Upgrading Radar Precipitation Data by Converting C-Band Radar into MP Radar

KAWASAKI Masaki, Head; TSUCHIYA Shuichi (D.Eng.), Researcher
Water Cycle Division, River Department

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1. Introduction

The Water and Disaster Management Bureau of the MLIT monitors rainfall across the country to use precipitation data for river management, disaster prevention information to the public, etc. For this, it uses 26 radar rain gauges ("existing radar") that operate on the C-band (wavelength of approx. 5 cm), and 35 dual-polarization radar rain gauges ("XMP radar") that operate on the X-band (wavelength of approx. 3 cm). The existing radar has a wider range of observation but is less accurate than XMP radar. In order to upgrade radar precipitation data, the existing radar, which is a single polarization radar that transmits and receives one type of radio wave, will be replaced by dual-polarization radar ("CMP radar") that can transmit and receive two types of polarized waves, horizontal and vertical. (At present, two units have been converted to MP [multi-parameter].) This paper examines the effort to convert radar observation data into precipitation in order to improve the accuracy of observation of existing radar infrastructure, by converting the existing radar into MP radar.

2. Rainfall observation with C-band MP radar

The Figure shows radar rainfall images from the 2012 Northern Kyushu Heavy Rain, taken by the existing radar (left), XMP radar (middle), and CMP radar (right). The precipitation measured by CMP radar was calculated with the precipitation calculation method studied by the NILIM. Note that the existing radar data was corrected using the precipitation data measured on the ground but no corrections were made to the data of XMP and CMP radars. With XMP radar, the whole rainy area was not captured due to the unobservable area formed by radio waves attenuated by intensive rain, while CMP and XMP radars provided mostly consistent shapes of rainy areas and variations in the distribution of rainfall. In addition, as a result of comparison between the ground precipitation and the time series precipitation by XMP and CMP radars, it was found that CMP radar is less accurate than XMP radar, but its data on precipitation at the beginning, peak, and end of the rain was almost consistent with the ground precipitation data, which verifies that observation was done with good accuracy.

3. Future perspective

Since CMP radar allows for accurate observation without the need for correction based on ground precipitation data, distribution cycle, the time required from observation to distribution can be reduced, which is expected to lead to improved precipitation information. In addition, joint use of CMP radar and XMP radar to supplement unobservable areas under XMP radar or due to rain attenuation is expected to improve wide-area observation accuracy across the country, as well as stable and highly accurate observation of urban areas where XMP radar is provided. The existing radar units are to be converted into MP radar as they come up for replacement. In fiscal 2013, four units were converted and, in fiscal 2014, one unit will be converted. The rainfall calculation parameter of converted units will be tuned by the NILIM and will be examined to ensure observation accuracy.

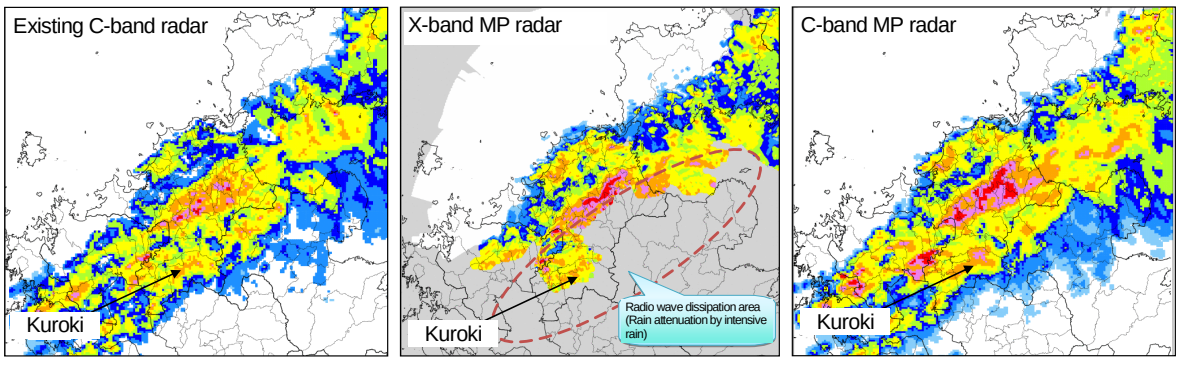

Figure: Radar Precipitation Image from 2012 Northern Kyushu Heavy Rain