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Possible associations between long term anomalous geomagnetic variations, Vrancea (Romania) intermediate depths earthquakes and the solar activity for the last 15 years

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Geomagnetic variations associated with earthquakes are widely accepted and several anomalous geomagnetic observations have been interpreted as a result of changing rock magnetic properties under varying tectonic stress (piezomagnetic effect).
During the last 15 years of geomagnetic investigations conducted in Vrancea seismogenic zone, period covering more than a complete solar cycle, the solar-terrestrial perturbations have fluctuated from very low to very large values, providing the ideal medium to observe the correlation between the long and short term geomagnetic field perturbations, solar activity and earthquakes. The October 2004 intermediate depth earthquake (Mw=6.0) offered us the opportunity to investigate possible connections between the local geomagnetic field behavior and the occurrence of moderate magnitude Vrancea earthquakes.
The comparison between the geomagnetic data obtained at a station inside the epicentral zone with other remote reference stations (outside the epicenter) considers an effective technique to detect the anomalous variation of a lithospheric origin.
The working data are: (i) the geomagnetic field records made at Muntele Rosu Observatory (MLR), Surlari (SUA) and/or Tihany (THY) INTERMAGNET Observatories; (ii) the seismic data for Vrancea source zone; (iii) the daily geomagnetic index from NOAA/Space Weather.
The one minute and daily averaged geomagnetic data were calculated at these stations for the whole period 1996-2011. The geomagnetic components: X, Y (horizontal North-South and East-West) and Z (vertical) and the normalized vertical component (Bz/Bx and Bz/By) were used in the data analysis processes and also in the comparison of the geomagnetic data between the selected stations.
Our results indicate the presence of long term anomalous variations (weeks or months) in the geomagnetic components and in the magnetic impedance at MLR Observatory (close to the epicenter) and no magnetic modifications in the SUA and THY recordings (far from the epicenter) preceding the occurrence of earthquakes with Mw>4.0. Moreover, in the periods of anomalous behavior, the geomagnetic components recorded at MLR show no correlation with those recorded at the other two stations, as they do in the rest of the time. The observed anomalous variations may be explained as a result of the tectonic stress variations and the enhancement of the lithospheric conductivity in the Vrancea region during the preparation period of earthquakes.