Using an S-band radar to verify polarimetric retrieval methods at C-band in a tropical environment

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Path-integrated attenuation particularly affects X- and C-band radars, and increases with rainfall intensity. High rainfall intensities, though, are typical for tropical rainfall regimes, which is why weather radars in tropical regions have, so far, been mostly operated at S-Band.

The situation is changing, though, with the increasing popularity of weather radar polarimetry. In 2011, the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) started to establish a weather radar network which by now consists of eight radar devices, including two dual-polarized C-band radars. Radar-based rainfall retrieval is particularly important in the Philippines where torrential and sustained rainfall from tropical cyclones, monsoon, and thunderstorms regularly affect the country.

In order to use the PAGASA C-band radar data for operational rainfall retrieval, we combined a method for fuzzy echo classification, and an iterative procedure to extract and reconstruct the differential propagation phase, PhiDP. The reconstructed PhiDP was used to estimate path-integrated attenuation, and to retrieve the specific differential phase, KDP. For the C-band radar near Tagaytay City, rainfall was then estimated from different variables: from observed reflectivity, from reflectivity that has been corrected for path-integrated attenuation, and from the specific differential phase.

In order to analyze the strengths and weaknesses of these different retrieval methods, we used rainfall estimates from an S-band weather radar near Subic city as a benchmark. This was in order to avoid issues of representativeness that arise from the comparison of radar-based rainfall estimates against rain gauge observations. The distance between the Subic and the Tagaytay radar is only 100 km, so the overlap is substantial. In our analysis, we focus on an enhanced South-West monsoon event in August 2012 which dropped more than 1000 mm of rain over the Manila Metropolitan region within three day.