



## **Anomalous pre-seismic behaviour of the electromagnetic normalized functions (EMNF) related to the intermediate depth earthquakes occurred in Vrancea zone, Romania**

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Electromagnetic research concerning a seismic hazard has been orientated for solving at least three kinds of pre-seismic phenomena occurred in the frequency ranges 100 MHz-DC: (i) Signals possibly emitted from earthquake sources which may produce geomagnetic/geoelectric changes in ULF-ELF-VLF-LF-HF bands; (ii) Anomalous transmission of electromagnetic waves due possibly to a disturbed ionosphere related to the transmission anomaly of man made (VLF) waves and scattering of MF radio waves (VHF); (iii) Spatial-temporal variation of the electric conductivity in the lithosphere, associated with seismic events inside and/or in close proximity of foci, may be reflected by the EM parameters carried out in ULF band. Thus, the EM techniques of monitoring able to reflect the relation between spatial-temporal changes of the electrical conductivity and seismic events, produced at the lithospheric level, may become an important subject in this direction, and the rock fracturing associated with dehydration processes and fluid migration through faulting systems, acting as high sensitive path, could be detected by means of the anomalous behavior of the EM parameters carried out throughout the frequency range 10-2 Hz - DC. To confirm the relationship between EMNF and the imminent earthquakes, a specific methodology for data collection and processing has been established. EM data were collected at Provita de Sus Geodynamic Observatory, located 100 km away from Vrancea epicentral zone. Finally, in this paper, the daily mean distributions of the EMNF ( $B_n = B_z/B_{perp}$ ;  $R_n = R_{par}/R_z$ ; where:  $B_z$  and  $B_{perp}$  are vertical and perpendicular geomagnetic components;  $R_{par}$  and  $R_z$  are resistivity parallel and vertical, respectively), possibly related to the intermediate depth seismic events with magnitude higher than 4 occurred within 2009 year, have been investigated and presented.