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Evaluation of micro physical products of GPM/DPR with X-band radar network data

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One of the major characteristics of dual-frequency precipitation radar (DPR) onboard Global Precipitation Measurement (GPM) core satellite, is estimation of cloud physical properties of precipitation such as drop size distribution (DSD), existence of hail/graupel particles and possibly the mixed phase region above freezing height. In this study, ground-based X-band radar network data are utilized for evaluate the cloud physical products from GPM/DPR. The X-band radar network, composed of 39 X-band dual polarimetric radars developed by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) of Japan, called XRAIN[1] is utilized for the evaluation. The XRAIN radar completes volume scan up to the elevation angle of 20 degrees in 5 minutes. By using multiple radars, three dimensional wind field is estimated by using the dual-Doppler analysis technique.In this analysis DSD parameter from DPR (which is called epsilon in DPR product) and dual frequency ratio (DFR) that correlate well median diameter of DSD are compared with ZDR and KDP from XRAIN data. The vertical wind data from XRAIN is utilized to characterize the Z of DPR. The case on August 27, 2018, on which GPM satellite flew over a hail producing convective storm around Tokyo, is analyzed. Comparison of three dimensional structure of the storm between KuPR (Ku-band radar of DPR) and XRAIN from multiple radar observations shows that both observations are quite similar each other except for the KuPR observation show rather larger volume because of the larger footprint size. At the rain region (below freezing height), the DSD parameter of DPR (epsilon) and DFR correlate well with ZDR and KDP from XRAIN, respectively. This result indicates the DPR algorithm works well to estimate the DSD information of rain. The comparison of Z with vertical wind speed indicates that the higher Z is characterized as higher variance of vertical wind speed. Above the freezing height, the relationship between both observations are complicated. This result indicates that the various types of precipitation particles not only solid particles but also liquid/mixed phase particle can exist in the severe convective storm. The hydrometeor type classification from XRAIN by using the method by Kouketsu et al. (2015) [2] confirms that the various types of precipitation exist in this case.

References

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(in Japanese with English abstract).

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