Performance comparison of receiving filters/algorithms in weather radar.

Andres Martinez Mera
University of Vigo, Spain
Santalla del Rio, Veronica (University of Vigo)

E-mail: veronica@uvigo.es

The accuracy of the power and Doppler parameters provided by a weather radar depends on the available number of independent samples, which is determined by the pulse repetition frequency, the dwell time and the sampling frequency in reception. These relationships between the different parameters lead to a tradeoff between the range resolution, the updating time, the azimuth resolution and the accuracy of the estimates.

Different methods have been proposed to improve the latter such as pulse compression [Ashok S. Mudukutore, V. Chandrasekar, and R. Jeffrey Keeler, Pulse Compression for Weather Radars, IEEE Transactions on Geoscience and Rremote Sensing, vol. 36, no. 1, january 1998] and whitening [Torres, S., C. D. Curtis, and J. R. Cruz, 2004: Pseudo whitening of weather radar signals to improve spectral moment and polarimetric variable estimates at low signal-to-noise. IEEE Trans. Geosci. Remote Sens., 42, 941–949]. While improving the accuracy of the estimates, these methods worsen other parameters of interest such as the signal to noise ratio or “spread” power to adjacent cells. To evaluate and compare the performance of the different alternatives different figures of merit have been defined to quantify the out of cell power spread, the variance decrease and the signal to noise ratio reduction caused by the different methods.

Additionally, other receiving filters (such as the matched filter or the MSE inverse filter) have been considered and implemented. Their performance will be analyzed and compared to previous solutions.