Real time electromagnetic monitoring system used for short-term earthquakes forecast related to the seismic-active Vrancea zone

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The existence of the pre-seismic electromagnetic signals related to the earthquakes is still under scientific debate and requires new reliable information about their possible inter-relationship. In this paper, to obtain new insights into the seismic active Vrancea zone (Romania), a 3-D magnetotelluric imaging has been used to strengthen the connection between the geodynamic model and a possible generation mechanism of the intermediate depth earthquakes. Consequently, it is considered that before an earthquake initiation, due to the torsion effect, a high stress reached inside the seismogenic volume that may generates dehydration and rupture processes of the rocks, associated with the fluid migration through the lithospheric faults system, what leads to the resistivity changes. These changes have been investigated by using ULF electromagnetic data recorded in real time at the Geodynamic Observatory Provita de Sus (GOPS), placed on the Carpathian Electrical Conductivity Anomaly (CECA) at about 100km far from the seismic active Vrancea zone. The daily mean distribution of the normalized function $Bzn(f) = Bz(f)/Bperp(f)$ (where: Bz is vertical component of the geomagnetic field; $Bperp$ is geomagnetic component perpendicular to strike; f is frequency in Hz) and its standard deviation are performed by using a FFT band-pass filter analysis in the ULF range 0.001Hz to 0.0083Hz, for which a 2-D geoelectrical structure under GOPS has been identified. To provide reliable information in anticipating the likelihood occurrence of an earthquake of Mw higher than 4, a statistical analysis based on standardized random variable equation has been used to identify the anomalous intervals on the new time series (Bzn*) carried out in a span of three years (2013-2015). The final conclusion is that the Bzn* shows a significant anomalous effect some days (weeks) before an impending earthquake and it should be used for short-term earthquakes forecast.