Evaluation of the rain rate estimates of GPM/DPR using ground radar data

*Tatsuya Shimozuma[1], Shinta Seto[1]

1.Nagasaki University

1. Introduction

GPM (Global Precipitation Measurement) Core Observatory satellite has been in operation since February, 2014. GPM Core Observatory satellite is equipped with the Dual-frequency Precipitation Radar (DPR), the DPR consists of a Ku-band precipitation radar (KuPR) and a Ka-band precipitation radar (KaPR). The observation made with the spaceborne radar DPR is the first trial, and the evaluation is needed for the observation results. In this study, we focus on matchup cases with the XRAIN ground radar, and compare the rain rate estimates by DPR and XRAIN. Moreover, we discuss the reason of difference in the rain rate estimates.

2. Method

The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) built the rainfall observation radar network called XRAIN. High frequency (every 1 minute) and high resolution (250m mesh) measurement becomes possible in comparison with a conditional ground radar. And XRAIN is operated at 39 places in Japan as of February 2016. And XRAIN is operated at 14 places in Japan as of February 2016. In this study, we focus XAIN radars to be operated in northern Kyushu region. Observation resolution is not same between DPR and XRAIN. The average is calculated from the XRAIN’s rain rate included in DPR’s footprint, and the rain rate estimates by DPR and XRAIN are compared. We used the DPR’s rain rates at the clutter free bottom, which is stored as the variable name of [precipRateNearSurface]. The product version of DPR is V03B.

3. Comparison of the rain rate estimates between DPR and XRAIN

The rain rate estimates are compared between DPR and XRAIN. As DPR and XRAIN make different observation area, their match-up data that satisfy the following conditions, (1) the observation area is overlap, (2) some degree of rain rate is observed, were extracted. 50 matchup cases of DPR and XRAIN are found between June 2014 and January 2016. In this section, a match-up data at 03:27 (JST) of July 7th, 2015 (DPR orbit number:7703) is presented. The rain rate estimates of DPR and XRAIN are shown in Fig.1. The rain rate estimates of XRAIN are overestimated, and the area where rain is detected are different. The linear distribution are found in XRAIN’s rain rate. The scatterplot of the rain rate between XRAIN and DPR is shown in Fig.2. X-axis is XRAIN’s rain rate, and Y-axis is DPR’s rain rate. Red symbols are for stratiform rain and blue symbols are for convective rain. From Fig.2, observation data that surrounded by XRAIN side show that XRAIN’s estimates are higher than DPR’s estimates. And the bias is negative value.

4. Comparison of the rain rate estimates in 50 matchup cases between DPR and XRAIN

In this section, the rain rate estimates of 50 matchup cases are evaluated. 2-D histogram of the rain rates between XRAIN and DPR is shown in Fig.3. Red line shows DPR's average rain rate estimates for XRAIN. From the Fig.3, the rain rate estimates of XRAIN are overestimated. And the average line is high in XRAIN rain rate over 0.6mm/hr. The factors of the differences are (1) measurement height is not same and (2) the estimation accuracy decrease as far from the central point of the radar. As DPR can provide the 3-dimensional rain rate distribution, in the future, we will compare the rain rate estimates at the same height.

5. Conclusion

GPM Core Observatory satellite has been in operation since February 2014. The observation made with DPR is the first trial, and the evaluation is needed for the observation results. We focus on the observation result of the XRAIN, and compare the rain rate estimates by DPR and XRAIN. As a result of comparison, the rain rate estimates of XRAIN are overestimated. The factors of the differences are focus height and distance from the ground radar. In the future, we will compare the rain rate estimates at the same height.

Keywords: Global Precipitation Measurement (GPM), Dual-Frequency Precipitation Radar (DPR), MLIT X-Band MP Radar Network (XRAIN)

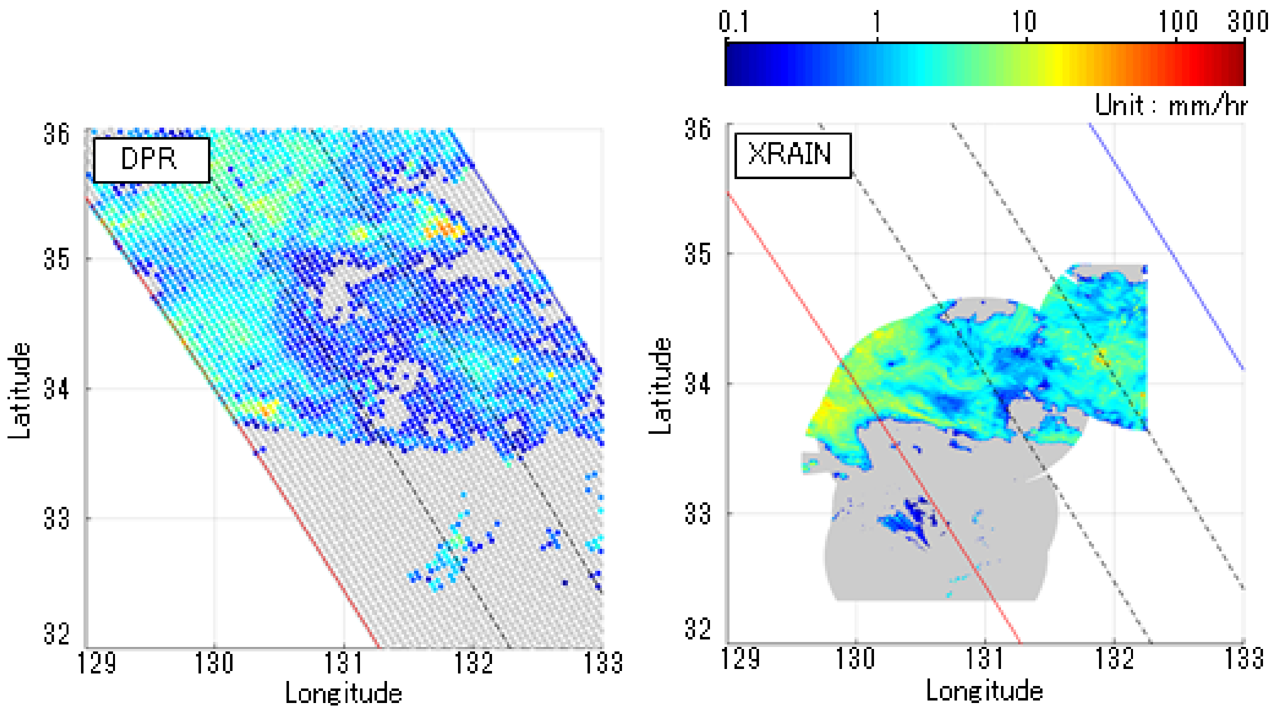

Fig.1 The rain rate estimates

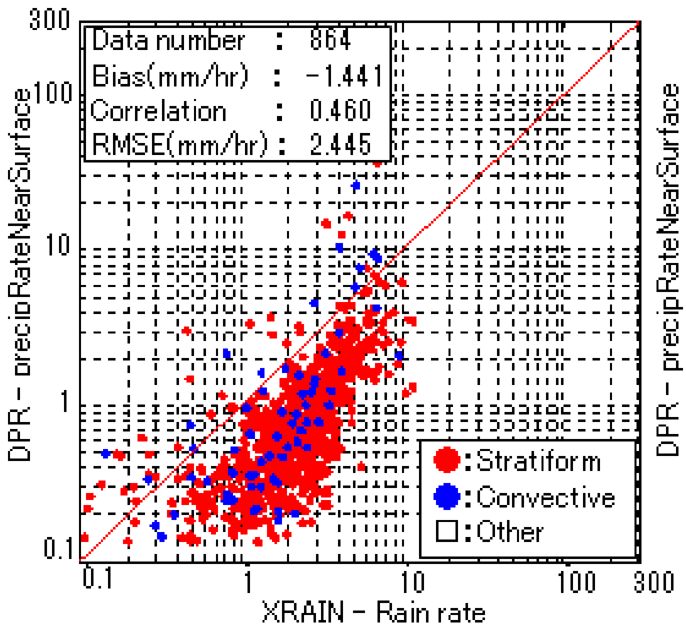

Fig.2 Scatterplot of the rain rate

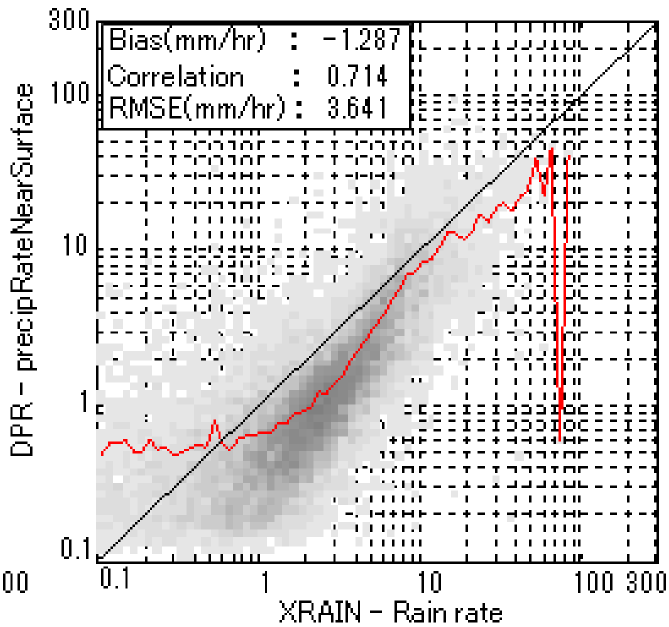

Fig.3 2-D histogram of the rain rate