

Shanghai Urban Array Weather Radar Network Experiment

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Shanghai Meteorological Service(SMS), Meteorological Observation Center of CMA and Eastone Washon Corporation started a new project to develop the Shanghai Urban Radar Demonstration Observation Network based on the New Array Weather Radar (AWR) System. The AWR system for experimental observation was designed and developed by the Meteorological Observation Center of CMA and Eastone Washon Corporation, and started to install in Shanghai in November 2018. It is well known that rapidly evolving small-scale weather phenomena (e.g. downbursts, thunderstorms, tornadoes, etc.) were a threat to our lives, especially in densely populated megacities like Shanghai. Currently, S or C-band mechanically rotating radar systems have been proved to be effective for weather surveillance, especially in a large area more than 100 km in range. However, the limitations of spatial and temporal resolution of typical S or C band radar systems are not sufficient to capture the rapidly evolving small-scale weather. In order to better understand the basic processes and dynamic characteristics of this rapidly changing weather phenomenon, observations with high temporal and spatial resolution are required.

With the development of phased array technology and networked radars, the Array Weather Radar is developed, which is a distributed and highly collaborative radar. The AWR comprises at least three phased array transmit-receive sub-arrays, and the detection region of the AWR can be enlarged by increasing the number of sub-arrays. The three sub-arrays installed in this experiment are located in three areas of Shanghai Baoshan, Pudong and Chongming, forming an observation network similar to an equilateral triangle. Three sub-arrays works as a group, which performs collaborative scanning to ensure data time differences at the same spatial point are less than 2 seconds, thereby the correct flow fields can be synthesized by using radial velocity of the sub-arrays. And one volume scanning time of the AWR is 12 seconds. Each sub-array using phase array scanning technology to cover the whole sky with 30m resolution and up to 43km. The radar adopts the digital beam forming technique for elevation and mechanically rotates the antenna in azimuth. It transmits 4 broad beams and receives the back scattered signal with 64 channels. After the installation of the AWR system in Shanghai, the initial observation campaign was made in Shanghai urban area. A preliminary comparison with the S-band radar system shows that the system can obtain three-dimensional velocity and intensity (reflectance factor) data, and the structural and dynamic processes of precipitation could be reflected in more detail than any other radar systems.

Keywords: array weather radar, phased array weather radar, sub-array, observation experiment

