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Characteristics of ULF emission for determination of earthquake precursors for strong earthquakes near Sumatra

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Earthquake precursor studies using magnetic-field power spectra in the ULF band have been affirmed as a way to identify earthquake precursors effective for short-term. In this paper we studied the characteristics of the earth's magnetic waves associated with earthquakes, which we regarded as a sign (signature) before the earthquake.

Several methods of signal analysis have been used in this research, including spectral analysis in the Pc-3 range (10-45 seconds), ratios of the Power Spectral Density (PSD) between Hs (Zs) in Kototabang (KTB, located near the epicenter) and Pelabuhan Ratu (PEL, located far from the epicenter), and the correlation between Hs (Zs) in KTB and PEL. The goal of the signal analyses is to assure that the disturbance signal (perturbation) really reflects the lithospheric activity.

The results of the above-stated analyses are as follows: For a few strong earthquakes in Sumatra in 2008-2011, perturbations in the geomagnetic field had signatures which could be regarded as earthquake precursors. We also found relationships between the earthquake magnitude, epicentral distance, and the magnetic perturbation amplitude averaged over a period before and after the main earthquake (main shock). That is, the magnetic perturbation amplitude had a positive correlation with the earthquake magnitude, and a negative correlation with the epicentral distance..

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