Lithosphere Dynamics, Bucharest, Romania (dstanica@geodin.ro, armand@geodin.ro)

In this paper, we used the geomagnetic data, collected in real time on the intervals (August–September and November–December, 2016) by the electromagnetic monitoring system placed at the Geomagnetic Observatory Provita de Sus (GOPS), to emphasize possible relationships between the anomalous behavior of the normalized function B_{zn} and the earthquakes of M5.7 and M5.6, both being generated in the seismic active Vrancea zone on September 24 and December 28, 2016. It has already been demonstrated that for a 2D geoelectric structure, in pre-seismic conditions, the normalized function B_{zn} has significant variations, due to the resistivity changes, possibly associated with the earthquake-induced rupture-processes, followed by dehydration of the rocks and high-pressure fluid flow through the existing lithospheric faulting systems expanded between the Vrancea zone and GOPS. Consequently, the daily mean distributions of the $B_{zn} = B_z/B_{perp}$ (where B_z is vertical component of the geomagnetic field; B_{perp} is geomagnetic component perpendicular to the geoelectric strike) and its standard deviation (SD) are carried out for the both above time-intervals, in the ULF frequency range 0.001Hz to 0.0083Hz, by using the FFT band-pass filtering. Further on, to investigate the singularities of the pre-seismic geomagnetic signals related to the M5.7 and M5.6 earthquakes, we applied a statistical analysis based on a standardized random variable equation, and the results are presented as B_{zn}^* time series, performed on the new intervals 1-30 September and 1-31 December, 2016. Finally, two pre-seismic anomalous signals are observed: (i) first one, with values greater than 5 SD was identified on September 22, 2016, what means a lead time of 2 days before the M5.7 earthquake; (ii) second one, with values greater than 4SD, identified on December 21, 2016, with a lead time of 7 days prior to M5.6 earthquake. In conclusion, as the work-station has specific programs for geomagnetic data processing, analysis and real time (daily) B_{zn} and B_{zn}^* display on the institute website, this may be used as an early warning system able to provide useful information for the resilience improvement against the Vrancea intermediate depth earthquakes.