Evaluation of Quantitative Rainfall Estimation by X-band Dual-Polarization Radar Observations

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Over the years operational weather networks have been based on S- and C- bands radar units and recently on the more advanced Dual-polarization Doppler technology. The advancement to dual-polarization has shown considerable improvements on the quantitative estimation of rainfall rates and the estimation of the rainfall drop size distribution (DSD). However, operational weather radars have demonstrated limitations (1) due to low spatial resolution effects in the quantification of localized convective storms that can cause flash floods in small scale basins, and (2) over complex terrain environment introducing marginal gaps and the need for vertical profile corrections due to the higher elevation scans. Recent research has demonstrated that cost-effective low-power Dual-polarization X-band weather radar systems could be used as 'fill gapers' of large operational radar networks and for small scale hydrological applications (including flood forecasting of urban catchments). These systems offer an increased sensitivity in the differential phase shift compared to the lower frequencies (S and C-band), but they are associated with increased rain-path attenuation. This work examines the use of X-band dual polarization measurements in quantitative rainfall estimation for a number of convective storms, radar ranges, and scales of aggregation. We will investigate all existing polarimetric retrieval algorithms applied on attenuation-corrected X-band radar parameters. The algorithms are evaluated based on localized intense convective storms measured by a dense network of rain gauges during an experiment in Crete over the period December 2006 to April 2007.