Methods to Improve Fields of Correlation Coefficient Estimates

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The cross-correlation coefficient (herein referred to as correlation coefficient) is one of the main polarimetric variables. The estimates of correlation coefficient are invalid when they become larger than one, and are qualitatively described as “pink fringe” in the Weather Surveillance Radar – 1988 Doppler (WSR-88D) radar fields. Invalid estimates are caused by: 1) the mismeasurement of noise powers in the horizontal and vertical channels which causes the incorrect scaling of the cross-correlation moduli estimates in the conventional lag-0 estimator, 2) the inherent positive bias in the conventional lag-0 and lag-1 correlation coefficient estimators, and 3) the standard deviation of the correlation coefficient estimates. The first cause can be addressed by using more accurate noise power measurements capable of capturing noise power variations in time, elevation, and azimuth (e.g., radial-based noise power estimation). The second cause is addressed by the use of estimators that exhibit a smaller inherent bias when compared to the conventional estimators (please see the abstract Improved Correlation Coefficient Estimator). The third cause can be addressed by increasing dwell times, but would require changes to the existing scan strategies, which may not be acceptable. The described approaches can decrease the number of invalid correlation coefficient estimates, but cannot entirely eliminate them.

To further improve the appearance of the correlation coefficient fields, two additional techniques are proposed. First, a nearest-neighbor spatial interpolation technique is employed in which an invalid estimate is replaced by a value computed using the surrounding valid estimates, pending a sufficient number exist. Second, in cases where two Pulse Repetition Times (PRT) scans are used at the same elevation (e.g., split cuts in WSR-88D), data from the two scans can be combined to improve the correlation coefficient fields in accuracy and appearance. These two approaches are applied to the correlation coefficient fields produced from real time-series using the radial-based noise estimation and the novel improved correlation coefficient estimator. The results are presented herein.