

Study on the time development of lightning and precipitation activities by LLS and radar observations

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The lightning and precipitation activities are studied in this paper by Ku-band broadband radar (Ku radar) and Lightning Location System (LLS) observations. The authors have been conducting cooperative lightning observations in Toyama, Japan, in where winter thunderstorm are developed. This paper focuses on the time development of thunderstorm activities.

Ku radar is a low-power high-resolution Doppler radar for meteorological applications. Ku radar employs bi-static system which is composed of a pair of Luneberg Lens Antenna, and solid state amplifier which transmits the wideband signal (80 MHz) in Ku-band. The pulse compression technique, which has the advantage that high range resolution profiles can be acquired by low transmitting power, is applied. Observation time resolution for a full volume scanning and range resolution less than 1 minute and 2.5 m are realized with Ku radar, respectively.

LLS is a passive remote sensing system locating impulsive lightning EM radiation sources associated with lightning return strokes. LLS brings locations and the estimated values of stroke currents.

The comprehensive studies of these observations for the locally and quickly developed thunderstorms indicate the below:

The time development of the peak value, and the top and the most active height of the radar echo are similar with each other.

Most lightning return strokes are located where strong radar echo is noticeable at high altitude.

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