Data Article

Data that effectively demonstrate the benefits of a 3D CAPPI algorithm

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Abstract

The data presented in this article are related to the research article entitled “Three-dimensional analysis of the initial stage of convective precipitation using an operational X-band polarimetric radar network” [1]. The data presented were obtained using a three-dimensional constant-altitude plan-position-indicator (3D CAPPI), which was generated by a new method proposed by [1]. The data used to create the 3D CAPPI were derived from two X-band polarimetric radar installations in the Kanto region of Japan, Ebina (139.39°E, 35.40°N), and Shin-yokohama (139.60°E, 35.51°N). These data are superior to operational radar data in terms of their temporal and spatial resolution. These high resolution data can indicate a rapidly developing storm, such as localized precipitation. It is particularly important to understand the early stages of storms in terms of numerical and short-term models. These data show the time of appearance, life cycle, and evolution of each cell that constitutes a storm in three-dimensional detail.

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Keywords: High-resolution, Three-dimensional, X-band polarimetric radar, Convective precipitation, Initial stage

Article history:
Received 15 April 2019
Received in revised form 24 May 2019
Accepted 29 May 2019
Available online 11 June 2019

DOI of original article: https://doi.org/10.1016/j.atmosres.2019.03.015.

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1. Data

The data presented here were observed by two radar installations in the Kanto area on 19 July 2012. The observation target was a rapidly developing storm that evolved over a short period of time and was observed on radar from 1210 LST to 1249 LST. The specifications of the two X-band polarimetric radars are shown in Table 1, while Fig. 1 shows the location of the radar installations and the area of the observation target. The beam-height cross sections in Fig. 2 [1] shows elevation angles for each radar.

2. Experimental design, materials, and methods

2.1. High spatio-temporal resolution data

The data presented here were derived from observational radar data, with the application of temporal and spatial interpolation [1]. The high-resolution data were created at 30-s intervals in time (Animation 1 of Appendix A) and 0.1° intervals in space (Animation 2 of Appendix A).

Table 1

| Radar site     | Ebina                          | Shin-yokohama               |
|----------------|--------------------------------|-----------------------------|
| Type           | X-band polarimetric radar      | X-band polarimetric radar   |
| Observation range | 80 km                       | 80 km                       |
| Volume scan interval | 5 min                        | 5 min                       |
| Operation agency | NIED                        | MLIT                        |
| Location       | 139.39° E, 35.40° N           | 139.60° E, 35.51° N         |
| Number of elevation angles | 12 (0.7°–10.3°)  | 12 (1.0°–20.0°)             |
| Data resolution | 100 m (range), 1.0° (azimuth) | 150 m (range), 1.2° (azimuth) |
| Beam width     | 1.3°                         | 1.05°                       |
| Frequency      | 9.375 GHz                     | 9.7–9.8 GHz                 |
| PRF            | ≤1800 Hz                     | 1440–1800 Hz                |

NIED: National Research Institute for Earth Science and Disaster Prevention, MLIT: Ministry of Land, Infrastructure, Transport and Tourism, PRF: Pulse Repetition Frequency.
While operational radar data (left image in Animation 1) show the temporal evolution of a storm at 5-min intervals, high-temporal-resolution data (right image in Animation 1) can provide more detail, as demonstrated in the time evolution at 30-s intervals. Because the advection vector updates by calculating for a period of volume scan interval [1], a storm in the high-temporal-resolution data do not move smoothly (such as a jumping downward movement shown in the right image in Animation 1).

Fig. 1. Radar sites are indicated by black squares (■). In the Kanto region of Japan, the Ebina radar is located at 139.39'E, 35.40'N and the Shin-yokohama radar is located at 139.60'E, 35.51'N. The ranges of the EBN and SYK radars are shown by the dashed red and violet lines, respectively (80 km range). The target area is enclosed by the black rectangle.

Fig. 2. Beam-height cross sections of the (a) EBN radar and (b) SYK radar [1].
The left image of Animation 2 shows observational radar data with 12 elevation angles before elevation interpolation from 1235 LST to 1239 LST; the right image shows 0.1° high-spatial-resolution radar data with 97 elevation angles at 1238:30 LST.

2.2. Implementation of three-dimensional storm information

Using the high spatio-temporal resolution data, a three-dimensional constant-altitude plan-position-indicator (3D CAPPI) was created at a resolution of 250 x 250 x 250 m. The 3D CAPPI described the evolution of the storm at various angles. Investigating the evolution of a storm from various angles is useful for understanding storm structure, development, and movement (Animation 3--6 of Appendix A).

Acknowledgements

This study was supported by a Japan Society for the Promotion of Science KAKENHI [grant no. JP16H03145]. This study was also supported by the Korea Meteorological Institute [grant KMI 2018-05410]. The authors express their thanks to MLIT for the provision of X-band polarimetric radar data.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104116.

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