



## **Present status and preliminary results obtained by the Romanian VLF/LF radio monitoring system as part of the INFREP European Network**

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The Romanian VLF/LF monitoring system consisting in a radio receiver and the infrastructure that is necessary to record and transmit the collected data is a part of the European international network named INFREP.

In January 2009 a European network of radio receivers able to measure the electric field intensity from various VLF/LF broadcasting stations located throughout Europe, was installed. Five new receivers constructed by an Italian enterprise have been delivered to Greece, Romania, Turkey and Italy, completing the existing network composed by Italy, Austria, Russia and Japan. In 2010 another enlargement of the network happened with a new receiver installed in Portugal. After a necessary testing period of one year, each one of the receivers is monitoring up to ten different transmissions of radio stations across the continent and the LF/VLF radio signals are now simultaneously and continuously being sampled.

Information on electromagnetic fields' intensities created by transmitters at each receiving site and gathered from this network are indicating the quality of the propagation along the paths between the receivers and transmitters. Studying the ionosphere's influences on the electromagnetic waves' propagation along a certain path is a method to put into evidence possible modifications of its lower structure and composition as earthquakes' precursors.

The VLF/LF receiver installed in Romania was put into operation in February 2009 and has already proved its utility in the forecast of some earthquakes from Europe and Turkey: the case of Abruzzo – Italy earthquake (6th of April 2009,  $M=6.3$ ) and the case of Erzincan - Turkey (July 30, 2009,  $M_w = 4.9$ ). As a preliminary result we inspect specific cases in which an anomaly in the radio signals is clearly related to the transmitter or to the receiver (e.g. meteorological conditions around the sampling site). Simultaneously we monitor, in the same site with the VLF/LF receiver, the vertical atmospheric electric field and different other meteorological parameters as: temperature, pressure or rainfall. The global magnetic conditions are emphasized with the help of Daily Geomagnetic Index  $K_p$ . At a basic level, the adopted analysis consists in a simple statistical evaluation of the signals by comparing the instantaneous values to the trend of the signal.

A new LabVIEW application which accesses the VLF/LF receiver through internet was developed. This program opens the receiver's web-page and automatically retrieves the list of data files to synchronize the user-side data with the receiver's data. Missing zipped files are also automatically downloaded. The application appends daily files into monthly and anual files and performs 3D colour-coded maps with graphic representations of VLF and LF signals' intensities versus the minute-of-the-day and the day-of-the-month, facilitating a near real-time observation of VLF and LF electromagnetic waves' propagation. This type of representation, firstly performed by the Austrian team, highlights the modification of the terminator time versus the length of the solar-day, improves the user's capability to detect possible propagation anomalies due to ionosphere conditions and allows a quick visual inspection of unexpected behaviors of transmission channels at different frequencies and paths.