AN ADAPTIVE PEDESTAL CONTROL ALGORITHM FOR THE NATIONAL WEATHER RADAR TESTBED PHASED ARRAY RADAR

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Purpose of Developing Pedestal Control Algorithm

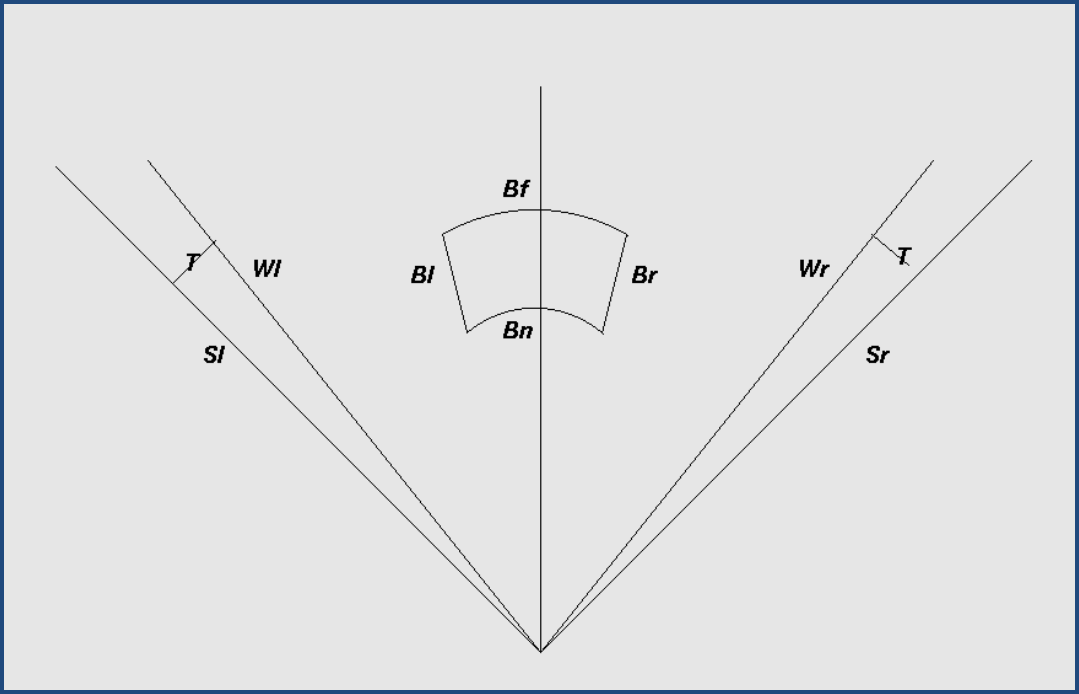
- NWRT PAR has a single array capable of electronically scanning a 90 degree sector
  - Field of view is +/- 45 degrees off broadside
- Operator must rotate the antenna to follow a weather feature
  - Tracking storms generally requires numerous antenna rotations; especially for storms close to the radar
    - Focus taken away from watching weather
    - Determine optimal antenna position
- Data quality
  - Data collection interrupted while operator repositions the antenna
    - The entire process generally requires a minimum of 30 seconds
  - Beam width increases away from broadside
    - 1.5 degrees at broadside
    - 2.1 degrees at +/- 45 degrees
- Demonstrate algorithm control capabilities for adaptive scanning
  - Improvements made to computing infrastructure (Torres et al, 2011)
    - Simplify process of adding new algorithms
    - Demonstrate full control thread

WXTRACK Algorithm

- Algorithm processes reflectivity data inside user defined box
  - Polar box defined by operator
  - Centroid of data inside box calculated
    - Threshold
    - Weighted
      - $W_i = (Z_i - Z_T)^2 + 1$
- Box is repositioned after each scan
  - Centroid of first scan used as anchor
    - Position relative to center of box
  - Box sides adjusted so new centroid matches anchor position relative to box
- Antenna is rotated if box reaches scan window boundary
  - Field of View
  - Tolerance

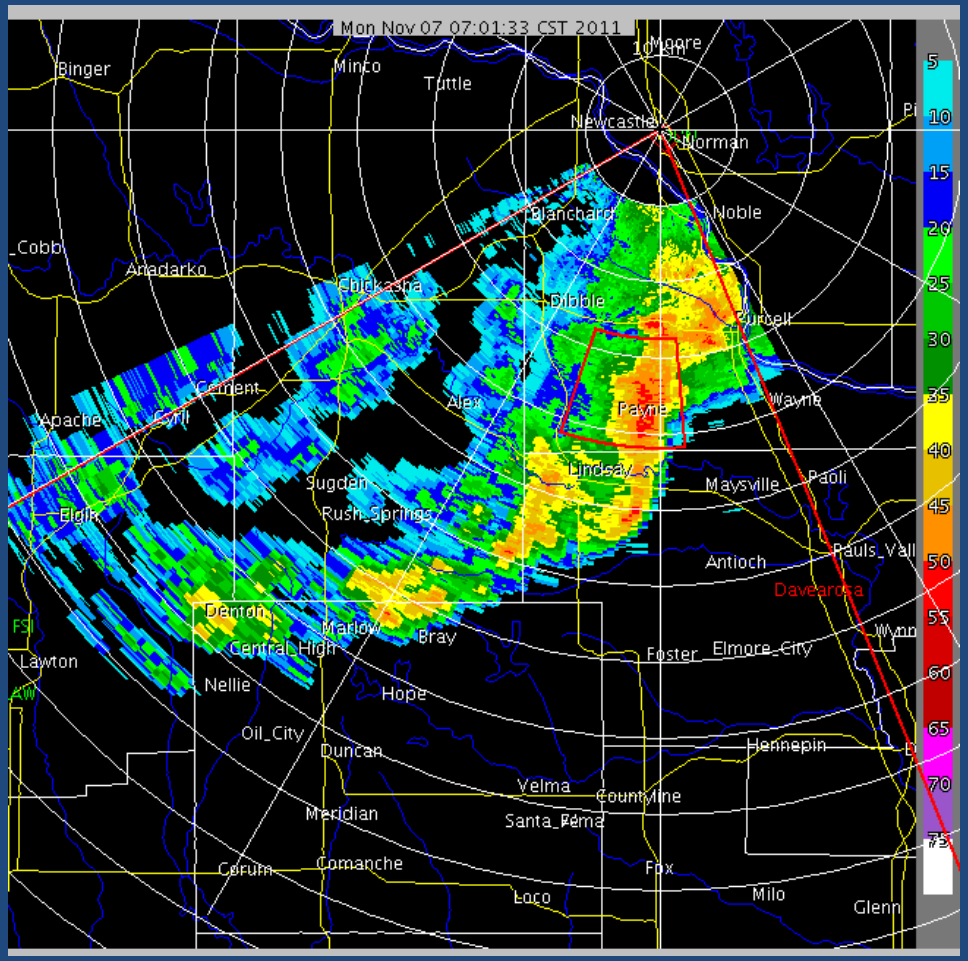
Beam width	Tolerance
2.1	0.0
2.0	3.6
1.9	7.1
1.8	11.4
1.7	16.9
1.6	24.6

Repositioning the Antenna



If Br >= Wr the antenna is rotated clockwise so Bl = Wl+4
If Bl <= Wl the antenna is rotated counterclockwise so Br = Wr-4

Test Case 1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Tuttle
Moore
Newcastle
Norman
Blanchard
Noble
Cobb
Anadarko
Chickasha
Dibble
Purcell
Cement
Apache
Cyril
Alex
Payne
Wayne
Lindsay
Maysville
Paoli
Sugden
Rush_Springs
Elgin
Antioch
Pauls_Valley
Davearosa
Denton
Marlow
Bray
Central_High
Foster
Elmore_City
Lawton
Nellie
Hope
Oil_City
Duncan
Hennepin
Velma
Countyline
Meridian
Santa_Rosa
Comanche
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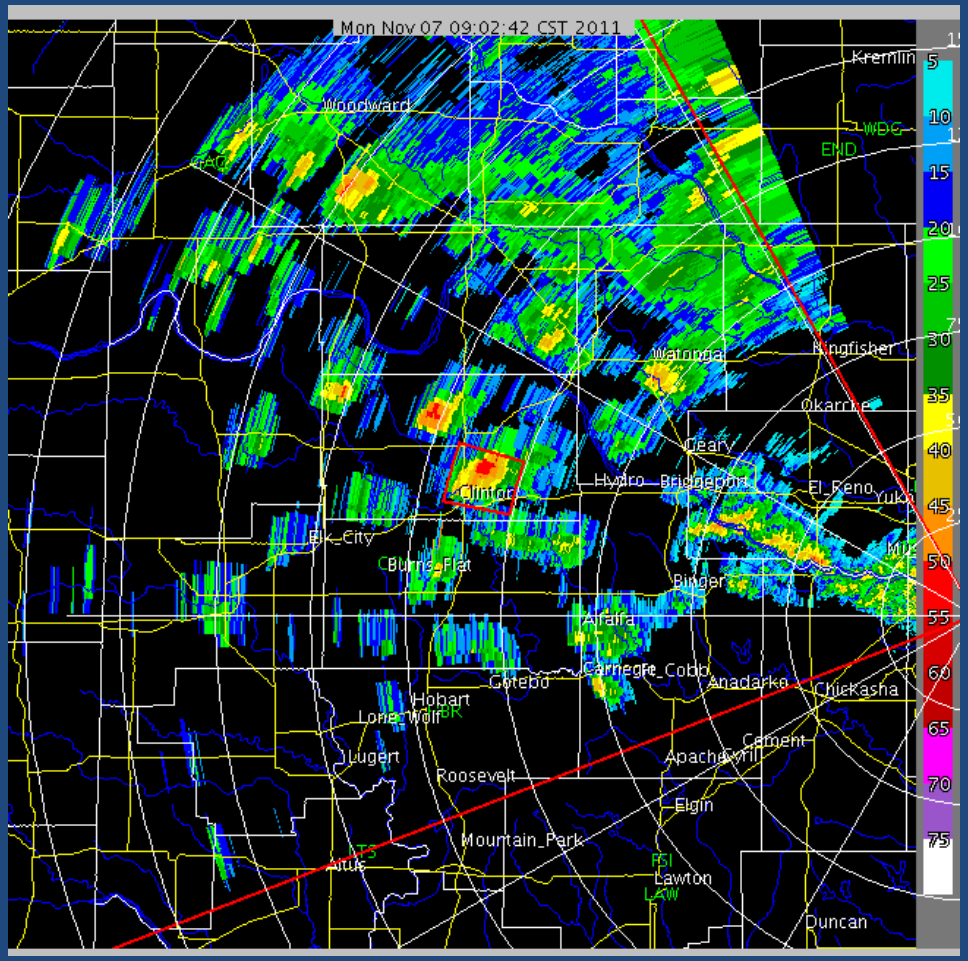
Test Case 2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Bridgeport
El_Reno
Yukon
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Elk_City
Burns_Flat
Binger
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Elgin
Mountain_Park
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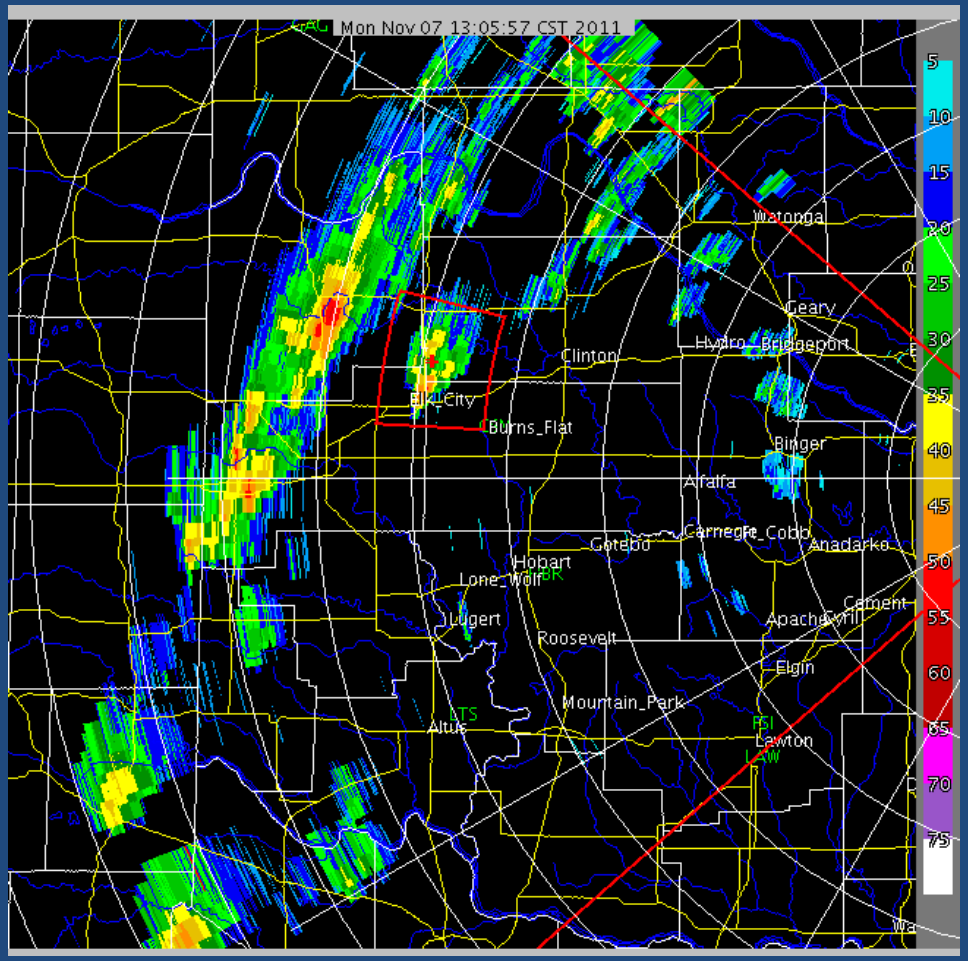
Test Case 3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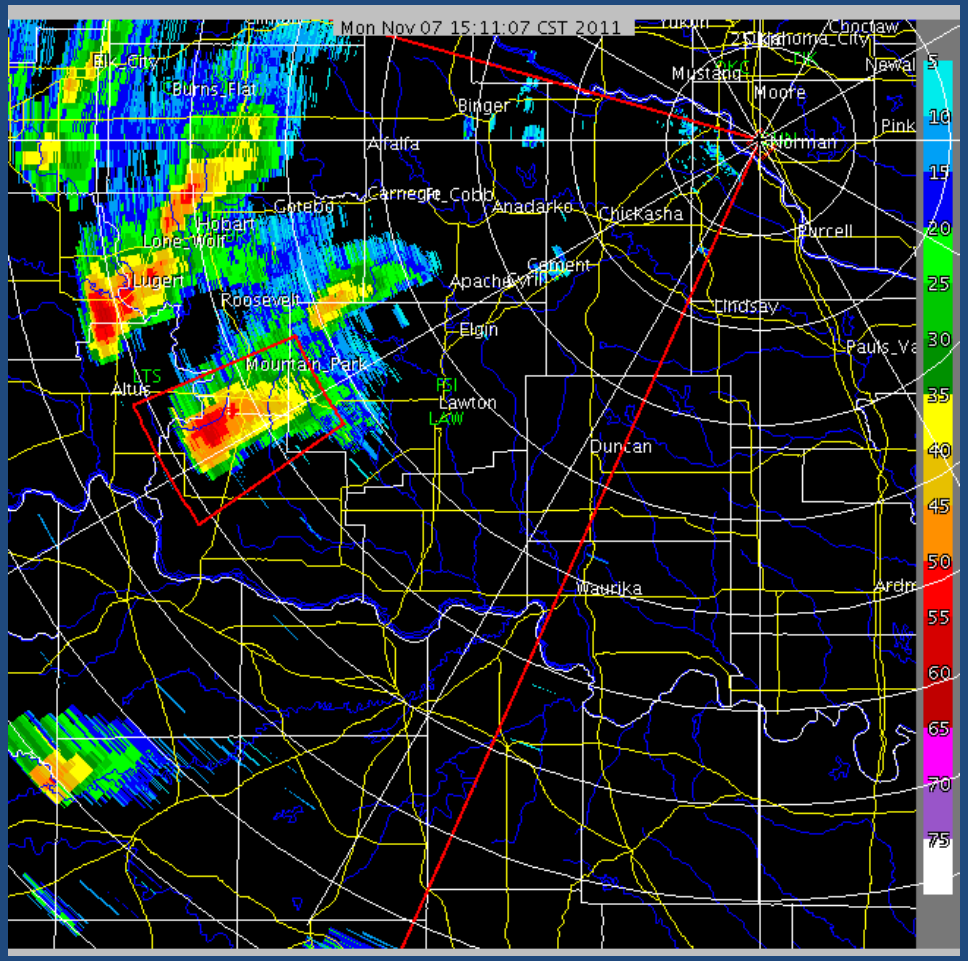
Bridgeport
Clinton
Elk City
Burns_Flat
Binger
Arapaho
Carnegie
Cobb
Anadarko
Gotebo
Hobart
Lone_Wolf
Lugert
Roosevelt
Apache
Cement
Elgin
Mountain_Park
Altus
Lawton

Test Case 4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Burns_Flat
Binger
Alfalfa
Carnegie
Cobb
Anadarko
Chickasha
Hobart
Lone_Wolf
Gotebo
Mustang
Moore
Norman
Purcell
Cement
Apache
Lindsay
Roosevelt
Elgin
Mountain_Park
Lawton
Duncan
Waurika
Choctaw
Newal
Pink
Pauls_Va
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Final Comments

- Algorithm performed well in most of the test cases
  - Best for isolated storms
  - Worse for small embedded storms using small box
  - Time between scans when moving pedestal < 6 seconds
- More testing to be done using different thresholds and tolerances
- 3D option being added to centroid calculation