

QUANTITATIVE PRECIPITATION BY X-BAND DUAL-POLARIZATION RADARS ESTIMATION IN COMPLEX TERRAIN

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ABSTRACT

Recently, an X-Band radar with dual-polarization capabilities was deployed in Santa Rosa, California to aid in monitoring precipitation and to provide high resolution Quantitative Precipitation Estimation (QPE) by better understanding the rainfall processes in this region. Despite the fact that the Bay Area has coverage from the operational radar network of Next-Generation Weather Radar (NEXRAD), topographic influences provide a unique challenge for QPE in this region. The poor performance of NEXRAD radars can be associated to several factors, such as radar beam blockage, radar beam overshooting, discontinuity in vertical reflectivity profile (VPR) etc. Moreover, not considering the microphysical difference of precipitation formation in this region, the NEXRAD radars tend to limit the accuracy of rainfall measurement. Often times, storms developing in mountainous regions are affected by orographic enhancement which in turn affects the intensity and spatial variability. The dominant type of rainfall occurring in this region is stratiform and it can be further classified into cold bright-band rain and warm orographic rain with absence of bright-band. This creates a challenging task for obtaining accurate QPE from radar observations. S-Band profiler and disdrometer measurements from two NOAA Physical Sciences Division sites are used to study the microphysics of these two rainfall types. A methodology has been developed to discriminate these rainfall types using dual-polarization radar variables and apply appropriate Specific Differential Phase rainfall estimators according to the rainfall type. When applied to operational radar data, the method shows great potential for improving the QPE compared to traditional operational products. Several precipitation events from January 2019 to April 2019 are evaluated. Hourly rainfall accumulations are calculated at the pixels corresponding to the rain gauge locations. This paper presents an overall methodology for rainfall estimation and comparisons against rain gauges demonstrating the added value of the X-Band radars to the existing operational system. Overall, the performance of the X-Band radar QPE is more robust and is able to better capture the precipitation variability both during a specific event and across different storms.