Geophysical Research Abstracts
Vol. 19, EGU2017-17327, 2017
EGU General Assembly 2017

Investigation of Ionospheric Anomalies related to moderate Romanian earthquakes occurred during last decade using VLF/LF INFREP and GNSS Global Networks

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Ionospheric TEC (Total Electron Content) variations and Low Frequency (LF) signal amplitude data prior to five moderate earthquakes (Mw$\geq$5) occurred in Romania, in Vrancea crustal and subcrustal seismic zones, during the last decade were analyzed using observations from the Global Navigation Satellite System (GNSS) and the European INFREP (International Network for Frontier Research on Earthquake Precursors) networks respectively, aiming to detect potential ionospheric anomalies related to these events and describe their characteristics. For this, spectral analysis on TEC data and terminator time method on VLF/LF data were applied. It was found that TEC perturbations appeared few days (1-7) up to few hours before the events lasting around 2-3 hours, with periods 20 and 3-5 minutes which could be associated with the impending earthquakes. In addition, in all three events the sunrise terminator times were delayed approximately 20-40 min few days prior and during the earthquake day.

Acknowledgments
This work was partially supported by the Partnership in Priority Areas Program – PNII, under MEN-UEFISCDI, DARING Project no. 69/2014 and the Nucleu Program - PN 16-35, Project no. 03 01