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Passive Microwave Rainfall Error Analysis using High-Resolution X-band Dual-Polarization Radar Observations in Complex Terrain

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Accuracy and reliability of hydrological modeling studies heavily depends on quality and availability of precipitation estimates. Difficulties in representation of high rainfall variability over mountainous areas using ground based sensors make satellite remote sensing techniques attractive for hydrologic studies over these regions. Even though satellite-based rainfall measurements are quasi global and available at high spatial resolution, these products have uncertainties that necessitate use of error characterization and correction procedures based upon more accurate in situ rainfall measurements, such as those obtained during experimental studies with research radars. This study evaluates rainfall estimates from passive microwave (PMW) sensors onboard different earth orbiting platforms based on high spatial (150 m) and temporal (3 min) resolution rainfall estimates derived from dual-polarization X-band radar (XPOL) observations during various field experiments in US and the Mediterranean region. The study first conducts independent error analysis of the XPOL precipitation estimates using independent in situ observations from rain gauges and disdrometers. Subsequently, coincident XPOL and PMW rainfall estimates are matched in space and time for a number of convective and stratiform type precipitation events. Standard GPROF PMW retrievals on SSM/I, TMI (2A12) and GPM-DPR observations are used to conduct the error analysis. All coincident XPOL data are extracted for the indicated overpasses to produce the satellite field-of-view averages for the orbital PMW sensor and produce match-ups of PMW/XPOL rainfall and raindrop size distribution parameters. In addition, gridded merged PMW datasets (MWCOMB, 3B40RT) that are used in most merged rainfall products are evaluated against the XPOL measurements. We will present error analysis results of PMW rainfall estimation and investigate dependences on precipitation type, vertical structure and precipitation microphysics (derived from XPOL).