Application of X-band polarimetric radar obeervation for flood forecasting in Japan

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Abstract

The radar observation system in Japan is operated by two governmental groups: Japan Meteorological Agency (JMA) and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) of Japan. The JMA radar observation network is comprised of 20 C-band radars (with a wavelength of 5.6 cm), which cover most of the Japan Islandsand observe rainfall intensity and distribution. And the MLIT's radar observation system is composed of 26 C-band radars throughout Japan. The observed radar echo from each radar unit is first modified, and then sent to the National Bureau of Synthesis Process within the MLIT. Through several steps for homogenizing observation accuracy, including distance and elevation correction, synthesized rainfall intensity maps for the entire nation of Japan are generated every 5 minutes. The MLIT has recently launched a new radar observation network system designed for flash flood observation and forecasting in small river basins within urban areas. It is called the X-band multi parameter radar network, and is distinguished by its dual polarimetric wave pulses of short length (3cm). Attenuation problems resulting from the short wave length of radar echo are strengthened by polarimetric wavelengths and very dense radar networks. Currently, the network is established within four areas. Each area is observed using 3-4 X-band radars with very fine resolution in spatial (250 m) and temporal (1 minute intervals).

This study provides a series of utilization procedures for the new input data into a real-time forecasting system. First of all, the accuracy of the X-band radar observation was determined by comparing its results with the rainfall intensities as observed by ground gauge stations. It was also compared with conventional C-band radar observation. The rainfall information from the new radar network was then provided to a distributed hydrologic model to simulate river discharges. The simulated river discharges were evaluated again using the observed river discharge to estimate the applicability of the new observation network in the context of operations regarding flood forecasting. It was able to determine that the newly equipped X-band polarimetric radar network shows somewhat improved observation accuracy compared to conventional C-band radar observation. However, it has a tendency to underestimate the rainfall, and the accuracy is not always superior to that of the C-band radar. The accuracy evaluation of the X-band radar observation in this study was conducted using only limited rainfall events, and more cases should be examined for developing a broader understanding of the general behaviorof the X-band radar and for improving observation accuracy.

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