Organization of Side Lobe Structure from Doppler On Wheels 6 Mobile Radar

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Introduction:

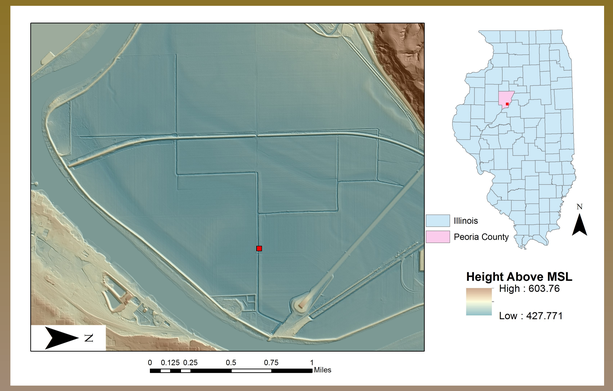
The Doppler on Wheels 6 (DOW 6) mobile radar was used to collect data at Powerton Powerplant located near Pekin, IL on September 28, 2013. Reflectivity images took on interesting characteristics due to radar beam side lobes reflecting ground clutter objects in the area. This study analyzes ground clutter imagery using SOLO3 (a radar visualization program) and trigonometry to determine side lobe energy and organization.

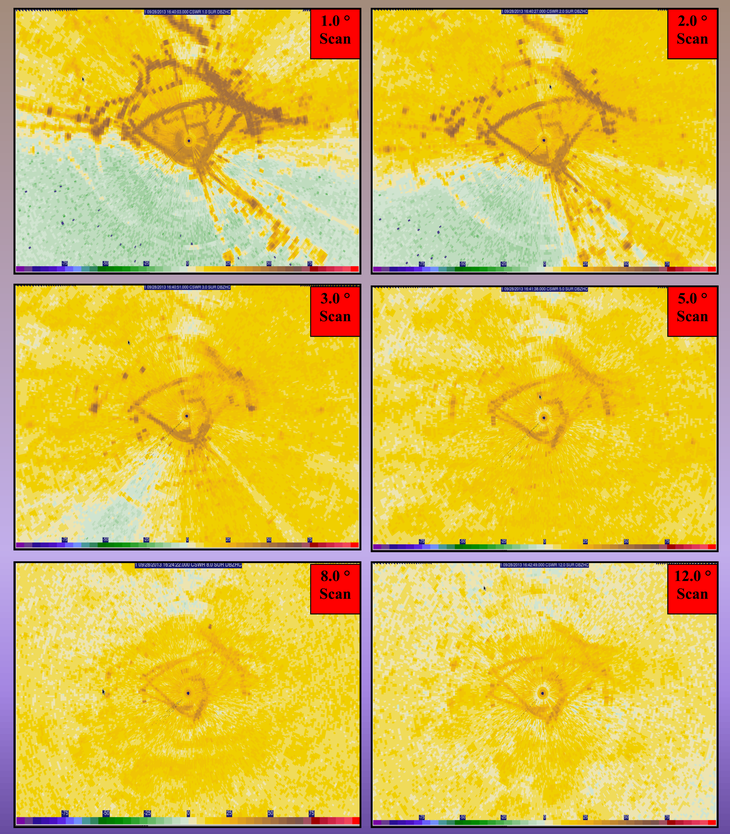
Study Area:

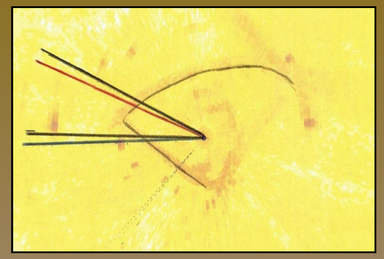
Powerton Powerplant is located in Pekin, IL just south of the Illinois River. The deployment site is located in the farm field north of the powerplant and the river. There is a berm running along the Illinois River and a train track that runs N-S through the study area. These feature show up well in the radar imagery and are used to diagnose side lobe characteristics.

Methods:

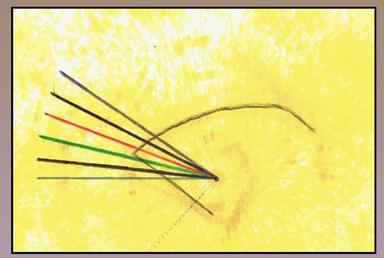
- Data collected using DOW6 mobile radar.
- Trigonometry was used to find height of main radar beam above the ground at distance of berm and train track.
- SOLO3 and trigonometry used to determine lateral angle between side lobes and vertical angle between the main beam and side lobes at each elevation scan.
- Use SOLO3 to find backscatter strength for side lobes at each elevation scan.

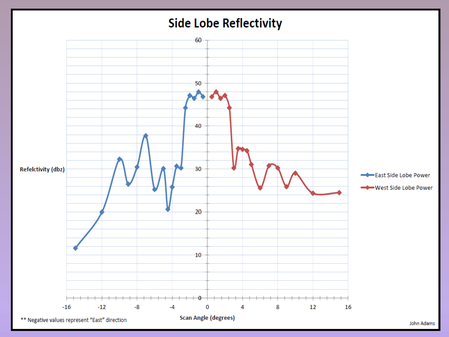


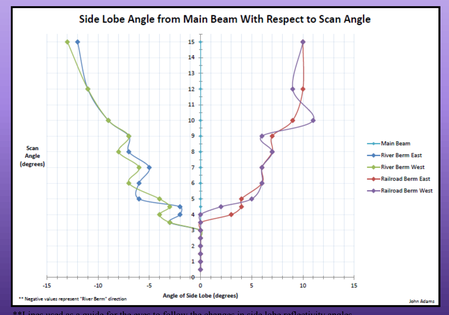




- Determine side lobe angles using trigonometry.
- Colors correspond to Side Lobe Angle plot below.
- **Black** line represents main beam.
- **Red** and **Purple** lines are west side lobes.
- **Green** and **Blue** lines represent east side lobes.
- Angle between Black line and colored lines represent angle of side lobe with respect to main beam.







**Lines used as a guide for the eyes to follow the changes in side lobe reflectivity angles

Results and Conclusions:

- The radar image for 1.0° elevation angle shows the berm and train track clearly. This is expected since the radar beam width for the main beam is 1°.
- There is side lobe energy directly below the main beam since the berm and train track are present at elevation angles between 0.5° and 3.5° even though the main beam should be too high to reflect objects.
- The berm and train track reflectivity returns split (show up as two berms and train tracks) at 3.5° elevation scan.
- Above the 3.5° scan angle, the split suggests that there is a change from side lobe energy directly under the main beam to side lobe energy on either side of and below the main beam.
- Reflectivity power varied as scan height increased indicating complex side lobe structure that did not change linearly with height.

In conclusion, there is a side lobe structure below the main beam from 0.5° to 3.5°. Above this scan angle the ground clutter objects appear to split indicating two side lobe structures as the elevation angle increases.

Future Research:

Future research should utilize GIS software and the Line of Sight tool to better determine the changes in side lobe energy and structure with scan height.

Acknowledgements

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