Range-Correction
And
Convective-Stratiform Separation
Algorithms

Presentation to the NEXRAD Technical Advisory Committee

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Purposes of RCA/CSSA

- **Range Correction Algorithm (RCA)**
  - Mitigate rainfall overestimation associated with bright band
  - Mitigate rainfall underestimation at longer ranges

- **Convective-Stratiform Separation Algorithm (CSSA)**
  - Identify areas of shallow and deep convective precipitation
  - Data from convective zones is excluded from RCA adjustment
Operational Needs

• Cool-season radar rainfall estimates often feature bright-band and range-degradation features that affect operational precipitation analyses used in hydrologic forecasting, hydrologic model calibration, parameter estimation

• Mosaic algorithms and local gauge corrections are often inadequate to mitigate these artifacts

• Statement of Need from OS&T and OCCWS in June 2003

• NEXRAD Active Technical Needs: TAC TN-10
Today’s Topics

• Brief explanation of RCA logic
• Brief explanation of CSSA logic
• Illustration of RCA effects on rainfall estimates
• Comparative verification statistics with and without RCA/CSSA
• Real-time field evaluation (underway)
RCA logic

- Construct areal-mean Vertical Profile of Reflectivity (VPR) from latest volume scan, using data close to radar.
- Use VPR to estimate near-surface reflectivity at ranges where lowest radar beam intersects melting layer, snow, or differing hydrometeor distribution aloft.
Technical References


Point reflectivity observations

Mean VPR
Reflectivity Adjustment Curves based on VPR

For 0.5° Tilt

For 1.5° Tilt
Original accumulation:
February 2003
(From DPA products)

Bright-band evident in north-central Virginia, central Maryland

Accumulation with range adjustment:

Bright-band effect mitigated;
Larger accumulations at long ranges
Azimuthal Mean Precipitation As Function of Range
FEBRUARY-MAY 2003, KWX

Range (km)
### Verification Statistics vs. 24-h Gauge Reports
#### FEBRUARY-MAY 2003, KLWX

- **7500 24-h gauge reports with radar precipitation > 0**
- **Mean gauge amount: 9.5 mm**

<table>
<thead>
<tr>
<th></th>
<th>RMSE</th>
<th>Rank</th>
<th>Reduction of Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gage/radar</td>
<td>9.8 mm</td>
<td>0.53</td>
<td>0.28</td>
</tr>
<tr>
<td>DPA</td>
<td>9.8 mm</td>
<td>0.53</td>
<td>0.28</td>
</tr>
<tr>
<td>RCA</td>
<td>9.3 mm</td>
<td>0.62</td>
<td>0.36</td>
</tr>
</tbody>
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RCA limitations

- Use of mean-field VPR is justified only when it is representative of entire umbrella
- Cannot apply when freezing level is very close to ground
- Does not extend effective detection range of radar
- Can be affected by non-precipitation echoes (clutter, insects)
- CPU usage being investigated
Convective-Stratiform Separation Algorithm

- Examines 3-D reflectivity morphology to assess probability that precipitation is convective
- Logic based on maximum reflectivity, horizontal and vertical correlation of reflectivity, vertically-integrated liquid
- Detects relatively shallow as well as deep penetrating convection
Vertically-Integrated Liquid
Site: KINX
Convective Probability
Site: KINX
Convective Classification
Site: KINX
CSSA and RCA

- CSSA is used to filter non-stratiform profiles from input to VPR estimate
- Range correction is not applied near zones judged to be convective (adjustment factor reset to 1 in these areas)
Real-time Field Evaluation

- Carried out for 6 sites, March-June 2004:
  - Portland OR (KRTX)
  - Twin Lakes OK (KTLX)
  - Minneapolis MN (KMPX)
  - Kansas City MO (KEAX)
  - Charleston WV (KRLX)
  - Pittsburgh PA (KPBZ)
- Associated WFO’s and ABRFC, MBRFC
- All products generated at NWSH, communications via LDM
- Graphic product access via secure website
Key Decision Points

Present field evaluation report to TAC (email or VTC) early July 2004

Implementation Readiness Review (internal) July/August 2004

SREC presentation, Fall 2004