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TIME: 3:30 - 4:30 pm

LOCATION: NCAR Foothills Laboratory
3450 Mitchell Lane, Building 2
Large Auditorium FL2-1022



Using a Regression Filter to Mitigate Ground Clutter Echoes and Improve Signal Statistics

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ABSTRACT

The identification and mitigation of radar ground clutter echoes continues to be an area of research interest. Currently, most weather radars use a Doppler spectrum-based approach to attenuate the ground clutter signal. For example, the NEXRADs use GMAP (Gaussian Model Adaptive Processing) for clutter filtering. In this presentation a regression-based clutter filter is investigated and proposed for ground clutter contamination mitigation.

Since ground clutter echo has primarily a zero-velocity component relative to a ground-based radar, the ground clutter echo is manifest as a power spike centered around the zero-velocity component of the Doppler power spectrum. The ground clutter echo is greatly attenuated by eliminating the part of the Doppler spectrum around zero velocity by setting those values to zero. The radar variables are then calculated from the remaining part of the Doppler spectrum. In order to eliminate as much ground clutter as possible, the time series signal of the clutter echo (with possible weather echo overlaid) is usually weighted by a window function such as a von Hann window or a Blackman window. These window functions taper the leading and end sections of the time series to zero or near zero. This causes the ground clutter signal to cluster around zero velocity. This is simply a property of the finite discrete time Fourier Transform.

A disadvantage of applying a window function to the time series is that it attenuates the signal and eliminates some of the information about the weather signal that may be present along with the ground clutter. This translates to higher measurement standard errors for the weather signal. This disadvantage has been accepted as a necessary feature when using a frequency domain (Doppler spectrum) ground clutter filter, such as GMAP.

Here it is shown that a regression filter suppresses ground clutter echo as well as or better than a “window and notch” technique (e.g., GMAP) but has superior statistical properties. One feature of GMAP is that the width of the notch can be adaptively adjusted to fit the strength of the clutter signal. Here we present an analogous technique where the order of the regression filter can be adapted to the strength of clutter signal present. The performance of the regression filter is analyzed via modeling as well as demonstrated with experimental data from NCAR’s S-Pol radar and NEXRAD data. This new filtering technique should be of interest to anyone who filters or conditions finite length time series.

Live Webcast: <http://ucarconnect.ucar.edu/live>

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