

RDA Clutter Suppression in a Nutshell

As a quick refresher the following is a reprint of an article that was first published in the Autumn 2007 edition of *NEXRAD Now*.

Definitions:

GMAP - Gaussian Model Adaptive Processing (GMAP) is the algorithm that performs clutter suppression in ORDA. The fundamental tenet of GMAP is that clutter targets produce a Gaussian frequency distribution around zero velocity with a known, narrow spectrum width. The starting spectrum width (seed) value used in the WSR-88D is 0.4 m/s. For each range bin, GMAP processes the frequency spectrum to identify the power centered on zero velocity. Using this power value, GMAP calculates a clutter Gaussian having a 0.4 m/s (seed value) spectrum width. GMAP then applies this initial clutter Gaussian to the frequency spectrum. If needed, GMAP iteratively recalculates the clutter Gaussian using successively narrower spectrum width values until only clutter power is defined within the clutter Gaussian. All power within the final resultant clutter Gaussian are assumed to be from clutter and are removed from the spectrum.

If there is sufficient meteorological-like power return (return with velocity) available after the clutter coefficients are removed, GMAP will construct a Gaussian curve from that remaining power spectrum and “rebuild” the meteorological signal power (see, http://www.wdtb.noaa.gov/buildTraining/ORDA/PDFs/Final_Chrisman_Ray.pdf).

Bypass Map - A special map generated for each Elevation Segment that identifies the geographic location of clutter targets (targets with near-zero radial velocity and a narrow spectrum



width) present within the radar’s viewing horizon at the time the map was generated.

Elevation Segment - An Elevation Segment is the grouping of contiguous data collection elevation angles. For the purpose of applying clutter suppression, each grouping (elevation segment) is treated as an individual entity. For more information go to http://www.wdtb.noaa.gov/buildTraining/Build9/pdfs/Joe_AMS_clutter_segments.pdf.

AP - Anomalous Propagation is the non-standard bending of the radar beam, either more or less steeply than expected. AP may result in the beam being trapped in the boundary layer for long distances resulting in significantly more return on the product displays.

Clutter - The broad definition of “clutter” is, “Any return that interferes with the observation of desired signatures on a radar display.”

However, we define “clutter” as stationary, hard (highly reflective), ground-based, non-meteorological targets. Unlike the first definition, this more restrictive clutter definition does not include return from biological targets (insects, birds, etc.), non-precipitable aerosols, and changes in refractive index, which may be implied in the broader definition, above. We use this more restrictive definition to distinguish ground-based “clutter” targets

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from those targets that can and do provide valuable boundary layer information.

From the radar's signal processing point of view, yet another definition needs to be introduced here. Because of the nature of the clutter filtering process, the radar considers ALL returns that have a near-zero radial velocity and a narrow spectrum width as clutter. This definition is important because, when clutter suppression is invoked, the radar performs suppression on all returns that have these characteristics (near-zero radial velocity and a narrow spectrum width).

Clutter Suppression:

GMAP ONLY operates where the operator, via the Clutter Regions window, tells it there is clutter. Within each defined region either the Bypass Map or All Bins can be selected.

Bypass Map - with the Bypass Map selection, ONLY those gates identified on the Bypass Map (within the defined region) will be processed by GMAP. *Use the Bypass Map selection to address routine, non-transient clutter.*

All Bins - with All Bins selected, EVERY gate within the defined region will be processed by GMAP. *Use operator-defined Clutter (Suppression) Regions with the All Bins selection to address transient clutter return caused by AP.*

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