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Electromagnetic pre-seismic anomalies induced by intermediate depth earthquakes (Vrancea zone-Romania)

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Recent studies show that before the earthquake initiation, the high stress level reached within the seismogenic volume may generate dehydration of rocks and fluids migration along surrounding faulting systems and could be reflected by electrical conductivity changes. In this paper we investigate these changes of conductivity using ULF electromagnetic and geomagnetic data recorded at both Geodynamic Observatory Provita de Sus, located on the Carpathian electrical conductivity anomaly (CECA), at about 100km distance of Vrancea epicentral zone, and Geophysical Observatory Surlari taken as reference station. Using ground-based monitoring system (GMS 06 and MAG03 DAM electromagnetic and geomagnetic equipments, respectively), possible anomalous variations of the electromagnetic normalized function (EMNF) have been surveyed, on the ULF range ($f < 0.0166$ Hz), in correlation with earthquakes with $Mw > 4.0$ triggered at the intermediate depth interval 70-160km, in seismic active Vrancea zone Subsequently, a methodology based on the correlation of the EMNF values (Bzn = Bz/Bperp and Ron = Ropar/Roz) selected according to temporal invariability criteria for a 2D geoelectric structure, in terms of non-seismicity, taking into consideration just their deviations from the electromagnetic pattern initially calculated, was elaborated. To have a comprehensive view on the applied methodology, the daily mean distribution of the Bzn and Ron parameters in correlation with the Vrancea deep seismic events taken from the seismic bulletin of the National Institute for Earth Physics, occurred simultaneously, in 2010 year, are revealed. Finally, we have to conclude that with 7-10 days before an EQ with M>4.0 occurred, the daily mean variation of the EMNF had anomalous behavior marked by a significant increase versus its standard deviation (EMNF>2.5 STDEV), and the results illuminate triggering mechanism and may represent an important step toward earthquakes forecasting.

Keywords: EM pre-seismic anomaly, Intermediate depth eartquakes