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The Observation of DC/ULF Emissions at Nakatsugawa, Japan in Possible Association with the Sumatra-Andaman Earthquake

KENJI OHTA[1)], NOBUO WATANABE[1)], MASASHI HAYAKAWA[2)]

[1] *Department of Electronic Engineering, Chubu University, 1200 Matsumoto-cho, Kasugai Aichi 487-8501, Japan*

[2] *Department of Electronic Engineering, The University of Electro-Communications, 1-5-1 Chofugaoka, Chofu, Tokyo 182-8585, Japan*

We have three orthogonal induction coils (1.2m permalloy) as magnetic sensors and we observe three magnetic field components (B_x, B_y and B_z; x, y are the horizontal axes, and z, the vertical axis) at Nakatsugawa (Geographic lat.35.4° N, long.137.5° E) in Japan. The signals from magnetic field components are amplified by means of pre-amplifiers (gain=66dB) with the low pass filter (with cutoff of 30Hz). Then the signals are converted by means of an A/D converter with sampling frequency of 100Hz, and they are stored on a hard disc every six hours. Signal analysis is based on the FFT with the data length of 1024, so that the temporal resolution is about 10 seconds and the corresponding frequency resolution is about 0.1Hz. We can measure the amplitude ratio and phase difference among the three components in the frequency range from 0Hz to 50Hz. The temporal evolution of the magnetic field intensity (horizontal $B_y$component: sensitive to the waves propagating in the NS meridian plane) at a particular frequency of 0.1Hz (to be exact, this frequency means the frequency below 0.1Hz) is given by FFT method. The intensity of background noise averaged over one file with duration of six hours. We noticed the significant difference between below 0.1Hz and another higher frequency. Only background nose of 0.1Hz does not show a regular diurnal pattern, and the intensity of 0.1Hz rises up for long hours before the big earthquakes. The intensity of +3dB above the average level during one month of December in 2004 rises on 17 and stops on 23. This term is just 10-3 days before the Sumatra-Andaman earthquake. The direction finding is the conventional goniometer by using only the two horizontal magnetic components. The measuring accuracy of the goniometric direction finding depends on the antenna length and antenna alignment accuracy. The length of one induction magnetometer is only 1.2m, so that the overall estimate of the measuring accuracy is on the order of ±10°. The azimuth is indicated southward from the geographic West direction (as estimated from $\tan^{-1}(B_y/B_x)$). The average azimuth of DC/ULF emissions at the frequency below 0.1 Hz during December 17-23, is found to be extremely stable and about 37° southward from the west, which means the noises during this period are arriving from 37° south of the west. The angle from Nakatsugawa to the epicenter of Sumatra earthquake is 30°.