COMPARISON OF REFLECTIVITY PROFILES BETWEEN TRMM-PR AND OPERATIONAL RADAR NETWORK MOSAIC OVER SOUTH KOREA

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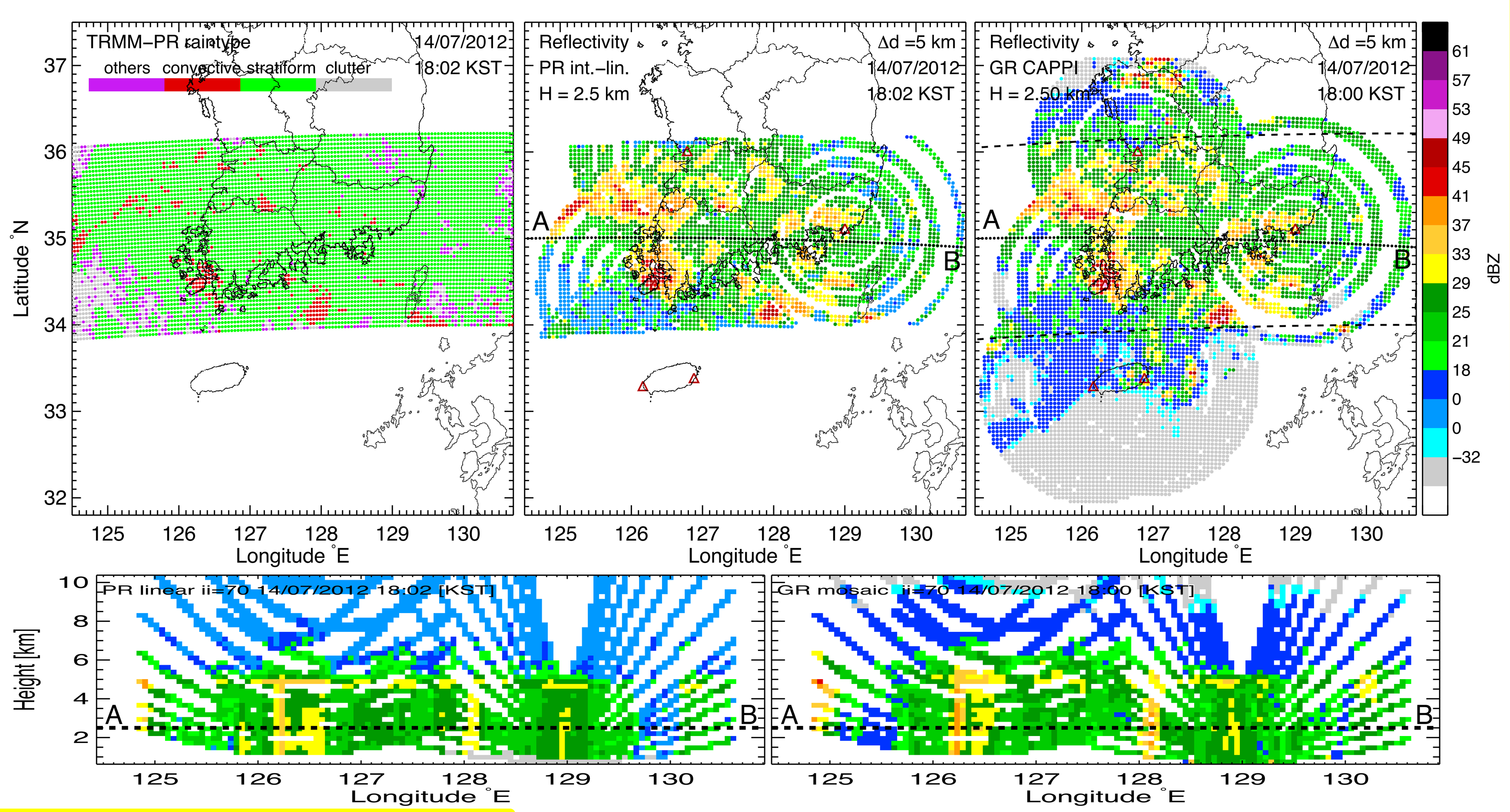
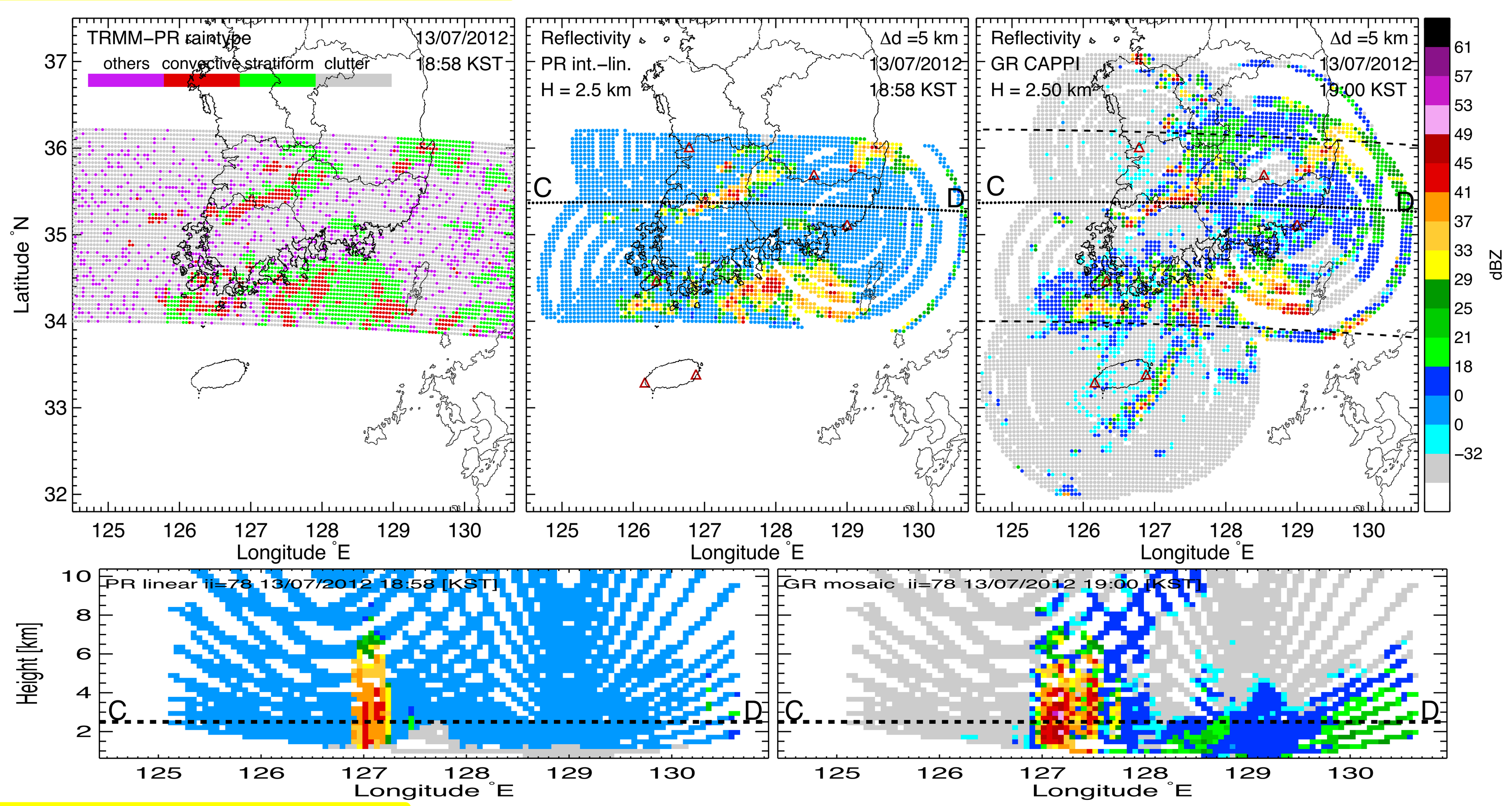
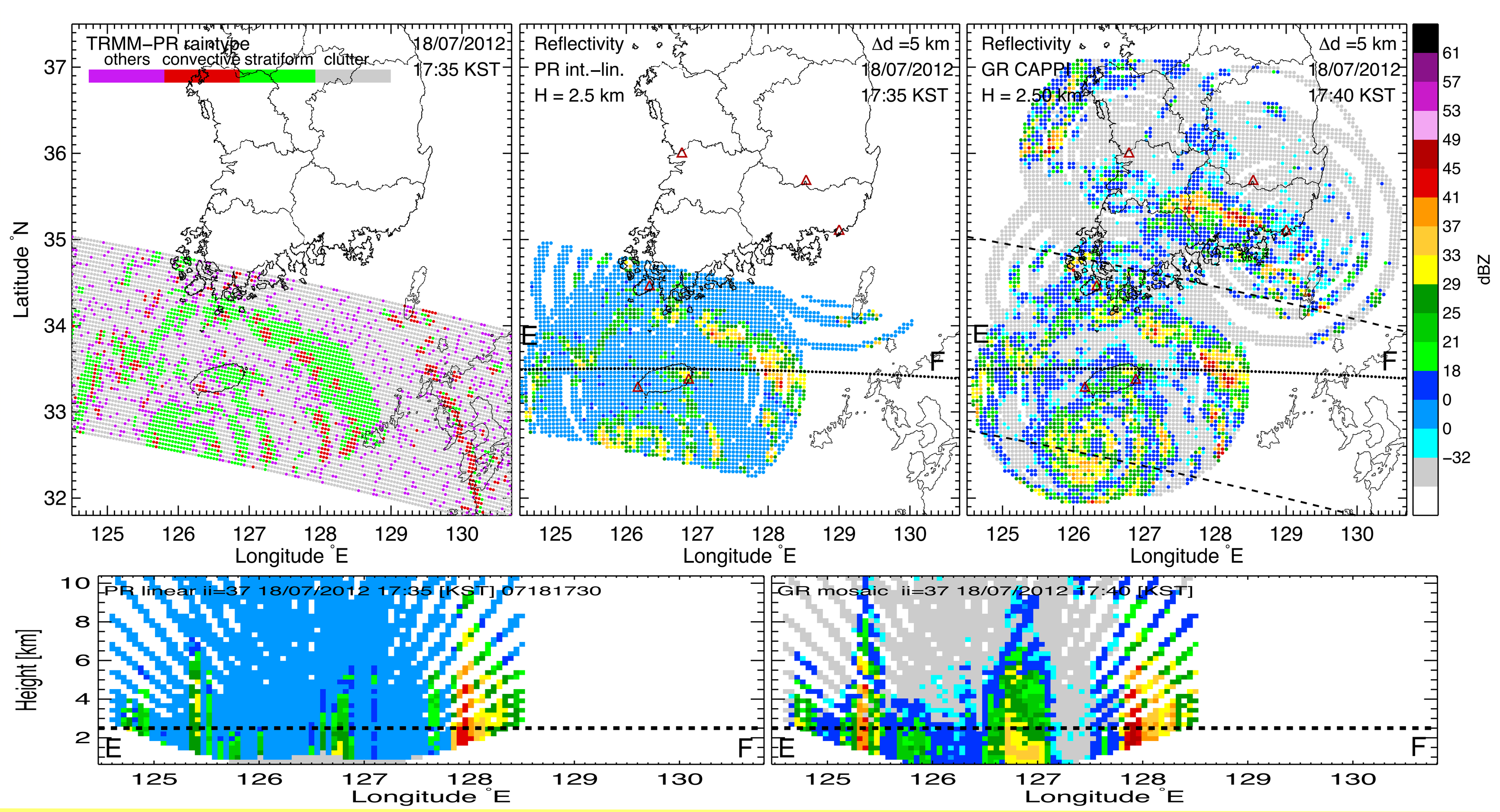
A widespread rain case



A convective rain case

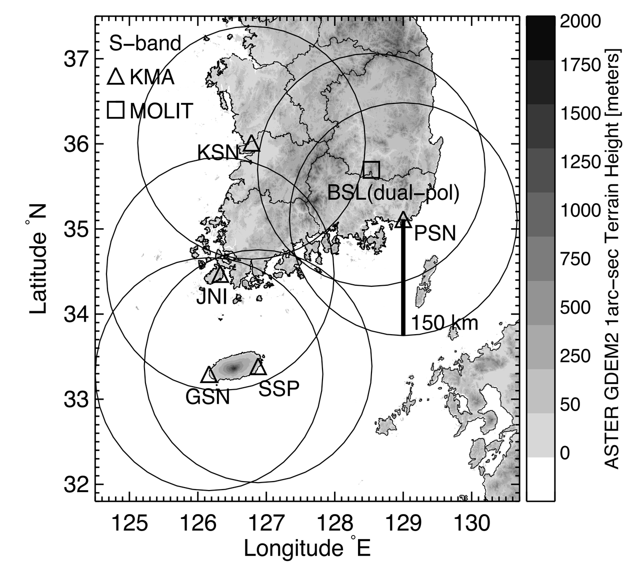


A typhoon case

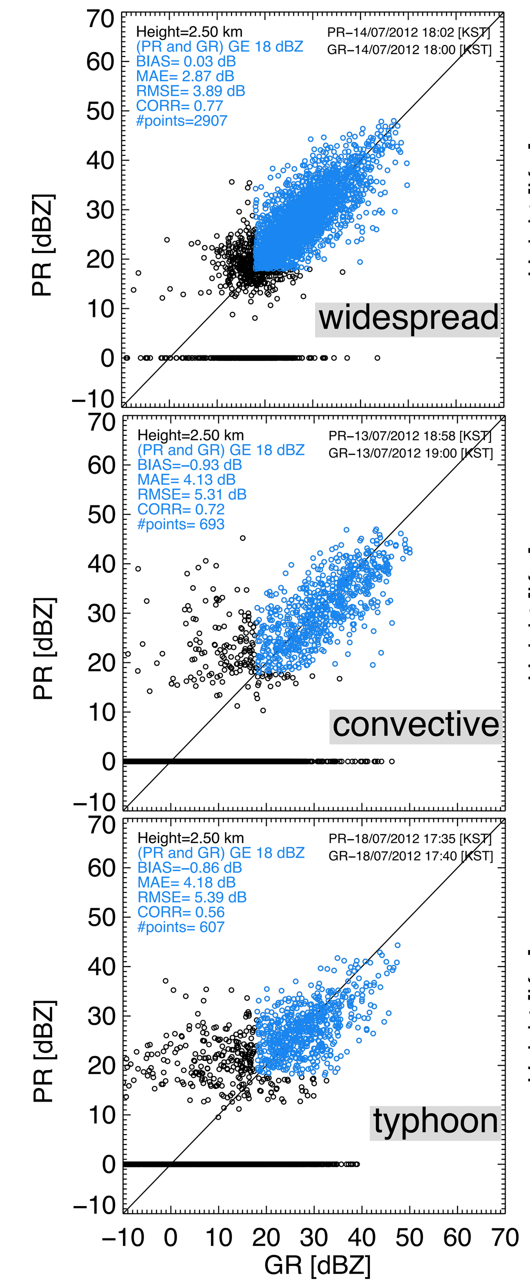


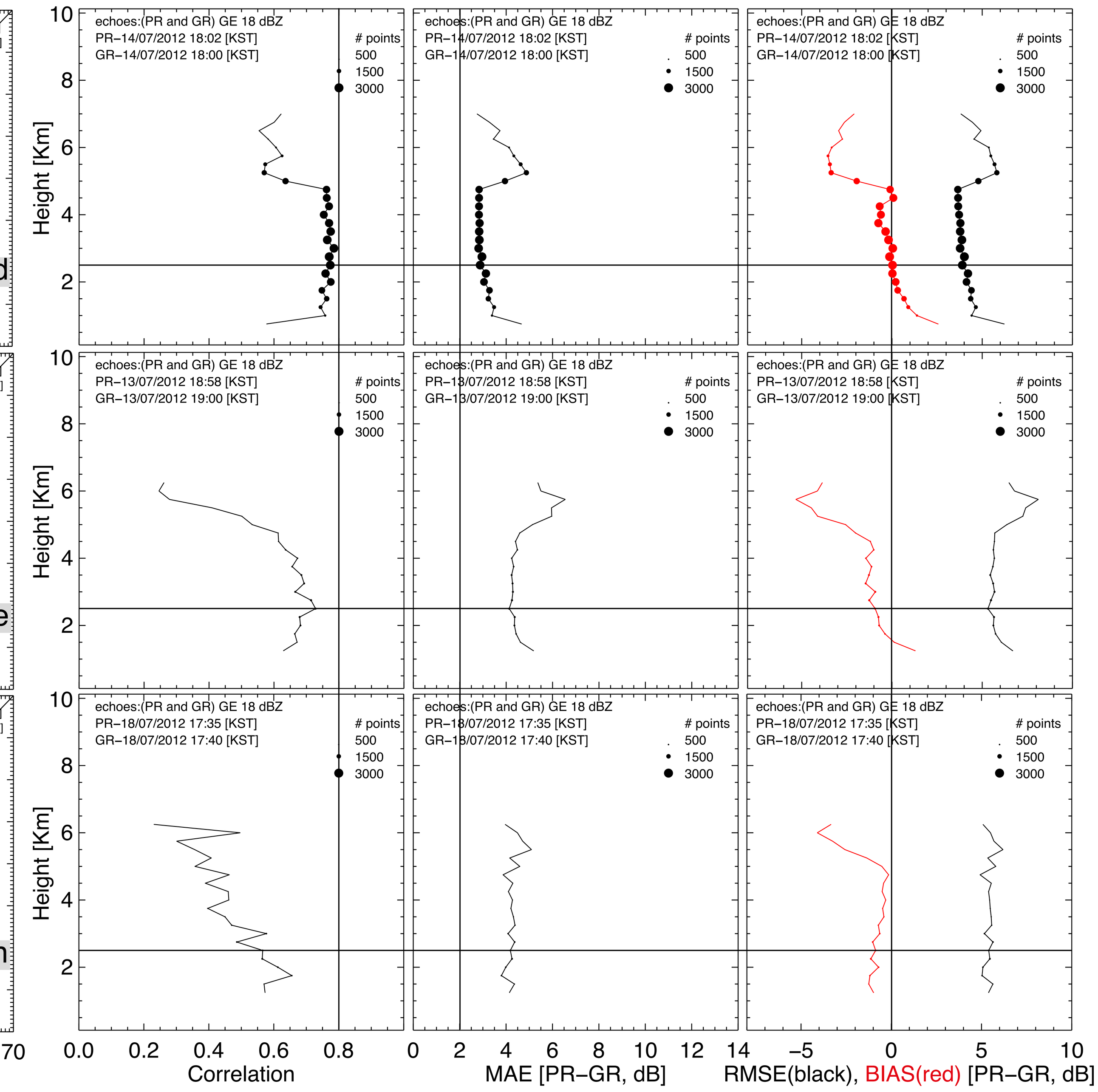
- The Tropical Rainfall Measurement Mission Precipitation Radar (TRMM-PR) observes the vertical distribution of precipitation by passing over the Earth's orbit.
- The reflectivity observed by volumetirc radar composite is utilized for ground validation of attenuation-corrected PR reflectivity.
- To match PR-GR reflectivities, a common grid is set with the resolutions similar to those of PR: 5 km in the horizontal and 0.25 km in the vertical. Individual GRs are remapped over the common grid by averaging the radar bins whose center falls in a grid cell. Whereas the GR reflectivity is projected in fixed longitude and latitude, PR varies with the orbit. Therefore, PR values are remapped into the GR's grid points.
- We present several statistical comparisons of PR-GR reflectivity observations for three different rain events specially focusing on the vertical structure.

Korean Radar Network



Differences	TRMM-PR reflectivity (2A25 v7)	Ground Radar (GR) reflectivity composite
Radar frequency	13.8 GHz (2.2 cm Ku-band)	3 GHz (10 cm S-band)
Data coverage (scanning strategy)	downward measurements from 402 km above the Earth surface, 49 beams per one scan w.r.t nadir, ~ 250 km swath (±17°).	scanning at several fixed elevation angles, CAPPI generated at the beam center and within the coverage of 150 km, 6 radars used in the composite.
Horizontal resolution	footprints of 4.3 km at nadir, 5 km at the edge of the scan	5 km (user-defined) projected over Lambert conformal map
Vertical resolution	250 m	250 m
Temporal resolution	3~4 times a day passing over Korea, 0.6 sec per scan, ~2 min crossing the country.	10 min
Minimum detectable signal	17~18 dBZ	< 0 dBZ
Dada processing	attenuation corrected , non-uniform beam filling algorithm added (Iguchi et al. 2009)	ground clutter removed, reflectivity calibrated with average biases obtained from 8 rainy days in July 05, 06, 11, 13 14, 15, and 17, 2012 for each radar:-1.5 (BSL), -4,0 (GSN), -1.2 (JNI), -4.9 (KSN), -2.3 (PSN) and -4.5 (SSP) in dB (Park and Lee 2010).





Conclusions

- Bias is quite smaller in the widespread rain case than that of convective rain and typhoon cases. In these cases, GR reflectivity is higher (about ~ 1dB) than PR especially for high values (around 40~50 dBZ).
- PR-GR scatter plots show better agreement for the widespread case. This can be explained in part by the more spatial variability of the convective and typhoon cases.
- CFAD shows the effect of the sensitivity threshold of PR.
- For the widespread case, the distributions of the two measurements agree well below the melting layer. Above, the two instruments have their limitations: PR is affected by the sensitivity, and GR observations are smoothed due to beam broadening.
- In general, there is a better agreement between Vertical Profiles of Reflectivity (VPR) in intense rainfall areas.
- Visual comparison of vertical cross sections shows the difficulties of PR to capture small-scale patterns. We have started analyzing the scale-dependence of the VPR comaprison to assess the effect of Non-Uniform Beam Filling.

Acknowledgements

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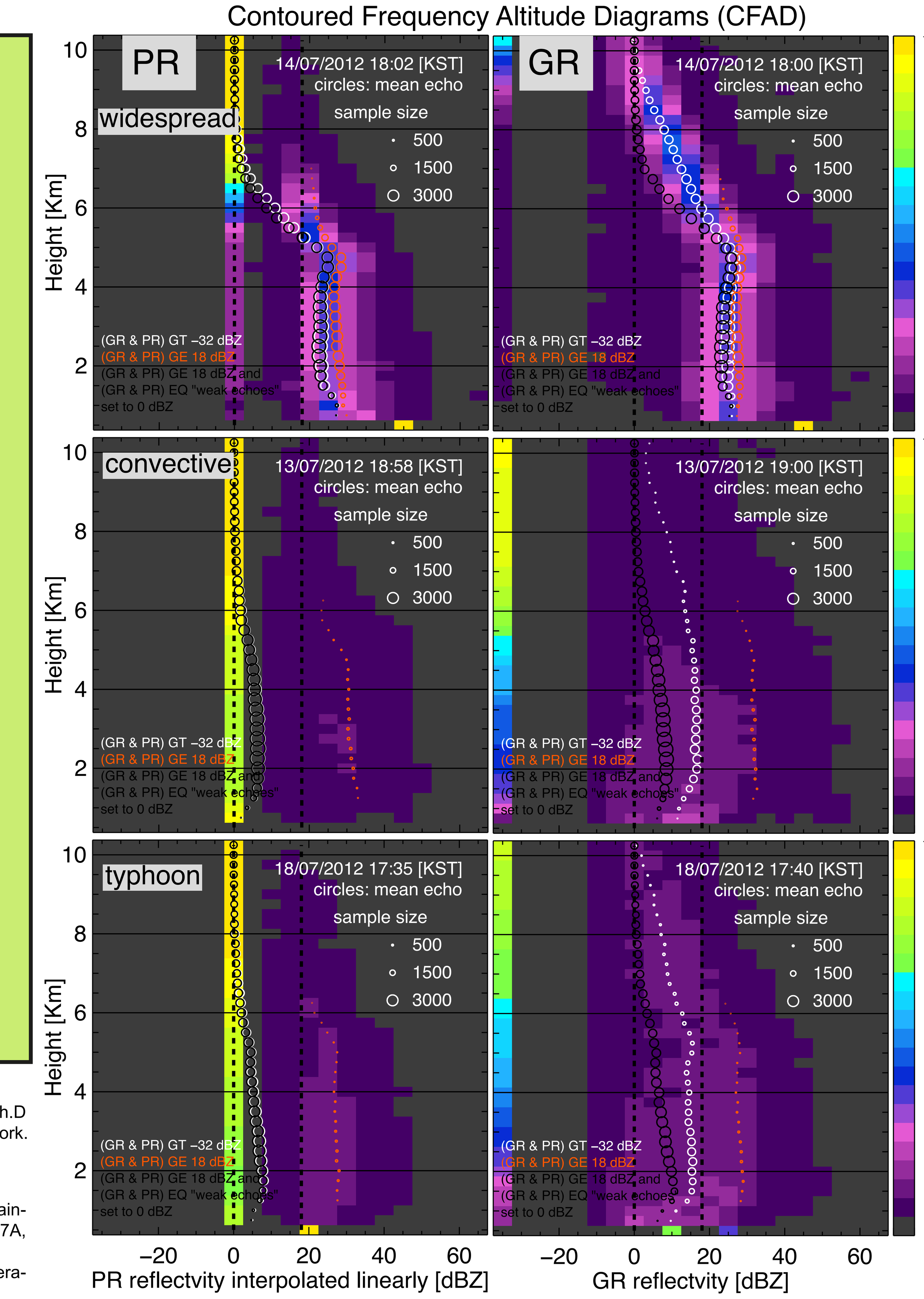
References

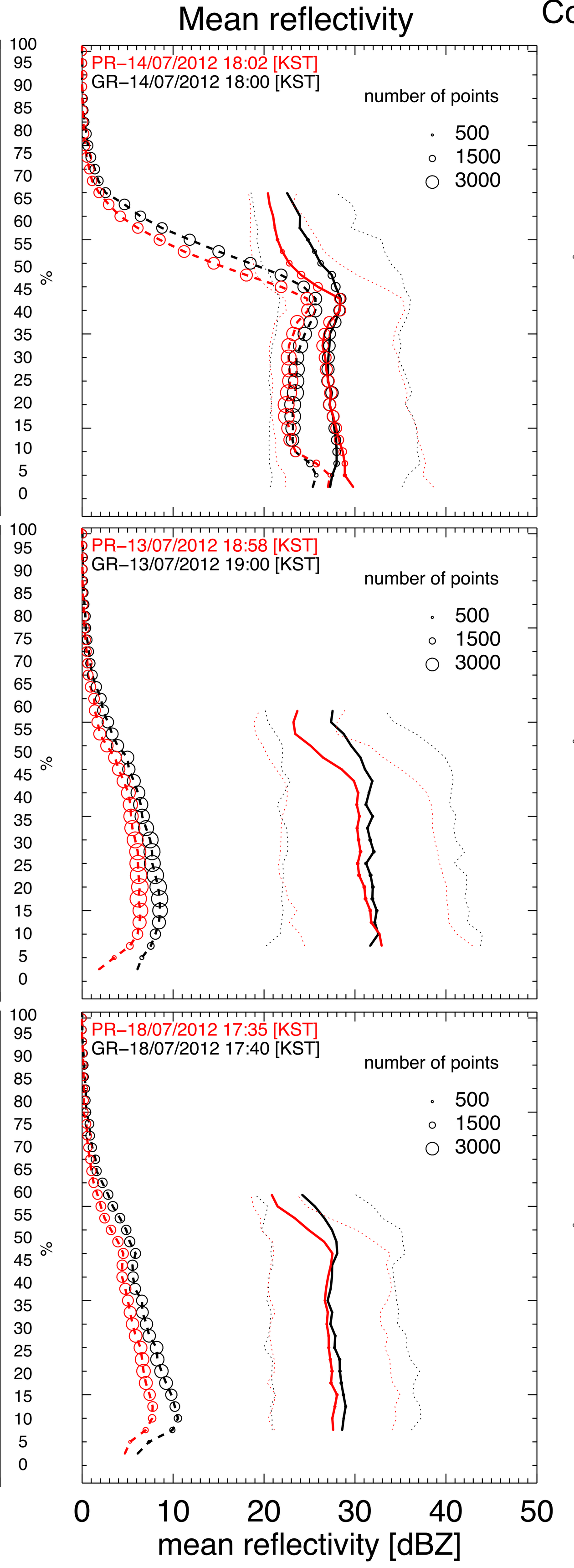
Iguchi, T., T. Kozu, J. Kwiatkowski, R. Meneghini, J. Awaka, and K. Okamoto, 2009: Uncertainties in the rain profiling algorithm for the TRMM precipitation radar. J. Meteor. Soc. Japan, 87A, 1–30.

Park, S.-G., and G. Lee, 2010: Calibration of radar reflectivity measurements form KMA operational radar network. Asia-Pacific J. Atmos. Sci., 46, 243-259.

Contoured Frequency Altitude Diagrams (CFAD)



Mean reflectivity



Correlation coefficient map of mean reflectivity profiles between PR and GR