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The development of the International Network for Frontier Research on Earthquake Precursors (INFREP) by designing new analysing software and by setting up new recording locations of radio VLF/LF signals in Romania

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Based on scientific evidences supporting the causality between earthquake preparatory stages, space weather and solar activity and different types of electromagnetic (EM) disturbances together with the benefit of having full access at ground and space based EM data, INFREP proposes a complex and cross correlated investigation of phenomena that occur in the coupled system Lithosphere-Atmosphere-Ionsophere in order to identify possible causes responsible for anomalous effects observed in the propagation characteristics of radio waves, especially at low (LF) and very low frequency (VLF). INFREP, a network of VLF (20-60 kHz) and LF (150-300 kHz) radio receivers, was put into operation in Europe in 2009, having as principal goal, the study of disturbances produced by the earthquakes on the propagation properties of these signals.
The Romanian NIEP VLF / LF monitoring system consisting in a radio receiver -made by Elettronika S.R.L. (Italy) and provided by the Bari University- and the infrastructure that is necessary to record and transmit the collected data, is a part of the international initiative INFREP. The NIEP VLF / LF receiver installed in Romania was put into operation in February 2009 in Bucharest and relocated to the Black-Sea shore (Dobruja Seismologic Observatory) in December 2009.
The first development of the Romanian EM monitoring system was needed because after changing the receiving site from Bucharest to Eforie we obtained unsatisfactory monitoring data, characterized by large fluctuations of the received signals' intensities. Trying to understand this behavior has led to the conclusion that the electric component of the electromagnetic field was possibly influenced by the local conditions. Starting from this observation we have run some tests and changed the vertical antenna with a loop-type antenna that is more appropriate in highly electric-field polluted environments.
Since the amount of recorded data is huge, for streamlining the research process we have realized the automation of the transfer, storage and initial processing of data using the LabView software platform. The special designed LabVIEW application, which accesses the VLF/LF receiver through internet, 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 performs primary, statistical correlation and spectral analysis, appends daily files into monthly and annual files and performs 3D color-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. Another feature of the software is the correlation of the daily recorded files for the studied frequencies by overlaying the 24 hours radio activity and taking into account the sunrise and sunset.
The next step in developing the Romanian EM recording system is to enlarge the INFREP network with new VLF/LF receivers for a better coverage and separation of European seismogenic zones. This will be done in the future by using national resources. The unitary seismotectonic zoning of Romania and the whole Europe is a very important step for this goal.