334

Time Series of Microphysical Structure and Lightning Polarity of a Group of Thunderclouds Generated Successively in a Line-shaped Area

Takeharu Kouketsu*, Hiroshi Uyeda and Tadayasu Ohigashi (Hydrospheric Atmospheric Research Center, Nagoya University, Nagoya, Japan)

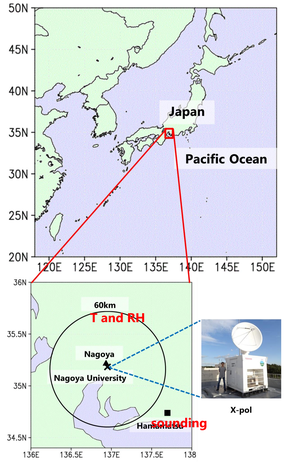
Introduction

We have constructed a **hydrometeor classification** (hereafter, HC) method for **X-band polarimetric radars** (X-pols) and examined **microphysical structure** of a **simple** thundercloud in Kouketsu et al. (2011).

In this study, we examine relationship between polarity of cloud-to-ground (CG) lightning and microphysical structure of more **complicated** system, a **group** of thunderclouds generated on August 25, 2010 about 40 km north of Nagoya, central area of Japan.

Conclusions

- We examined **microphysical structure** of a **group of thunderclouds** using **HC** method for **X-pol**.
- Following results were obtained not only for **whole** of the group of thunderclouds but for **individual thunderclouds** A, B, C and D;
  - **Negative CGs** were observed when the volume of **dry graupel** region was **large** (more than 50 km^3) and **increasing rapidly**.
  - **Positive CGs** were observed when **large volume** of **dry snow** and **ice crystal** regions were identified by HC.
- The **peaks** of **negative CG** of the **whole** of the group of thunderclouds **correspond** to the **peaks** of **negative CG** of **individual thunderclouds**.



▼Characteristics of the X-pol

Frequency		9375 MHz
Antenna size		2.0 m
Beam width		1.2°
Transmitter	Type	Solid state component
	Peak Power	200 W
Max range		61.8 km
Pulse width		1 μs (within 5 km) 32 μs (beyond 5 km, pulse compression)
PRF		2000 Hz / 1600 Hz (dual PRF)
Transmission		45° or H only or V only
Rotation rate		3.0 rpm (PPI) , 1.2 rpm (RHI)
Resolution		150 m
Nyquist velocity		16.0 ms^{-1} / 12.8 ms^{-1}

●Hydrometeor Classification

Polarimetric Parameters
- Z_h (Reflectivity)
- Z_{dr} (Differential Reflectivity)
- K_{dp} (Specific Differential Phase)
- ρ_{hv} (Correlation Coefficient)

Meteorological Parameters
- T (Temperature: Sounding)
- RH (Relative Humidity: surface)

0.5 km × 0.5km × 0.5km grid spacing

HC method (Kouketsu and Uyeda, 2010)

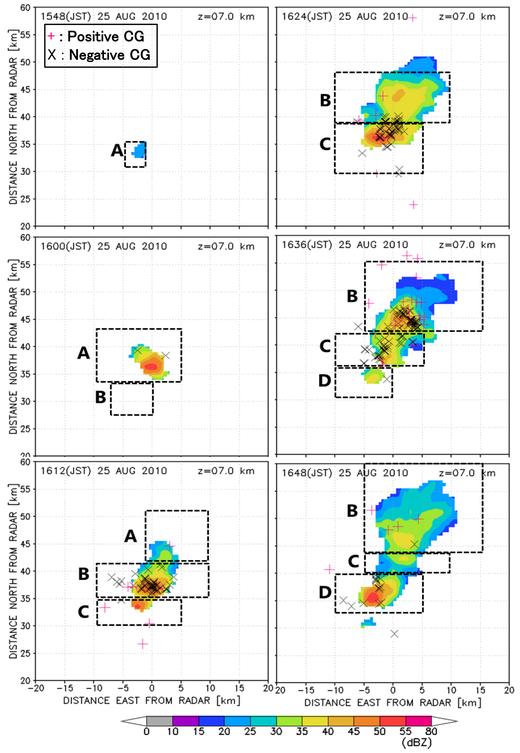
Hydrometeor
- Drizzle
- Rain
- Wet Snow
- **Dry Snow**
- **Ice Crystal**
- **Dry Graupel**
- **Wet Graupel**
- Small Hail
- Large Hail
- Rain and Hail

Volume of each Hydrometeor Type
- **Ice Crystal**
- **Dry Graupel**
- **Dry Snow**
- **Wet Graupel**

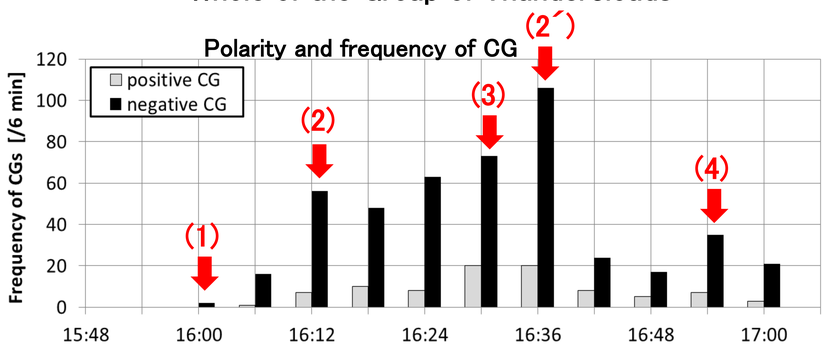
Comparison

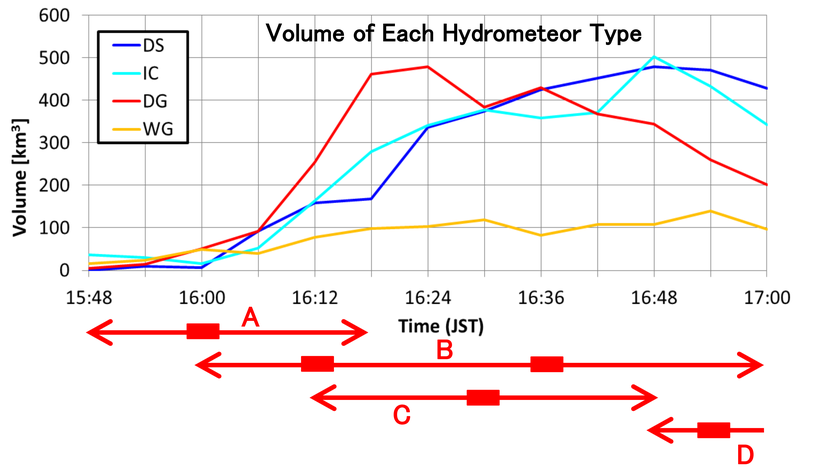
Lightning Location System Data
- **Location** of Lightning
- **Polarity** of Lightning

▼Z_h at 7 km (T = −10℃)
1548–1648 JST on August 25,2010

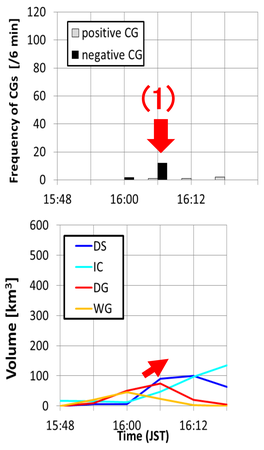


Whole of the Group of Thunderclouds

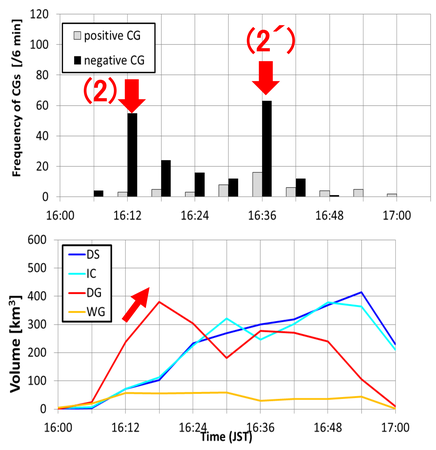




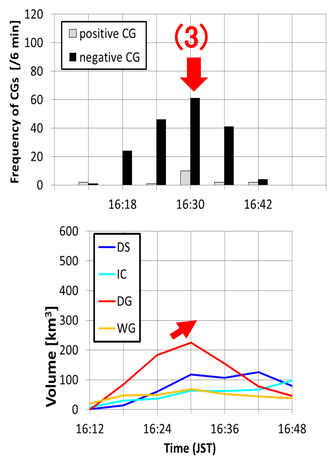
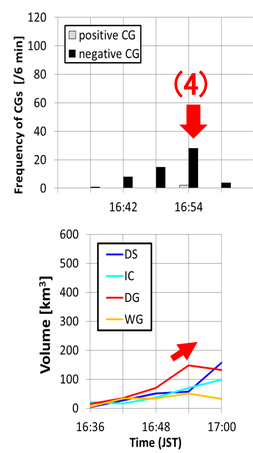
Thundercloud A



Thundercloud B



Thundercloud C



Thundercloud D