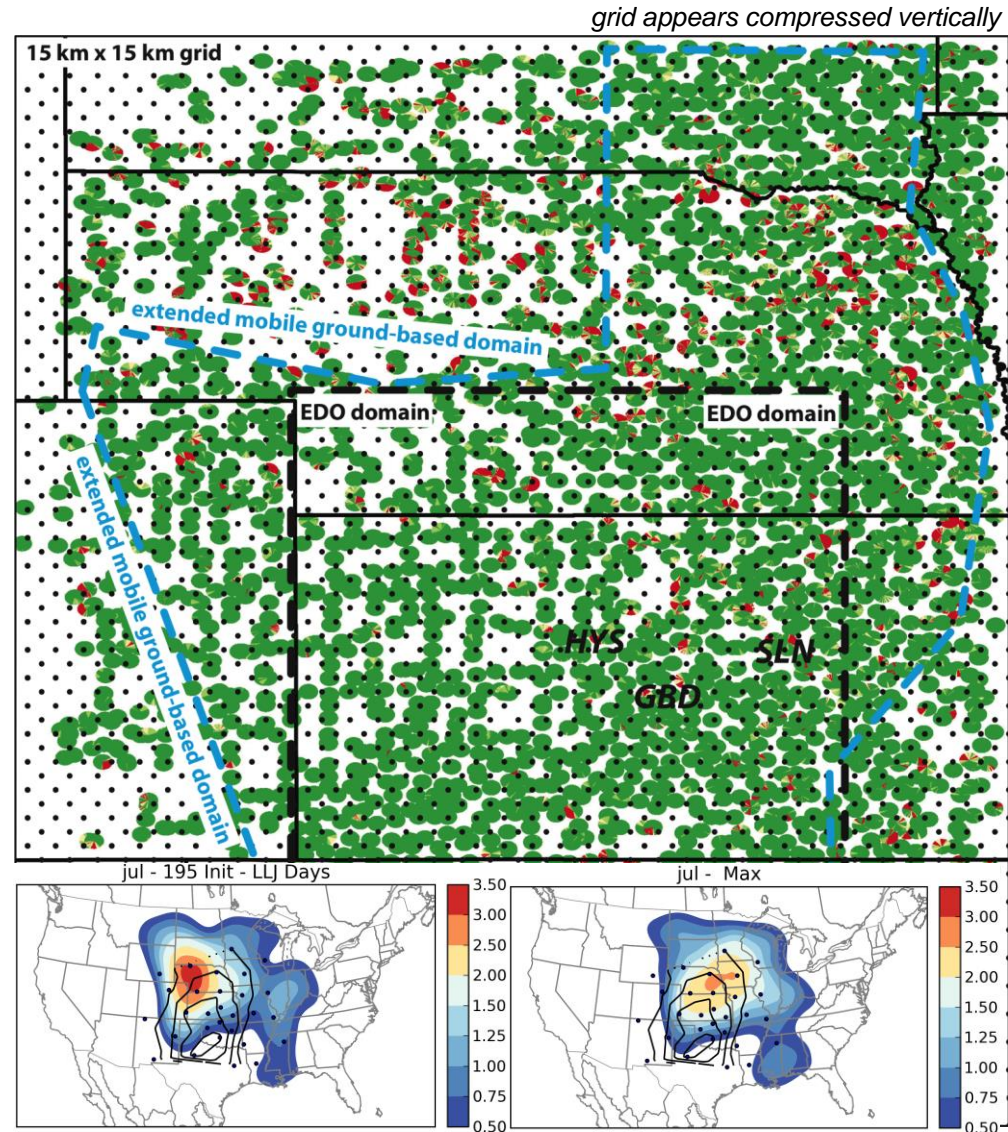


Mobile radar site characterization

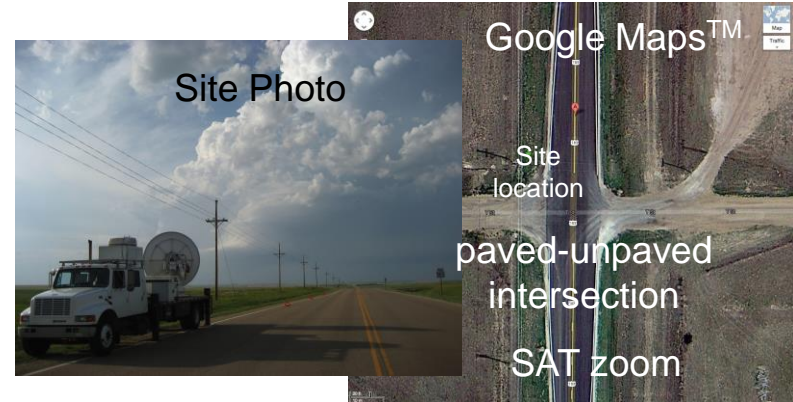
Conrad Ziegler, NSSL

- ❑ NSSL has derived pre-selected mobile radar sites for nocturnal deployments. (Sites are also useful for PISAs & soundings.)
- ❑ Sites cover extended PECAN domain to facilitate possible longer missions if insufficient MCS, CI, or Bore cases nearer Hays & earlier in field phase
- ❑ Sites are rasterized to 15 km staggered grid with up to 5 sites/GP. GP coordinates (IX, JY, NRANK), where (IX, JY) is position and NRANK = rank-order (1-5). Plotted sites have NRANK = 1
- ❑ Some GPs have < 5 (or even 0) sites
- ❑ Extended siting for e.g., MCSs in eastern CO/NE & southeastern SD in June-July & up to 5 sites/GP yields ~12,600 total sites

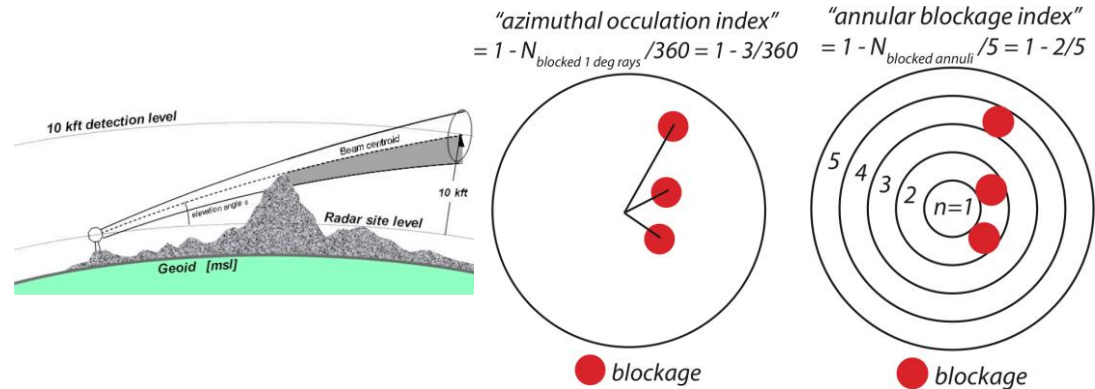


Objective characteristics of ideal mobile radar sites

- ❑ Road type (rating):
 - Paved-paved intersection (“best”)
 - paved-unpaved intersection (“2nd-best”)
 - paved road shoulder (“3rd-best”)



- ❑ Minimal low-level scan blockage:
 - azimuthal occultation (“best”)
 - annular blockage (“2nd-best”)



- ❑ Small radial distance to nearest gridpoint
(but blockage and road type are much more important)

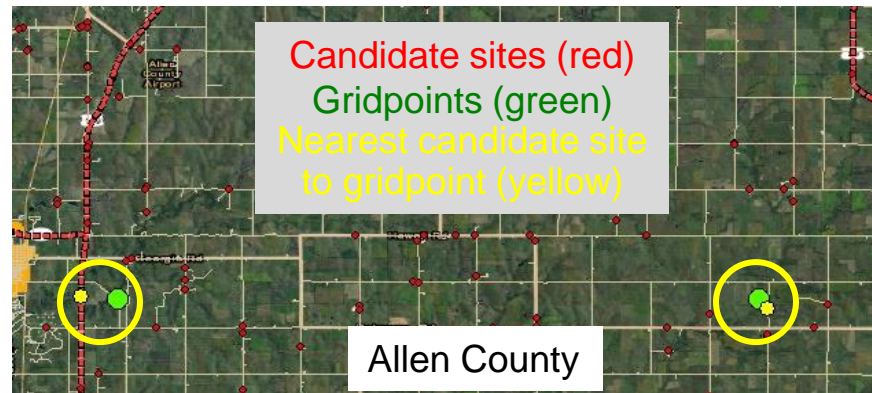
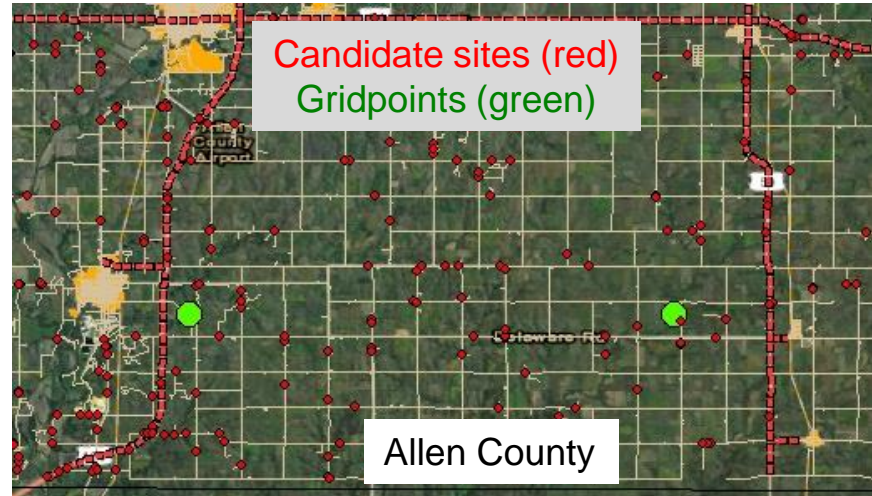
GIS site selection procedure

- ❑ Site selection is objectively handled using ArcView™ software and GIS datasets
 - TIGER-2010 census road shapefiles
 - State DOTs paved-unpaved shapefiles
 - 1 arc-sec (~30 m) USGS National Elevation Dataset (NED)
 - 1 arc-sec (~30 m) USGS land use dataset (from which tree cover is extracted)
 - 10 m tree height is added to NED elevation to calculate blockage with augmented hghts
- ❑ NSSL-authored ArcView plug-in Python scripts obtain candidate parking sites
 - select candidate sites from road database following objective characteristics
 - sites in/near population areas are rejected outright
 - sites with serious annular blockage are rejected outright
 - remaining candidates have azimuthal blockage computed from virtual 360 deg scans
 - hybrid virtual scan images are computed for all sites

Candidate sites and gridpoints

- ❑ Look at Allen County KS from older example assuming a 20 km grid
- ❑ apply objective siting rules in ArcView:
 - spaced along paved S1100 or S1200 roads;
 - paved-paved or paved-unpaved intersections S1100/S1400, S1200/S1400, S1100/S1200
- ❑ Upper panel: shows candidate sites from ArcView (red) and gridpoints (green)
- ❑ Lower panel: same as upper panel but shows nearest candidate site to each gridpoint (yellow)

(GIS analyses/images courtesy Ami Arthur, CIMMS/NSSL)



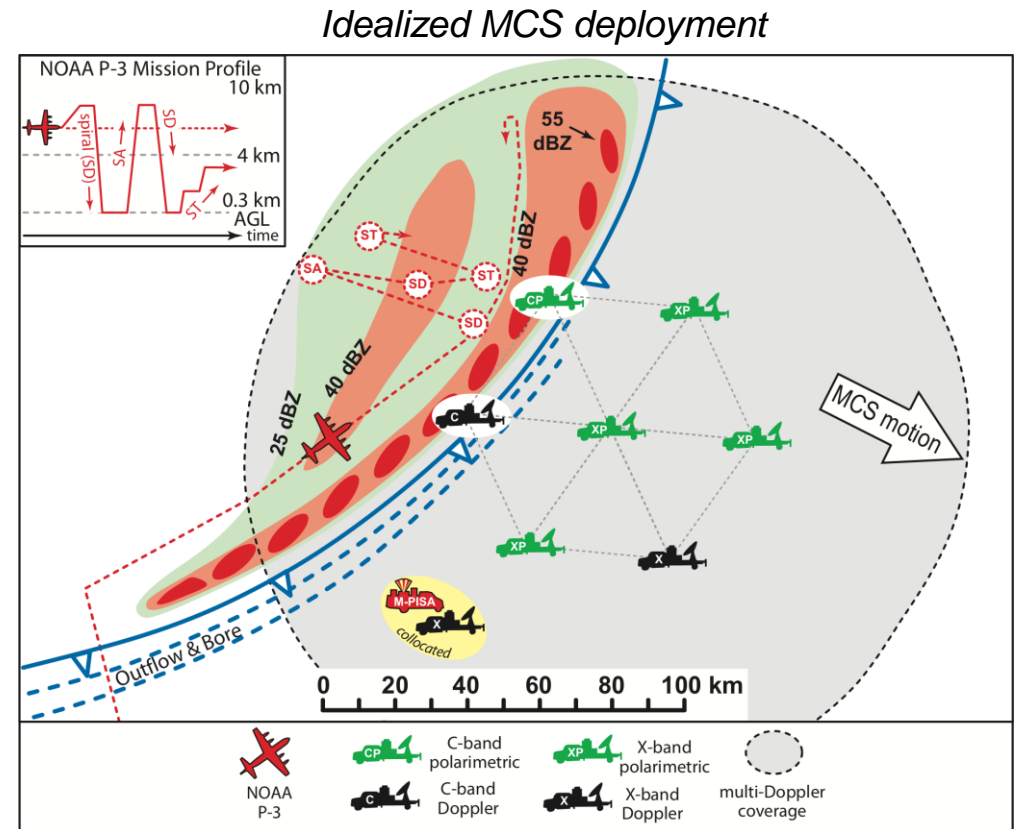
Ascii-formatted site listing dataset

- ❑ Header includes number of sites at each rank and (NX,NY) dimensions of staggered grid
- ❑ Data records (1/site) ordered from LL to UR of grid (all sites/GP) from SW (0,0) to NE (47,77)

N1	N2	N3	N4	N5	NX	NY							
2826	2681	2530	2372	2211	48	78							
I	J	L	WGT	RQI	ABI	AOI1	AOI2	AOI3	RDI	LAT (deg)	LON (deg)	HGT (m MSL)	
0	0	1	0.8194	1.0	1.0000	1.0000	1.0000	1.0000	0.0972	34.794250	-103.777551	1484.657958	
0	0	2	0.7915	1.0	0.9333	0.0906				34.822549	-103.742289	1494.605712	
0	0	3	0.7693	0.8	1.0000	0.2466				34.808827	-103.775906	1493.475219	
0	0	4	0.7541	0.8	1.0000	0.1703				34.794273	-103.795162	1486.733154	
0	0	5	0.7427	0.8	1.0000	0.1135				34.808803	-103.757007	1489.469116	
•													
•													
•													
28	21	1	0.7887	0.8	1.0000	1.0000	1.0000	1.0000	0.3437	37.527816	-99.320685	704.773681	
28	21	2	0.7548	0.8	0.9667	0.2408				37.542482	-99.320931	698.050415	
28	21	3	0.7490	0.8	1.0000	0.1452				37.494000	-99.461953	732.783630	
28	21	4	0.7448	0.8	1.0000	0.1241				37.454649	-99.320510	694.167236	
28	21	5	0.6007	0.8	0.5000	0.4037				37.498394	-99.320184	681.280273	

Geometric constraint on selecting mobile radar sites

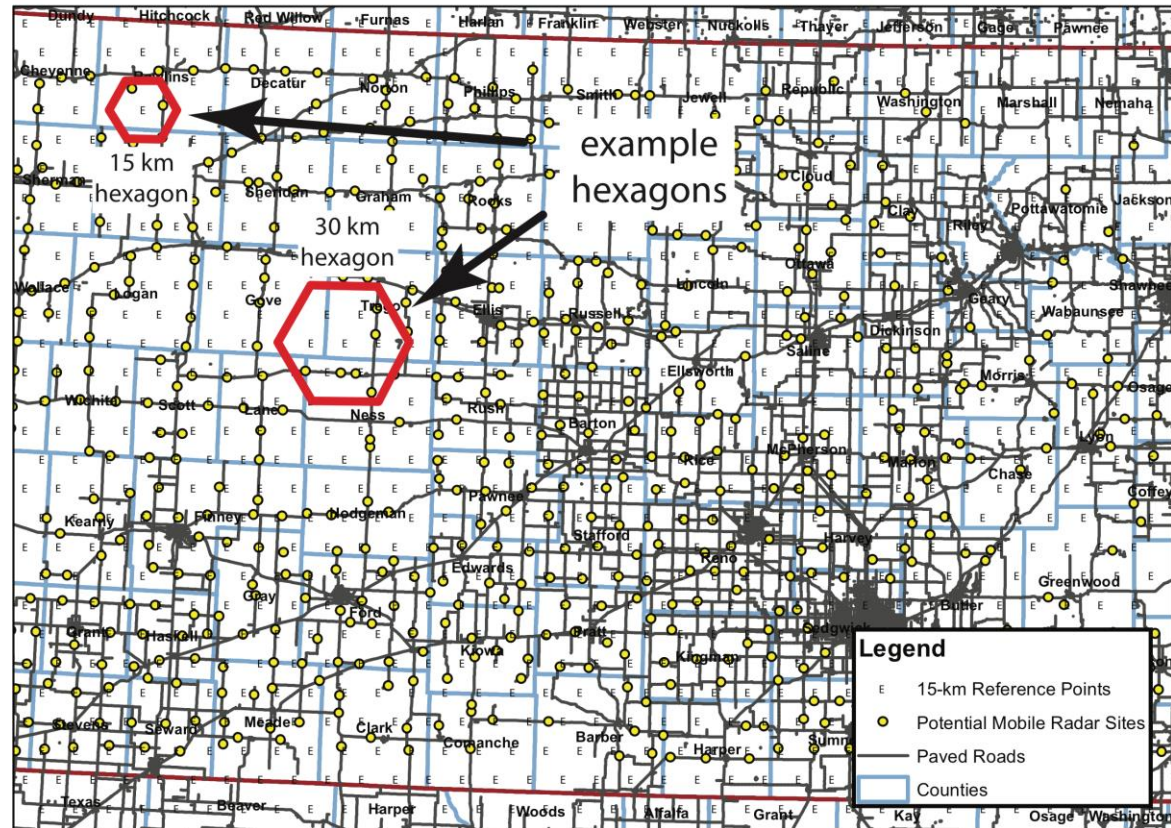
- ❑ Consider example idealized MCS deployment using mobile radar sites.
- ❑ Consider mobile radars only
- ❑ Basic equilateral triangular element of “radar hexagon” is optimal. Slight deviation d of baseline length R is acceptable ($d \ll R$). Depends on available sites.
- ❑ “Sub-arrays” composed of triangular elements are optimal for cases with < 7 radars.



Choosing sites relative to hexagon & gridpoints

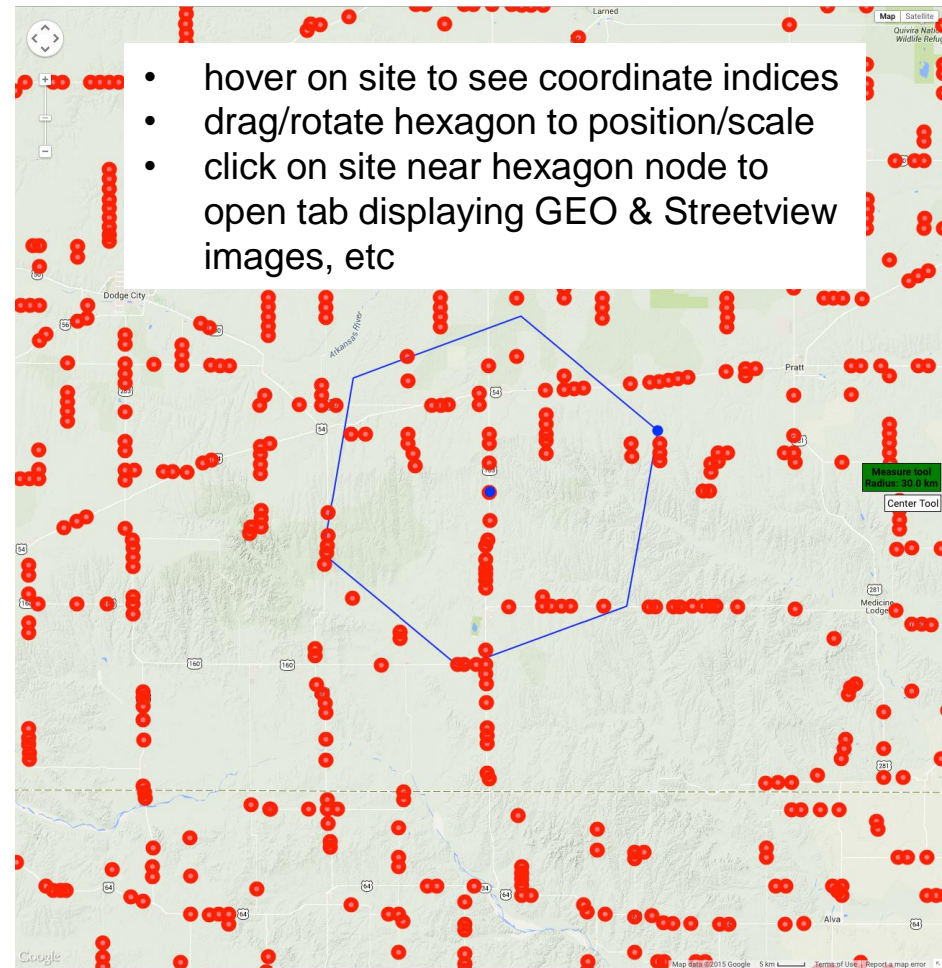
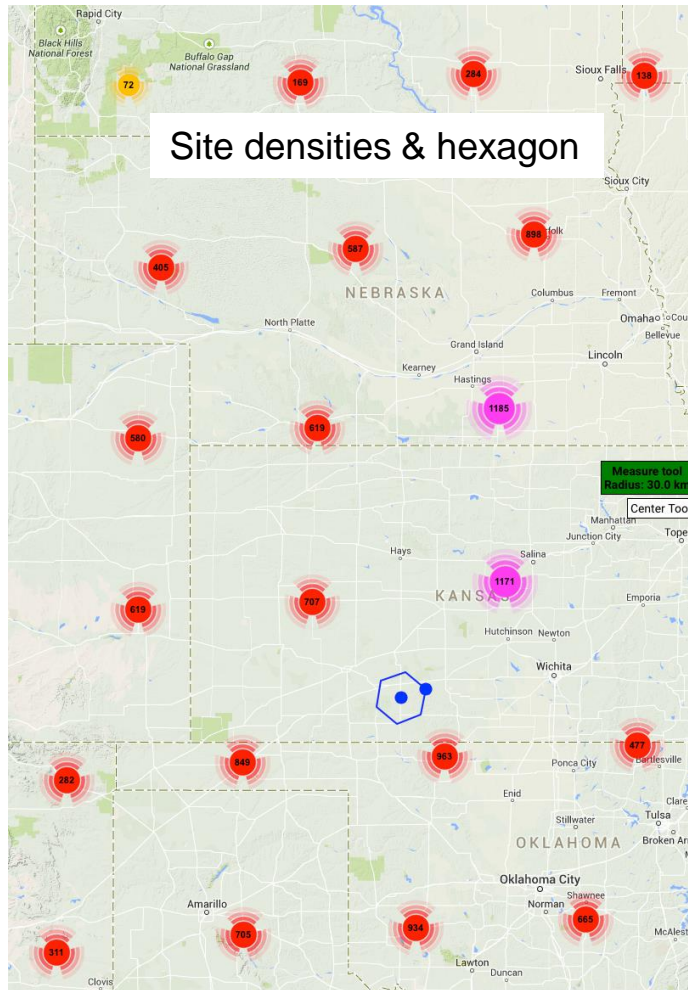
- ❑ Example shows radar sites & gridpoints in KS
- ❑ Two hexagons that would typically be used in PECAN
 - 15 km face (e.g., CI & pure Bore cases with no MCS)
 - 30 km face (MCS case)

Kansas Potential Mobile Radar Sites



Locating hexagon & choosing sites for a PECAN IOP

NSSL “PECAN Site Explorer”: www.nssl.noaa.gov/projects/shave/pecan (display/select sites with hexagon tool)



Example site images

- Google terms-of-use do not allow mass-storing content
- Solution: on-demand images generated using Google APIs
- Images are ~ 30 kB and quite suitable for rural bandwidth

Location: 37.454649 -99.32051 | Site: 28 21 4

BIRD'S-EYE (ZOOM | 150 foot radius)



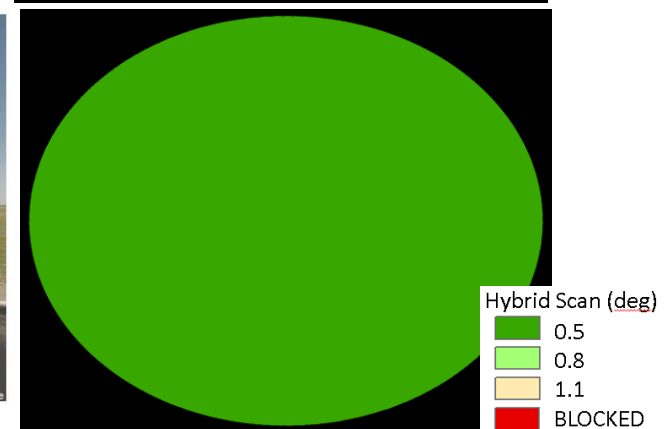
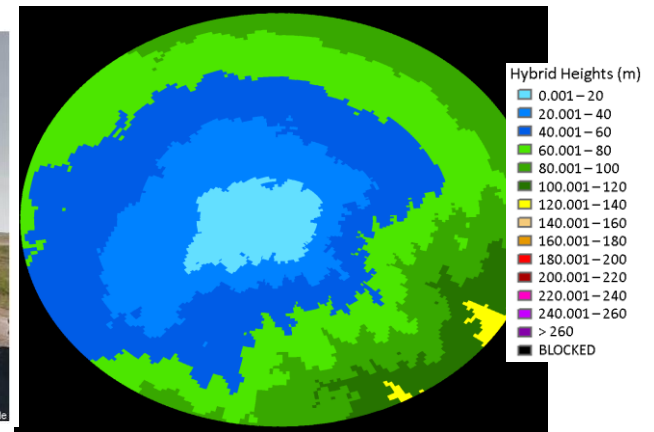
NORTH (FOV: 120 degrees)



WEST (FOV: 120 degrees)



Hybrid scan blockage images from ArcView (Top: height of lowest unblocked gate; bottom: elevation angle of lowest unblocked gate)



Site tools for mobile users

www.nssl.noaa.gov/projects/shave/pecan/mobile.html

Select desired image(s) in limited bandwidth

Look up site:

X:

Y:

Site:

Images:

Zoomed bird's-eye
(~0.1 mi radius)

Wide bird's-eye
(~4 mi radius)

North

East

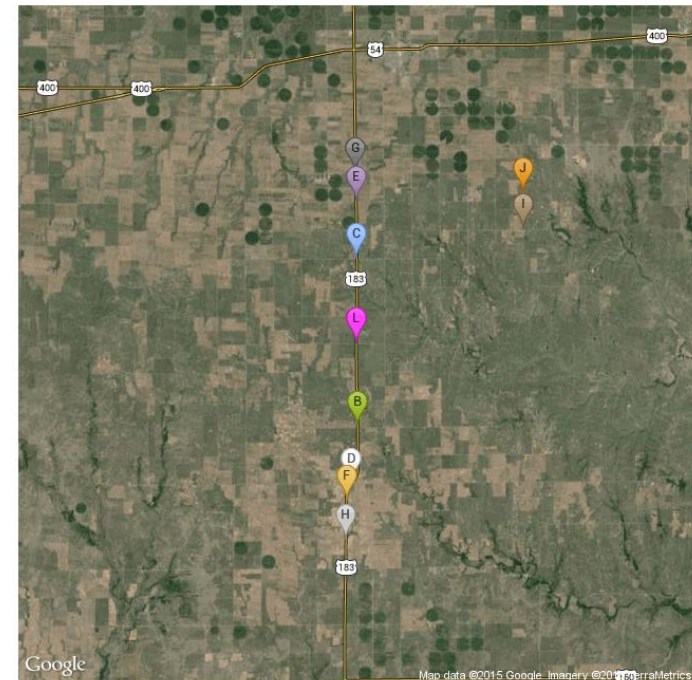
South

West

www.nssl.noaa.gov/projects/shave/pecan/nearme.html

Find sites closest to (variable) input location

18 sites are near you within 15 km (Closest 10 are displayed; 'L' current location)



Site (distance): X Y SITE

A (0.00 km): 28 21 4
B (4.81 km): 28 20 2
C (4.86 km): 28 21 5
D (8.04 km): 28 20 1
E (8.14 km): 28 21 1
F (9.08 km): 28 20 5
G (9.77 km): 28 21 2
H (11.30 km): 28 20 4
I (11.57 km): 29 21 1
J (12.87 km): 29 21 5