

Measurement of VLF sferics to monitor activity of cloud-to-ground lightning discharges in the Maritime Continent

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Electromagnetic wave radiated from lightning discharge is called as sferics. Measurement of sferics is one of the most efficient tools to monitor global activity of lightning discharges. There are mainly two advantages to observe sferics in extremely Low Frequency (ELF: less than 3 kHz) range and Very Low Frequency (VLF: 3-30 kHz) range.

One is a radio propagation characteristic in ELF and VLF range. Attenuation rate of ELF and VLF sferics is quite low. Therefore, radio waves emitted by cloud-to-ground (CG) lightning discharges can propagate long distance. This feature allows us to monitor the activity of CGs on a regional scale or on the globe with single or few observation sites.

The other is that electrical property of individual CG can be derived based on the observation in ELF and VLF sferics. Methodology to estimate polarities, charge moment, and peak current of CGs has been established in previous works. These techniques make it possible to evaluate not only the activity of CGs but also that of thunderstorm.

We have developed new system to measure ELF and VLF sferics and applied to the observation to monitor the lightning activity in the Maritime Continent. Waveforms of vertical electric fields and horizontal magnetic fields are obtained with vertical dipole antenna and orthogonal loop antennas, respectively. This instrument has been installed at Tainan in Taiwan (23.1°N, 121.1°E), Saraburi in Thailand (14.5°N, 101.0°E) and Pontianak in Indonesia (0.0°N, 109.4°E). Furthermore, we prepare to install new system in the Philippines and Vietnam.

In this presentation, we introduce the speculation of our observation system. Estimated CGs distribution in the Maritime Continent based on our VLF observation is also shown as an initial result.

Keywords: lightning discharge, sferics, ELF, VLF, Maritime Continent