

Isolated cumulonimbus initiation observed by 95-GHz cloud radar, X-band radar, MTSAT-1R (rapid scan), and photogrammetry

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Simultaneous observations of cumulonimbi using the MTSAT-1R (rapid scan), the 95-GHz FM-CW cloud radar (the Chiba site), the X-band radar (the Yokosuka site), and photogrammetry were carried out during the summer of 2010 in the Kanto region, Japan to understand the convection initiation (CI) and the structure of heavy rainfall in the Tokyo metropolitan area. The formation process of an isolated cumulonimbus which generated in the afternoon on a fine mid-summer day on 24 July and 23 August 2010 would be presented.

The generation of the cumulonimbus was initiated by cloud turrets. A continuous generation of turrets was observed from the visible images, and a total of four turrets (24 July) and five turrets (23 August) formed. The growth rates of turrets were quite different among the turrets in these cases. The first radar echo of the X-band radar was detected at 3 km AGL, three minutes after the turret reached its maximum height. The cloud radar detected echoes, approximately two minutes after the generation of the turret and 15 minutes before the turret reached its maximum height. The intermittent echo pattern observed by the cloud radar denotes fine structures in the Cb, such as cloud and precipitation.

Based on the rapid scan data, cumulus and cumulonimbus can be detected by the visible brightness data at the formation stage of the cumulonimbus. The temporal change of the visible brightness suggests the evolution of the cumulonimbus turrets.

Keywords: cumulonimbus, turret, first radar echo, cloud radar, MTSAT rapid scan