



A LF radio anomaly revealed by the wavelet analysis during July-August 1998 and its possible connection with the seismic activity (Central Italy)

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On February 1996, a receiver able to measure the electric field strength of LF radio-signals, with a sampling frequency of ten minutes, was put into operation in a site (AS) located in the Apennines (Central Italy). On the basis of the best reception, the LF broadcasting stations - MCO (France, $f=216$ kHz) and CZE (Czech Republic, $f=270$ kHz) - were selected. The receiver is located 518 km far from the MCO broadcasting station and 818 km far from the CZE broadcasting station. Here, we present the result obtained by the analysis of the MCO data. LF radio wave reception is characterised by ground-wave and sky-wave propagation modes. The sky-wave signal is greatly variable between day and night and, at day time, between winter and summer. The ground-wave, for distances lesser than 500-1000 km, provides a stable signal that can be significant one. At first, we calculated the theoretical electric field strength of the ground wave for the MCO radio signal, using the GRWAVE software package and we found a value of 0.54 mV/m. For the same signal we calculated the theoretical electric field strength of the sky wave at night time and at day time during winter and summer, using the wave hop approach and we found the values: 3.1 mV/m (night time), 0.50 mV/m (winter day time) and 0.02 (summer day time). Then, on the MCO data we collected since February 1996 up to September 2004, we separated the night time data and the day time data (in winter and summer). Finally, we applied the wavelet analysis on the night and day time data. The main result of the analysis was the appearance of

a very clear anomaly during summer (July-August) 1998, at day time and at night time. The anomaly is a strong exaltation of the components with period in the 25-40d range. From the previous calculations, the only way to justify this anomaly seems to assume the occurrence of an increase of the ground wave propagation mode. Such an increase could be connected with an increase of the ground conductivity or with modifications of some parameter of the troposphere. At August 15, 1998 a seismic sequence ($M=3.0-4.6$) started on the Reatini mountains, that is a seismogenic zone located 30 km far from the AS receiver, exactly along the path MCO-AS. We present the possibility that the previous radio anomaly is a precursor of this seismic activity.