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Recent Progress on the Automatic Quality Control of ELDORA Data

Cory A. Wolff, Michael M. Bell, Wen-Chau Lee, and Huaqing Cai
National Center for Atmospheric Research, Boulder, CO

Introduction

A process for automatic quality control of the data collected by the Electra Doppler Radar (ELDORA) is under development. Fields and techniques have been introduced that are thought to be good candidates for inclusion in an algorithm to automatically remove noise and non-weather returns. This poster presents the performance of an early version of the algorithm when it is run on data collected by the ELDORA during five field programs.

Current Algorithm

Field Name	Field Description	Threshold
NCP	Normalized Coherent Power – effective at removing noise (ELDORA only)	< 0.2
Ground Gate Probability	Determined by elevation angle, aircraft altitude, and beamwidth (flat surface only)	> 0.7
Spectral Width Reflectivity Ratio	Ratio of spectral width to linear radar reflectivity factor (SW / Z)	> 0.6
Speckles	Small areas of isolated echoes – can be along a ray or on adjacent rays	≤ 5 gates

Verification

The cases were chosen to test the algorithm in a variety of different environments. The range of weather conditions is ideal for determining where the algorithm performs well and where it needs work. Each case also has the benefit of having been manually edited by a radar meteorologist, which provides a truth dataset against which to verify the algorithm.

A baseline field was first produced with basic noise and ground removal done using solo. This is because noise constitutes most of a raw sweep and any statistics calculated would be overwhelmed by the large amount of bad data. Starting from a point where the obvious bad gates have been removed makes the measures and their comparisons more meaningful.

Field Program	Date	Description
VORTEX	16 May 1995	Tornadic supercell
IHOP	11 Jun 2002	Pre-convective boundary layer
BAMEX	23 Jun 2003	Mesocyclone in MCS
RAINEX	22 Sep 2005	Mature hurricane (Rita)
T-PARC/TCS08	14 Sep 2008	Pre-depression tropical convection

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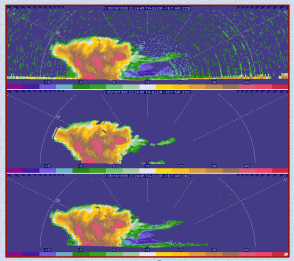
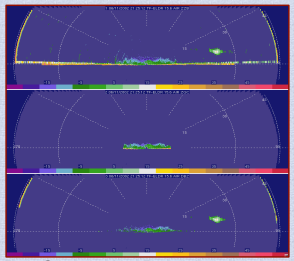
Algorithm Examples

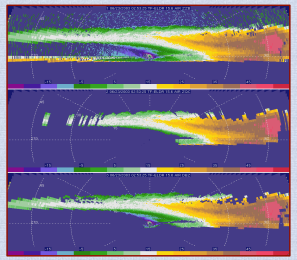
Top = Baseline reflectivity Middle = Reflectivity after automatic QC Bottom = Manually edited reflectivity



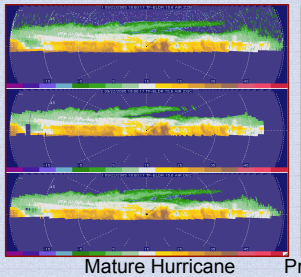
Tornadic Supercell



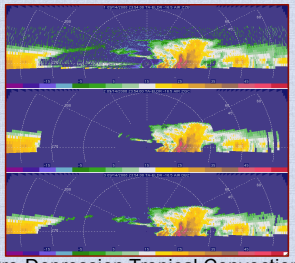
Pre-Convective Boundary Layer *



Mesocyclone



Mature Hurricane



Pre-Depression Tropical Convection

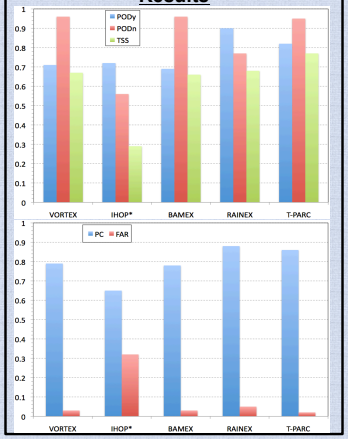
* The algorithm did not include the SW / Z ratio in this case.

Statistics

Automatic QC	Manually Edited: Yes	Manually Edited: No
Yes	A (Hit)	B (False Alarm)
No	C (Miss)	D (Correct Rejection)

PODy (hit rate) = A / (A+C)
PODn (reject rate) = D / (B+D)
PC (proportion correct) = (A+D)/(A+B+C+D)
FAR (false alarm ratio) = B / (A+B)
POFD = B / (B+D)
TSS = PODy – POFD

Results



Summary and Future Work

- There are plans to replace the hard thresholds with interest maps and weighting functions. A new field called "Probability of Weather" will be introduced based on these principles. The user will be able to set his or her own threshold above which gates will be kept and may depend on how the data are to be used or the case itself.
- New fields are also under consideration for inclusion into the algorithm. These are being tested by comparing their values in the baseline data for gates that are kept versus those that are removed in the manually edited data. Fields such as texture, standard deviation, and gradients are being considered.
- The code is freely available online at https://github.com/mmbell/Airborne-Radar-QC