Observation system for thunderstorm development using ground lightning detection network and thermal infrared camera onboard micro-satellites

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We will observe the thunderstorm development using lightning detection networks and micro-satellite. A previous study has shown that electrification process on the cloud started when the peak of the cloud reaches the threshold height and continue to growth vertical with an upward ~8 m/s (Krehbiel, 1986). With the reverse though, the lightning activity can be used to indicate the updraft presence inside the cloud. Moreover, lightning activity represents the intensity and area of precipitation and/or an updraft area. In this study, the Asia VLF lightning Observation Network (AVON) will be used to detect electromagnetic wave emitted by lightning. The basic algorithms in the determination of the location of lightning, peak currents, and moment changes have been developed and confirmed for lightning in Japan. For this work, we are extending this method to Southeast Asia and improving the accuracy of the lightning geolocation. Adding to the lightning observation, cloud observation using thermal infrared camera onboard LAPAN-A4, which will be launched in 2019 FSY, will provide the temperature distribution with the surface resolution of ~180 meters and field of view of ~ 54 x 54 kilometers. Using this high resolution thermal infrared camera, the cloud top altitude can be estimated, assuming temperature profile of the ambient atmosphere. By making such observation at some time interval, the developing speed of thunderstorm can be calculated in 3D. The first lightning occurrence detected by AVON, which could be assumed as the timing that the cloud has reached the threshold height to become a thunderstorm, will initiate the micro-satellite observation with the thermal infrared camera, from which we could make a prediction of torrential rainfall.

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