C-band procedure for rainfall estimation using polarimetric measurements

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Due to orographical complex contexts, conventional and polarimetric C-band radar systems are widely used in Italy for meteorological applications. In fact, C-band is a suitable compromise between S- and X-band in terms of non-Rayleigh effects, maximum sensitivity with minimum attenuation of reflectivity and influence of the backscattering phase shift as well as the overall cost. Actually, the Italian weather radar network of the Civil Protection Department will be made up of C-band Doppler radars, some of them with polarimetric capability. Since 1980, in Italy the weather radar polarimetric techniques have been widely studied in order to improve radar rainfall estimation for hydrological purposes and to infer on the microphysical characteristic of cloud and precipitation. This paper presents an integrated methodology which, starting from polarimetric radar measurements, allows to obtain the best rainfall estimation. The procedure takes into account key radar meteorology issues such as: real time calibration check, ground clutter identification, and attenuation correction. The method takes advantage of the synergy between radar measurements of reflectivity factor (Zh), differential reflectivity (Zdr) and specific differential phase (Kdp), as expressed by the self-consistency principle. The methodology is applied to a case study analyzed by means of the ISAC-CNR Polar 55C radar during an intense rainfall event which occurred on 25 September 2006 over the Lazio region (central Italy). A comparison analysis of the method is also performed using rainfall data collected by the Hydrographic regional Office telemetered network.