



Anomalous behaviour of the electromagnetic parameters related to the intermediate depth earthquakes occurred in the Vrancea zone (Romania)

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Short-term earthquakes prediction has not been achieved despite its importance and many years of research. However, in the last decade, the research activity of the electromagnetic (EM) community has been orientated for solving at least three kinds of pre-seismic phenomena/parameters: (i) signals possibly emitted from earthquakes sources (geomagnetic/geoelectric changes in ULF - ELF - VLF - LF - HF bands); (ii) anomalous transmission of electromagnetic waves due possibly to disturbed ionosphere (transmission anomaly of man made waves-VLF and scattering of MF radio waves-VHF); (iii) time variation of the electric conductivity in the Earth colligated with the accumulation and release of the energy in seismic active zones and their neighborhood (computing the EM precursory parameters in ULF band). Recognizing the importance of recently reported electromagnetic precursors to seismic activity of the Vrancea zone, this paper aims at a systematic research on them, in varied frequency ranges, and the clearing up of their physical mechanisms. Therefore, an efficient research of precursors associated with earthquakes needed both long time continuous monitoring of the EM field and the appropriate algorithms to outline and extract possible anomalous behaviour. In this respect, a specific methodology able to emphasize precursory parameters was established according to the geotectonic features of the Vrancea zone and its surrounding areas. According to the frequency range taken into account - corresponding to the intermediate depth earthquakes, the processing and the analysis of the EM time series were accomplished in such a manner that these led to outline and extract the anomalous fluctuations. Subsequently, a methodology based on the correlation of the EM parameters (Bzn and Ron) - selected according to temporal invariability criteria for a 2D geoelectric structure, in terms of non-seismicity - with

seismic events recorded simultaneously, taking into consideration just their deviations from the electromagnetic pattern initially calculated, was elaborated. The changes of electrical conductivity for the seismogenic volume of Vrancea zone and surroundings had been detected by means of the EM parameters selected by the magnetotelluric tensor impedance decomposition technique, before a seismic event occurred as a sequence of physical modifications appeared in the frame of the geological structure at subcrustal level. Finally, to have a comprehensive view on the applied methodology, the daily mean distribution of the Bzn and Ron parameters in correlation with Vrancea's intermediate depth seismic events occurred simultaneously in the last two years is highlighted.