Observations of earthquakes through variations of the VLF magnetic field in Antarctica and middle north latitudes

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Variations of the magnetic field in very low frequency (VLF) range are regularly observed at the Vernadsky station (Ukraine) in Antarctica since April 2005 and in Kharkov region (Ukraine) since November 2004. Magnetic field is observed with VLF receiver “Tezey” which includes three orthogonal coil sensors oriented in the geomagnetic north-south, east-west and vertical directions. Output signals from these sensors after processing procedure were recorded as a number of pulses repetition rate.

Both stations are located in the seismically quite areas. Observational station in Kharkov region in Ukraine is in the north edge of the Dniepr-Donetsk Basin. The station in Antarctica which is far from artificial sources of electromagnetic noise allows more precise studying of global variations of magnetic field.

VLF magnetic field variations have been studied through the comparison with world wide earthquakes data. We found general similarities for earthquakes appearances in magnetic data recorded at both sites of observations. Shallow-focus earthquakes ($<$ 30 km deep) occurred at distances $<$ 2000 km from the site of observation can be recognized in corresponding station. Deep-focus earthquakes were observed at both stations. Magnetic precursors associated with such earthquakes were recorded at the same time and had similar shapes. For example, Indonesia earthquake (06.04.2005, = 5.7, 67 km deep) recorded in both stations was characterized by anomalous increasing of the magnetic field variability (up to 3 times higher than usual level) was observed during 10 days before the earthquakes commencement.

We carried out the complex analyzes of VLF magnetic field variations together with data obtained by other scientific systems mounted in the Vernadsky station (Ukraine) in Antarctica including seismic recorder and radon gas tester. We found that magnetic precursors for earthquakes are accompanied with the increase of infrasound emission and characterized by higher radon gas flow occurred perhaps due to changing in background crack population.