Observation of Hailstorm with Higher Spatial Resolution Using a Compact Dual Polarimetric X-Band Weather Radar

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1.Introduction

Recently heavy snow and hailstorm in a localized region cause a big damage on our life and assets as well as traffic transport systems such as highways, railways and airports. Observation of hailstorm with higher spatial resolution using a dual polarimetric Doppler weather radar can give us valuable information about classification of hydrometeors.

2.One Case Study

One interesting case study of 14th April 2015 is presented when a cold vortex has passed through the Kagoshima Prefecture.

According to the local news reports, a hailstorm was observed near Kagoshima City about 5:00 p.m. on 14th April. The hailstorm was observed using a dual polarimetric weather radar which has been deployed in the west part of Kagoshima.

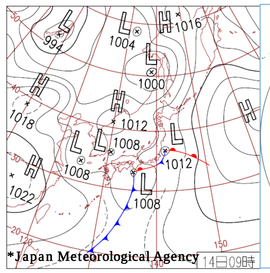


Fig 1 : Weather chart at 9:00 a.m. on 14 April, 2015

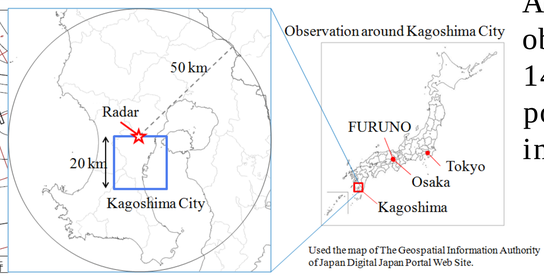


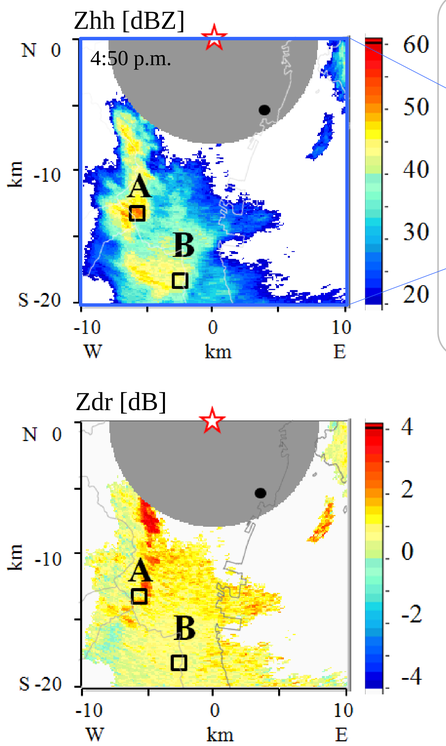
Fig 2 : The observation area and the location of Kagoshima

Table 1: The conditions for the observation

Items for observation		Conditions
Date		At 4:50 p.m. JST on 14th April in 2015
Region		The square of 20 km in south part of Kagoshima City
Sequence	Elevation	6 deg
	Mode	CAPPI, 9 elevations (6 - 18 deg), 5.5 rpm
Altitude		900 - 2700 m
Horizontal resolution		100 m

3.Results

The regions, A and B are defined based on the threshold of Zhh, 50 dBZ.



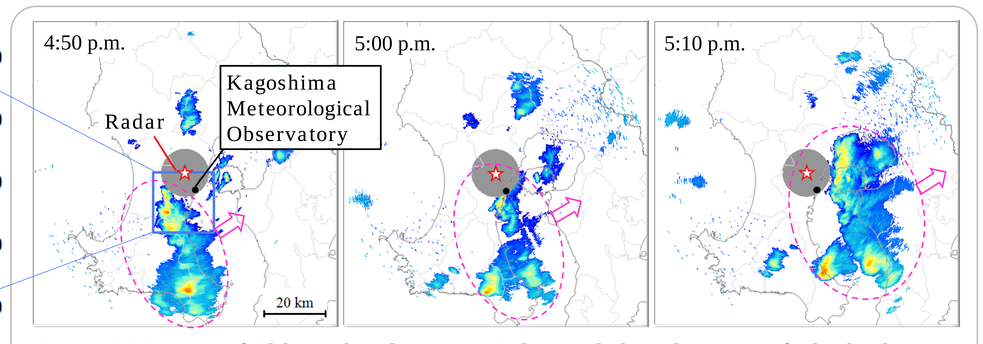


Fig 4: PPI maps of Zhh at the elevation, 6 deg and the advection of the hailstorm

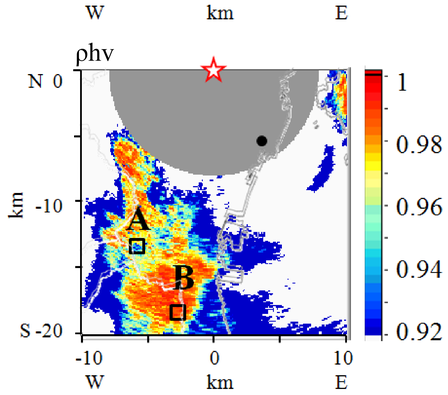


Fig 3: PPI maps of multi-parameters at the elevation, 6 deg and the definitions of regions A and B

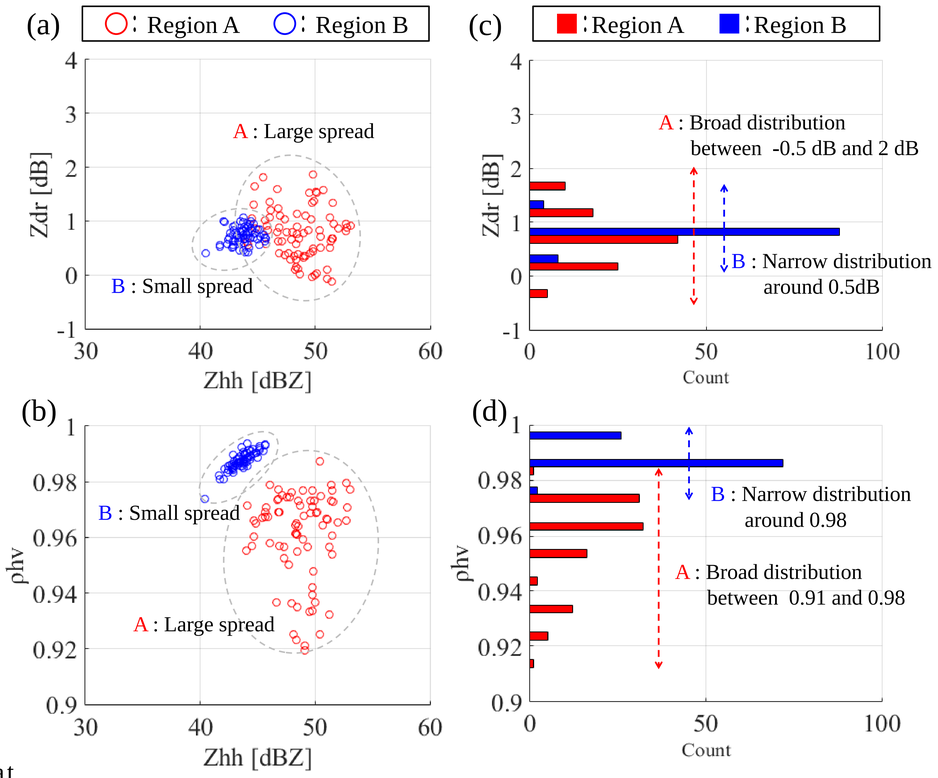


Fig 5: Comparison between region A and B using scatter diagrams and histograms

3-1. Analysis using scatter diagrams

Fig 5 (b) indicates that ρhv values of region A are relatively lower than those of region B and distributed between 0.91 and 0.98. Therefore it is possible to roughly estimate that region A might be covered with hail.

3-2. Analysis using histograms

In general ice particles like hail are expected to have various and non-uniform shapes and have a broader distribution of multi-parameter than water particles like rain. So it is very useful to analyze the spread of multi-parameter.

Fig 5 (d) indicates that the ρhv points of region B are distributed narrowly in more than 0.98, but those of region A are distributed broadly between 0.91 and 0.98. The spread of region A is larger than that of region B.

As a result it is possible to recognize that the region A is mainly covered with hail and the region B is covered with rain, based on the analysis using both scatter diagrams and histograms.

4.Conclusions

In an interesting case study of 14th April, the hailstorm was observed using a dual polarimetric weather radar. The results of multi-parameter analysis using both scatter diagrams and histograms of Zdr, ρhv and Kdp indicate that it is possible to recognize that the region A is mainly covered with hail and the region B is covered with rain. That's because a radar observation with higher spatial resolution helps us create a histogram with more sample points and distinguish them by means of spreads of multi-parameters.

*Used the map of The Geospatial Information Authority of Japan Digital Japan Portal Web Site.

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