A CASA-like Networked X-band Weather Radar System in Nanjing Area

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Abstract

Relative to ten minutes to a few hours life history of strong convective weather, the 5~10 minutes scanning cycle of traditional weather radar is insufficient for analyzing and forecasting. Motivated by CASA DFW Urban Demonstration Network, (Chandrasekar et al. 2013; Chen and Chandrasekar 2015) the first network in China, composed of four X-band Doppler radars, was deployed in Nanjing in June 2014. The radar network adopts the new approach of collaborative self-adaptive sensing with the expectation to obtain accurate observations with high spatial and temporal resolution for area of interest.

This poster presents an overview of the deployment of this radar network, the new approach of collaborative self-adaptive sensing for radar scanning, and an observation case.

System Specifications

The networked radar system is composed of four X-band Doppler weather radars and spaced nearly 40 km apart, each radar has a maximum detection range of 60 km. Radars are located in the towns of Jurong (short for JR), Lukou (short for LK), Gupinggang (short for GPG) and Yizheng (short for YZ) around Nanjing area. In addition, the networked radar locates in the overlapping area of the existing CINRAD radars, such as S-band radar in Longwangshan (short for LWS), Changzhou (short for CZ) and C-band radar in Ma'anshan (short for MAS). Deployment and system specification of networked radar system are shown in Figure 1 and Table 1.

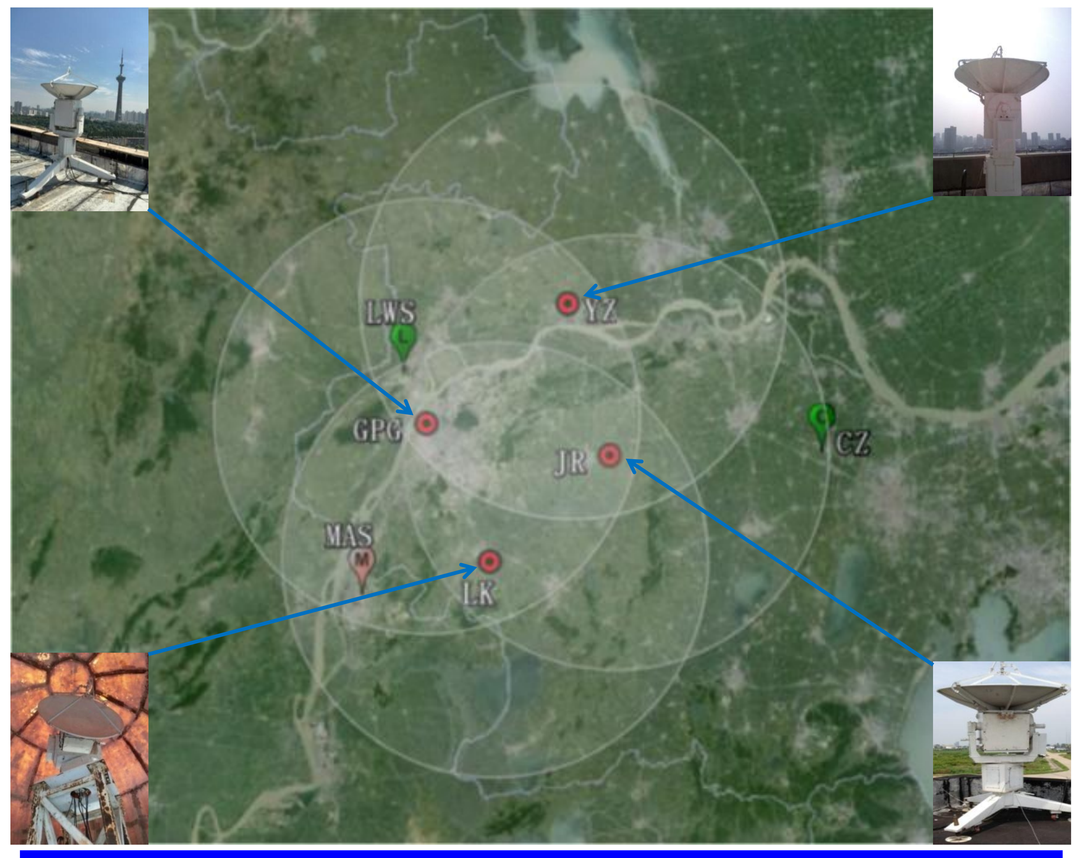

Fig. 1 Deployment of networked radar system in Nanjing Area

Table 1: Specifications of networked radar system in Nanjing Area

Total coverage	22607.85 km²	
Two-radar overlap	13025.30 km²	57.6%
Three-radar overlap	6103.38 km²	27%
Four-radar overlap	3502.40 km²	15.5%

Collaborative Adaptive Sensing Mode

The overall system's control architecture is divided into two consecutive parts: self-adaptive sensing for each radar and collaborative sensing for the networked radar system.

In the first part, We mainly utilized the characteristics of reflectivity of PPI at elevation of 2.3° after quality control to determine the priority of AOIs, including the maximum reflectivity, the mean reflectivity, the area and the variation of three before-mentioned variables. The AOI priority is determined by the value of these information through modest arithmetic operation after normalization incorporation with users' concern (Figure 2).

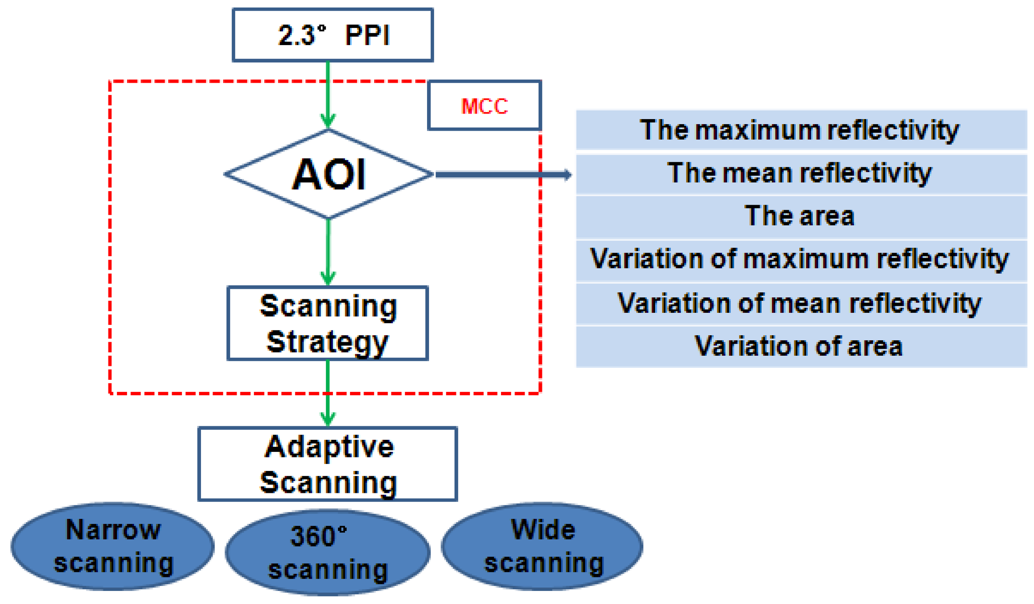

Fig. 2 Flowchart for self-adaptive sensing mode

The AOIs' information is transferred to the control center for the consecutive part, tasks are generated and networked radar accomplishes collaborative sensing on fixed scanning mode (Figure 3 and 4).

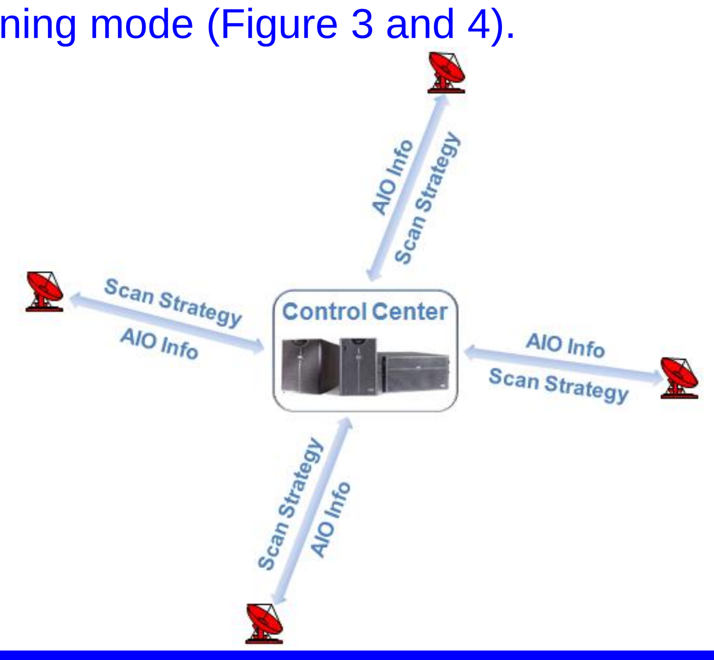

Fig. 3 Flowchart for collaborative sensing mode

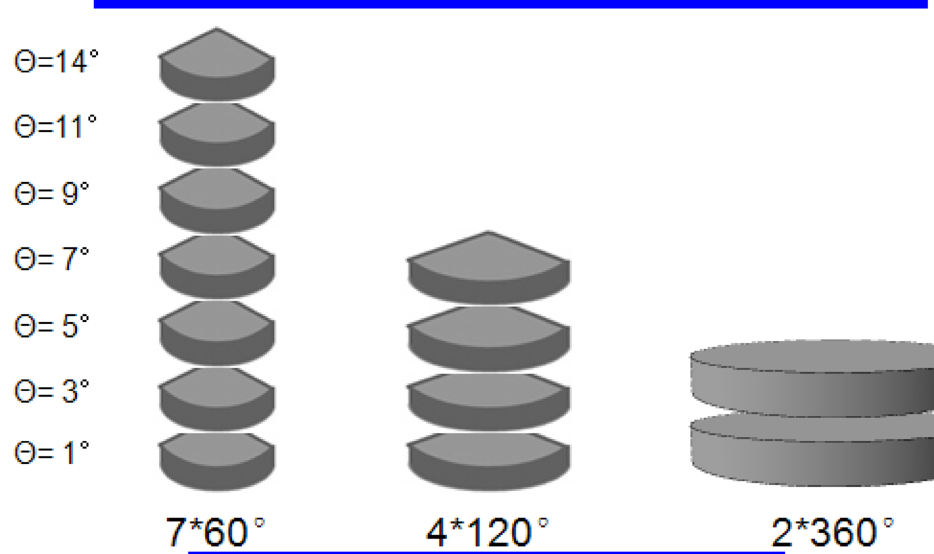

Fig. 4 Adaptive scanning options

Observation Case

Data collected from LK radar for a squall line event on the early morning of 27 Nov. 2014 is used for the comparison study. Figure 5 shows the adaptive sector scanning capabilities at 1°, 3°, 5°, 7°, 9°, 11°, and 14° elevations at times 01:32:24 UTC.

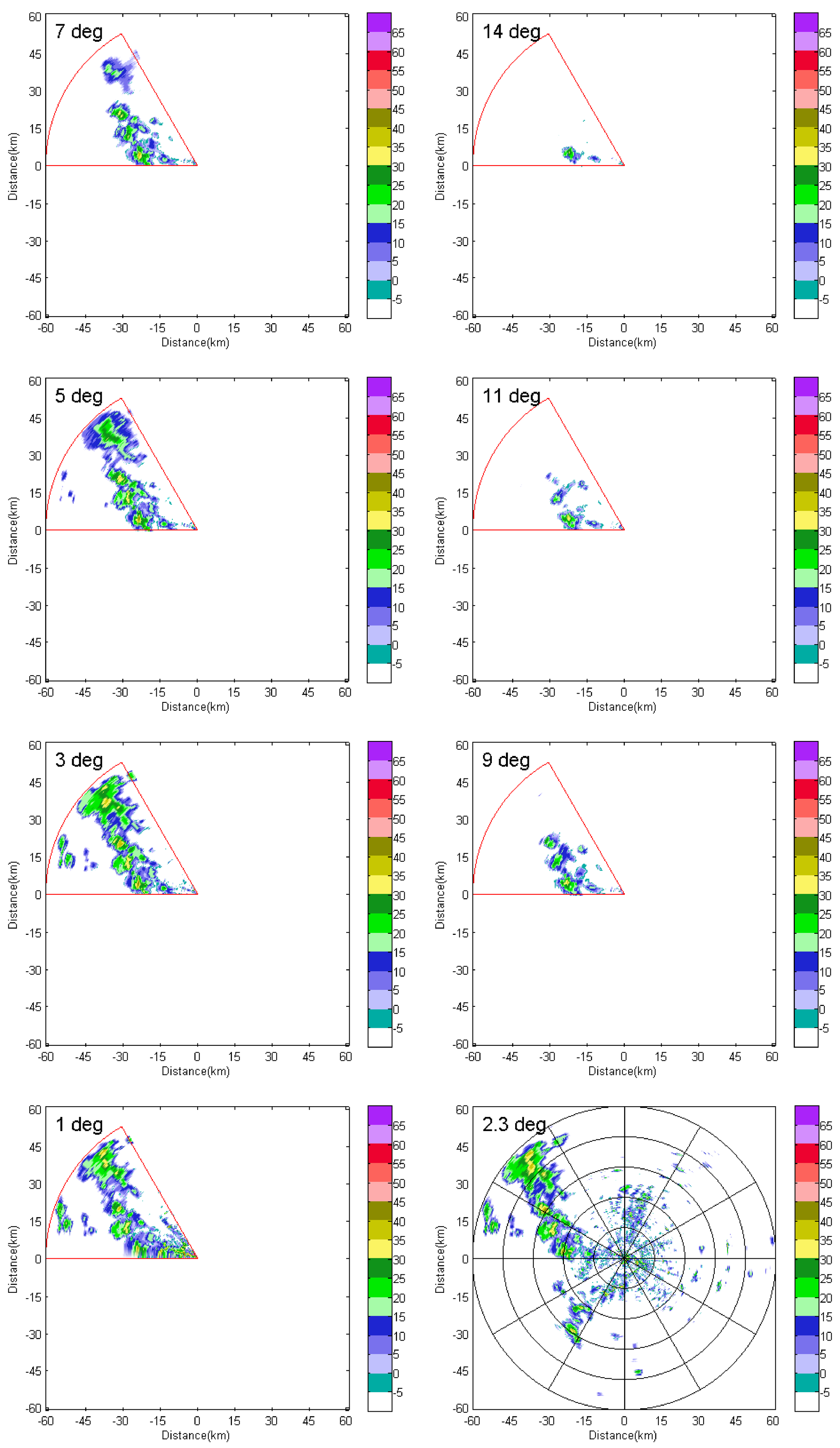

Fig. 5 The adaptive sector scanning capabilities as demonstrated by sensing the 27 Nov. 2014 squall line near LK radar

A series of images from the LWS radar site, collected between 01:32 and 01:38 UTC, indicated that the squall line rapidly developed. During this period, the 1.5-surveillance scans showed more formation in the reflectivity (Figure 6). Network reflectivity composite data showing the passage of a cluster of rain cells at 2.3 deg. Radar data were collected at 01:51:00 UTC 27 Nov. 2014 (Figure 7). (GPG radar didn't work).

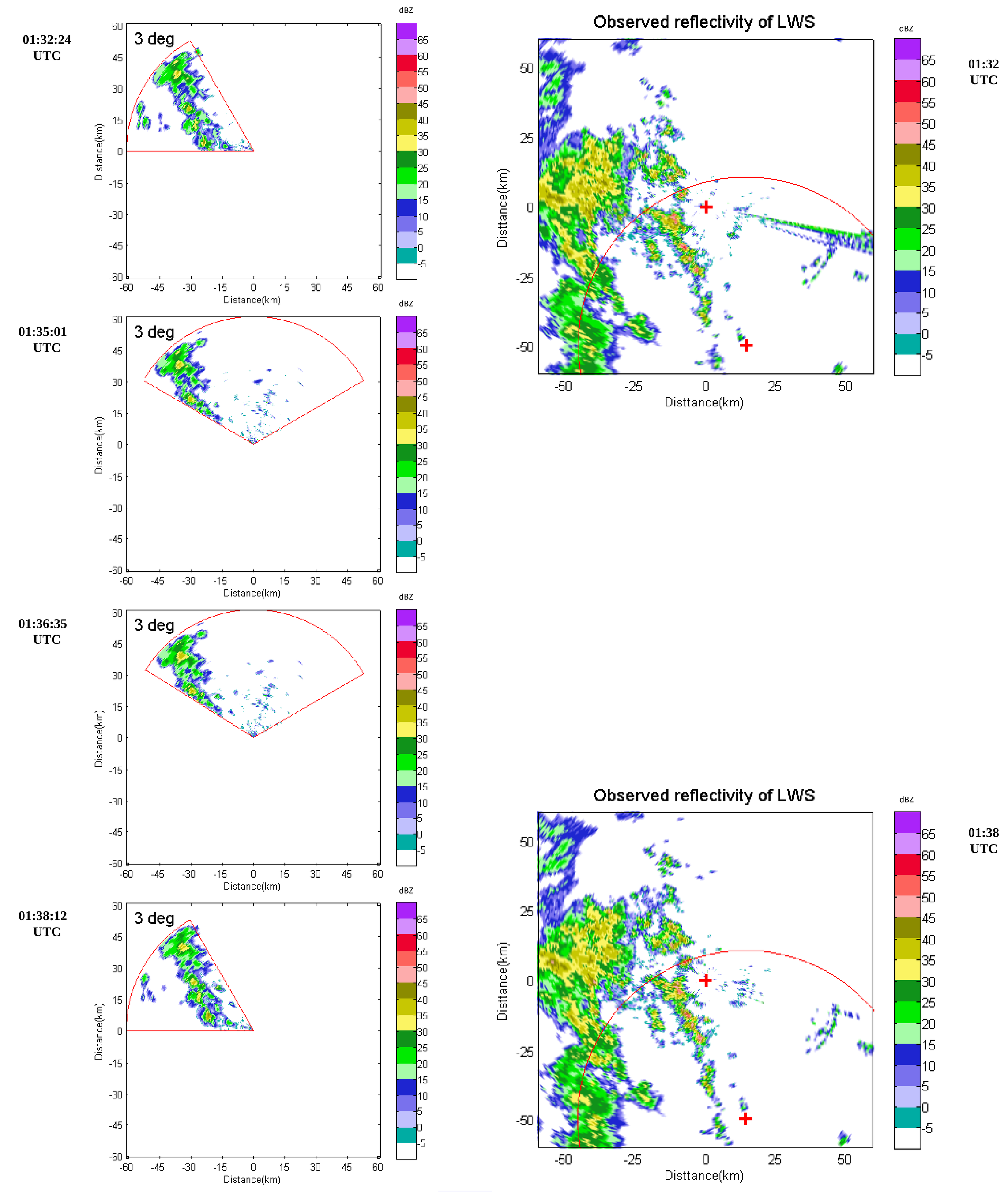

Fig. 6 Comparison of observation (LK vs. LWS)

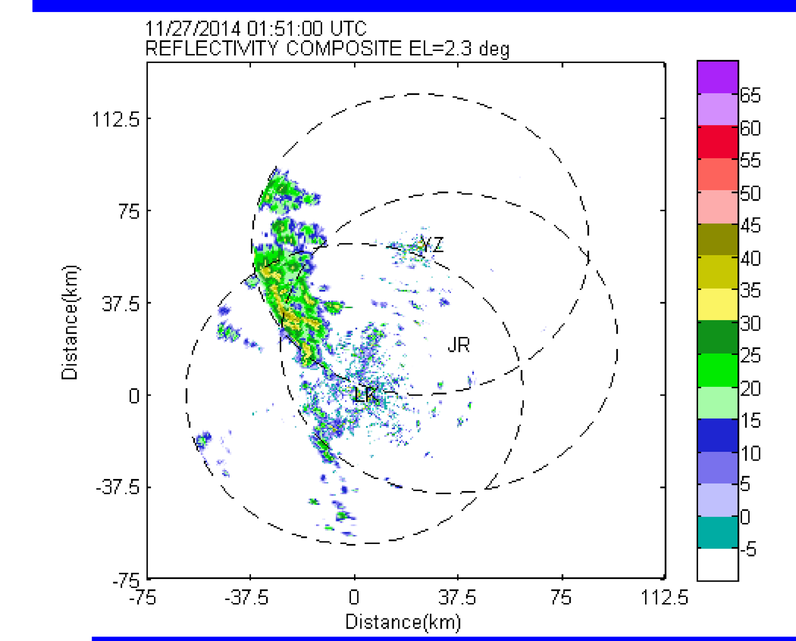

Fig. 7 Network reflectivity composite data

Next Steps

With this system, new methods for storm feature detection, tracking, and nowcasting are to be developed and demonstrated. And multi-Doppler wind retrieval, attenuation correction and networked reflectivity retrieval, quantitative precipitation estimation (QPE) and quantitative precipitation forecast (QPF) are also to be studied.

Acknowledgements

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