Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

AAS004-16 Room: 101 Time: May 28 14:30-14:45

The applicability of a GSMaP correction method (Effects of frequency of MWR observation on accuracy of the method)

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1. Introduction

In developing countries, it is urgent to implement non-structural flood countermeasures such as flood forecasting/warning systems to promote early evacuation in addition to structural measures. However, it is difficult to implement such systems in ungauged basins in developing countries due to lack of hydrological information because they require costly facilities and highly advanced observation, for example, with precipitation telemeters and radars.
On the other hand, satellite-based global rainfall data are widely available for public use, and research has been in progress to apply this type of data to a broad range of areas including flood management in ungauged basins. In particular, a near-real-time rainfall product called GSMaP_NRT has drawn much attention because of its high spatial and temporal resolutions and short data latency. This product is considered very promising for flood forecasting and warning in ungauged basins in developing countries.
However, research has found that satellite-based rainfall products in general tend to underestimate rainfall when compared with ground precipitation, which poses a problem in their use for flood forecasting and warning. Thus, a correction method for satellite data is necessary to use them for flood runoff analysis. Shiraishi et al. developed a correction method in their 2009 study, and found that the method can drastically reduce the error rate under certain conditions. This paper will briefly review the development of the correction method by Shiraishi et al. and describe its applicability assessment over river basins in Japan.

2. Review on development of a correction method

In search for a correction method for satellite-based rainfall data, Shiraishi et al. found that the error margin is proportionate to wind velocity. This finding led them to the idea that satellite data should be corrected proportionately to the movement of a rainfall area; large movement requires major correction, and a little movement, minor or no correction. Based on this, the correction method was developed and applied to GSMaP_MVK+, a satellite-based rainfall data. The method remarkably improved the satellite data in accuracy.

3. Applicability assessment

To test the applicability, we further applied their correction method to rainfall events in Sendai and Kikuchi River basins. The results varied in accuracy depending on rainfall event. The error rate of the total rainfall in the Sendai basin reduced from 77.5% to 2.8%; however, in the Kikuchi basin from 68.6% to 43.2%. We found that accurate reproduction of rainfall distribution and movement during a rainfall event was crucial. This suggests the necessity of more frequent observation by microwave radiometers (MWR) because the rainfall distribution is based on MWR observation.

4. Summary

We applied the correction method to two basins in Japan and found that it can be applied to the

following cases:
(1) MWR observation is frequently conducted, so that GSMaP can describe proper rainfall distribution and movement during a rainfall event even with poor Infrared Radiometer (IR) technique.
(2) MWR observation is not frequently conducted, but GSMaP can describe proper rainfall distribution and movement during a rainfall event because of good IR technique.
In other words, the correction method cannot be applied to cases in which due to infrequent MWR observation and poor IR technique, GSMaP cannot describe proper rainfall distribution and movement during a rainfall event.
This result shows the importance of the Global Precipitation Measurement, which will promote more frequent MWR observation.

5. Reference

Shiraishi Y., Fukami K., Inomata H.: The proposal of correction method using the movement of rainfall area on satellite-based rainfall information by analysis in the Yoshino River Basin, Annual Journal of Hydraulic Engineering, JSCE Vol.53, pp.385-390, 2009 (in Japanese)

Keywords: satellite-based precipitation, GSMaP, Correction method, Flood prediction