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On precipitation measurements collected by a weather radar and a rain gauge network

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The present work aims to analyze the correspondence between the rainfall radar estimates and the rain gauges measurements collected at different distances from radar. The radar data utilized in this work have been collected by the Polar 55C weather radar, located in Roma Tor Vergata research area, from 2008 to 2009. The scanning strategy adopted by Polar 55C prefigured the cyclical repetition of eight sweeps in all directions with constant elevation. Each 5 minutes 8 Plan Position Indicators are acquired, each one with a different elevation angle, ranging from 0.5 to 7.5°. This study considers measurements collected at 1.5° elevation. The noise level is determined by supposing that at great distance the sampling volume is likely situated in an atmospheric region above the precipitation. In this way the modal value in the last two range-bins has been chosen as a reference to determine the noise level at the receiver. The range-bins whose reflectivity doesn't exceed noise level were considered affected by noise. The modality developed for the ground clutter removal is based on the existence of typical values for the standard deviations of the differential reflectivity and of the differential phase when the radar return is caused by precipitation. In fact in the presence of meteorological echoes at the receiver, these standard deviations can be expressed by the width of the Doppler spectrum and the co-polar correlation coefficient, about which is well-known the variation range characteristic of rainfall. Only the radar reflectivity which corresponds to meteorological signal was converted into rainfall intensity by using a parametric algorithm. Finally, the radar rainfall intensity values were remapped onto a 1 square kilometre Cartesian grid, by assigning to each pixel the mean of the rainfall values estimated in the radar range-bins belonging to the pixel. Rain gauges located at different distances from Polar 55C were selected so that most of ranges in the scanning circle are covered. Moreover only rain gauges not placed in areas where the radar beam is blocked were considered. The rain gauges data were compared with rainfall radar estimates in the pixels where are located the rain gauges considered. The ratio G/R between rainfall amounts rain gauges measurements and rainfall amounts radar estimates was calculated against the distance from radar, by considering all the events utilized in this work. A trend was found; the greater the distance from the radar, the higher the ratio G/R. Once the trend has been found, a best fitting line was used to find the radar error at a given range and the radar rainfall estimates were consequently corrected.