Adaptive Clutter Removal in Operational Dual-Polarization Measurements

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We have developed a ground clutter removal system which is both bin-to-bin and scan-to-scan adaptive. The central idea of the algorithm is to use a predefined set of clutter filters and choose the best candidate by analyzing their output. Using the adaptive method we can remove both strong and weak clutter signals while minimizing artifacts created due to filtering. The selective filtering improves the quality of both single- and dual-polarization meteorological data.

The algorithm is designed to be used in operational dual-polarization weather radar measurements which poses restrictions on signal processing. For example, the system must cope with fast scanning speeds while still producing output in real time. This is achieved by utilizing the CPU's vector processor as well as the GPU acceleration capabilities of a modern PC.

The measurement setup utilizes triple-PRT pulsing which is capable of retrieving velocity information exceeding 50 meters per second with an operating range of 300 kilometers. For testing we have used a C-band radar at Kumpula, Helsinki, with a dwell time of 100 milliseconds translating to roughly 50 I/Q data samples per bin. We have collected and analyzed data from various weather events. The results show that adaptive filtering often produces superior moment data compared to standard schemes as verified by experts in meteorology.