Monitoring of Lightning Activity in Southeast Asia using VLF Observation Network

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The relationship between lightning activity associated with thunderstorm and vertical convection in troposphere which governs the development of thunderstorm is still open question. However, the quantitative comparison between lightning and vertical convection would provide us the essential information to evaluate the activity of cumulonimbus, such as precipitation and atmospheric vertical transportation, which would allow us to research severe weather warning. Therefore, it is necessary to coincidently carry out lightning and cumulonimbus observations.

The measurement of electromagnetic waves in the VLF range (a few to a few tens of kHz) radiated by lightning discharges is one of the efficient tools to monitor lightning activity in large cloud system. Therefore, we have been constructing VLF observation network in Southeast Asia. We have selected three sites as the VLF observatories based on terms of noise level, infrastructures, and accessibility. The first site is Tainan observatory (23.08° N, 121.1° E) in Taiwan. The second site is Saraburi observatory (14.53° N, 101.0° E) in Thailand which is an area of Chulalongkorn University. The third site is Pontianak observatory (0.0°N, 109.4° E) in Indonesia which is one of the LAPAN observatories. By measuring VLF waves at each site, it is possible to estimate lightning activity occurring all over Southeast Asia.

At each site, a set of orthogonal loop antennas is used to measure the magnetic-field (N-S and W-E) components and a dipole antenna is installed to obtain the vertical electric-field component of electromagnetic waves radiated by lightning. The sampling frequency is 100 kHz. Because temporal resolution is sufficiently high, observed data make it possible to derive the location of lightning discharge with accuracies of 10 km. At the presentation, we will report the system specifications of VLF network in detail and show the initial results.

Keywords: lightning; VLF range; Southeast Asia

References

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