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Iowa X-Band Polarimetric Radar Data Analyses: A Selection of Interesting Cases from IFloodS

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The University of Iowa X-band dual-polarimetric (XPOL) mobile Doppler radars are envisioned to provide improved estimates of near-ground precipitation characteristics specifically for studying small-scale hydrological processes. During April-June 2013, the four units of Iowa XPOL system participated in their first field campaign called Iowa Flood Studies (IFloodS) – organized in central and north-eastern Iowa in the Midwestern United States by NASA in collaboration with the Iowa Flood Center. Prepared under the aegis of the Ground Validation (GV) program of NASA Global Precipitation (GPM) satellite mission, IFloodS was the first field experiment focused towards hydrological applications of the GPM mission such as flood forecasting.

During IFloodS, the Iowa XPOLs were deployed in pairs with overlapping coverage over two different watersheds. XPOL-2 and XPOL-4 units observed diverse meteorological events with nearly uninterrupted operation for 46 days of the campaign. From XPOLs perspective, IFloodS represented an opportunity to test several engineering capabilities of new radars as well as to collect research-quality data in support of the campaign's objectives. To this end, the general scanning strategy of XPOLs involved automated heterogeneous scan sequences comprising low elevation PPIs, stacked sector PPIs for overlapping coverage regions, RHIs in the directions of interest and vertical pointing birdbath scans. These scan sequences were repeated for different range sampling regimes at multiple range resolutions and different pulsing schemes, not necessarily synchronizing the radar settings for paired radar units.

The IFloodS operations of XPOLs have resulted in a unique dual-polarimetric dataset of small wavelength observations of rainfall with high spatial and temporal resolutions. We present selected cases from this dataset for various precipitation types – light rain to severe mesoscale phenomena, and convective to stratiform rain. By extracting useful information on detailed and complex structure of precipitation viewed from different radar perspectives, we also demonstrate the field worthiness of XPOL units through long duration deployment and remote operations.

By examining the precipitation observations in the overlapping coverage of two XPOL units, the study further reveals inter-XPOL consistency indicating research quality, calibrated radar datasets. Additional statistical analyses of stand-alone data of a particular XPOL unit are included to verify the expected relationships between polarimetric variables such as reflectivity, differential reflectivity, copolar correlation coefficient and differential propagation phase. Finally, comparisons with S-band observations from NASA's NPOL radar (co-located in IFloodS coverage region) show the finer precipitation details recorded by the XPOLs.