Quality Control Techniques for Precipitation Radar

A. Theisen[1], S. Collis[2], S. Giangrande[3], and R. Peppler[1]

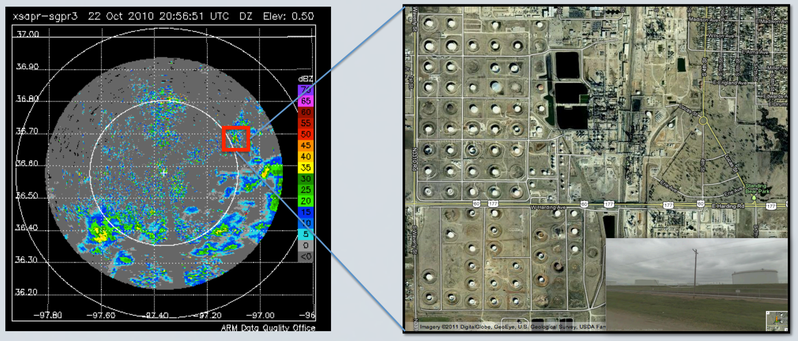
1-ARM Data Quality Office, CIMMS/University of Oklahoma Norman, OK

2-Argonne National Laboratory

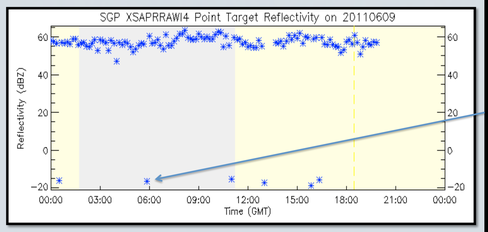
3-Brookhaven National Laboratory

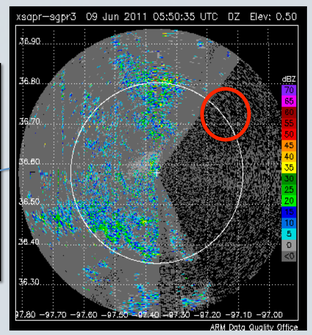
Point Targets

- Isolated point targets can be useful for gaining health and status information about an individual radar
- A point target can be anything that returns a signal, including buildings, radio and water towers, railroad tracks, bridges, etc…
- Point target reflectivity can be tracked over time and used to calculate the radar beam pattern



Reflectivity from the SGP XSAPR at I4 (SE). The point target is bounded by the red box. The map shows the points targets detected by the radar.

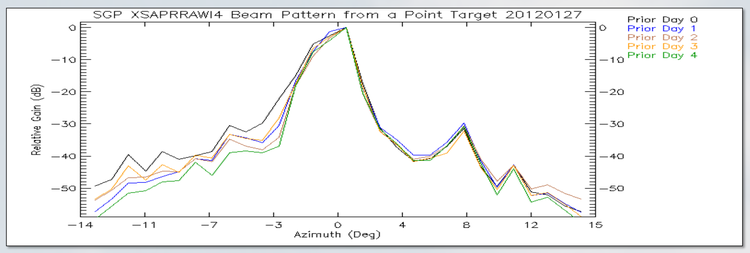




Time series of point target reflectivity and a PPI of reflectivity during a period of failing QC.

Beam Patterns

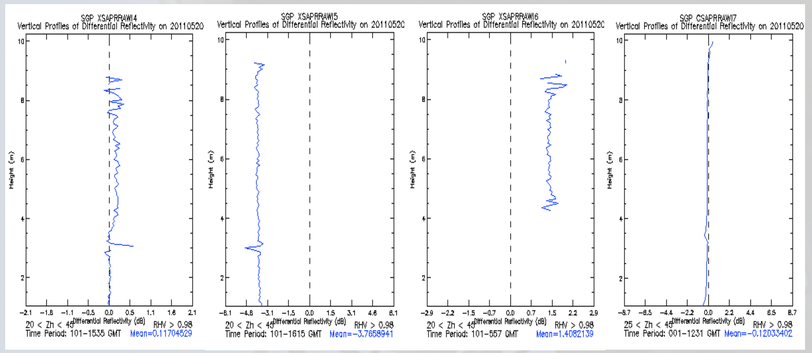
- Point targets can be used to determine a rough beam pattern of a radar's antenna
- Radars do not radiate energy uniformly, beam patterns can indicate how the energy is radiated from the radar



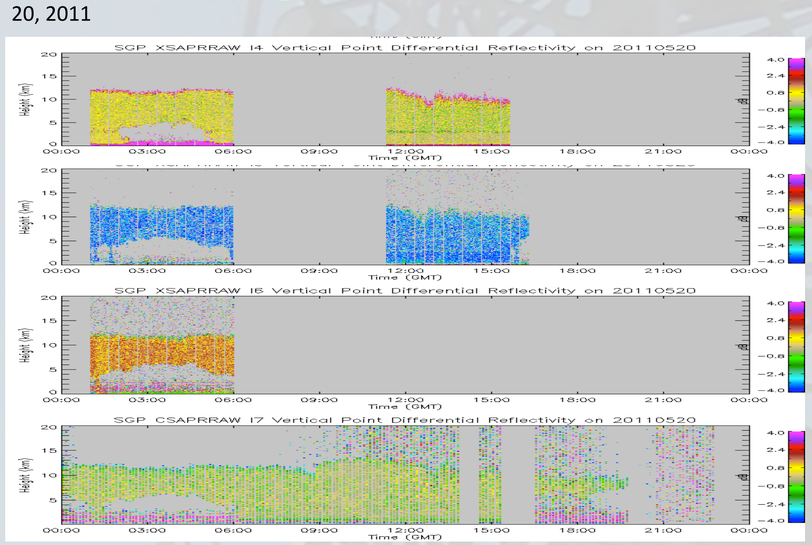
Average daily beam pattern calculated from a point target for the current day and past 4 days.

Differential Reflectivity Average Profiles

- Differential reflectivity, Z_{dr}, is the ratio of the power returned in the horizontal plane to that returned in the vertical plane; it gives an idea of the hydrometeor shape
- Rain should "look" circular to the radar when view from directly below and Z_{dr} should be around 0 dB
- Offset from 0 dB may indicate a bias with the radar



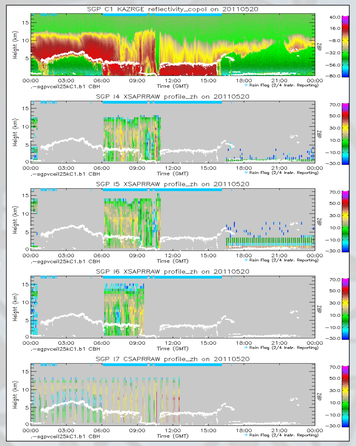
Average vertical profiles of Z_{dr} (dB) for the XSAPRs (I4, I5, I6) and CSAPR (I7) on May 20, 2011



Vertical profiles of Z_{dr} for the XSAPRs (I4, I5, I6) and CSAPR (I7) on May 20, 2011

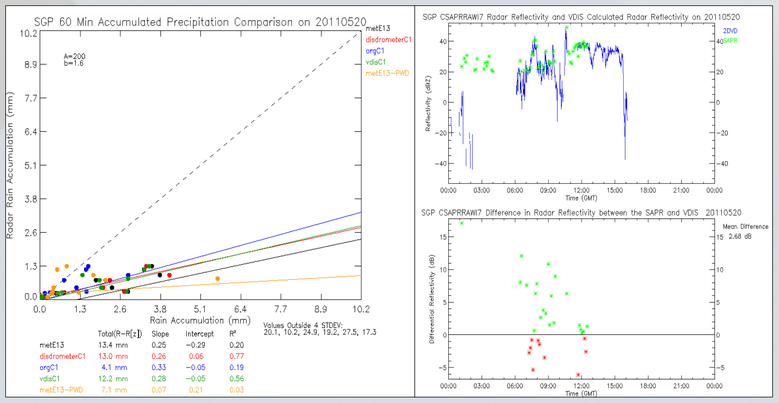
Instrument Comparison

- Profiles of radar reflectivity over the CF's are extracted for comparison (right)
- VCEIL cloud base heights (white) and surface precipitation flags (blue) overlayed
- Lidars, wind profilers, and disdrometers are also used in comparisons (not shown)



Surface Precipitation Comparison

- Rain rates are calculated over the SGP Central Facility using a Marshall-Palmer Z-R relationship
  - A=200, b=1.6
- 60 minutes accumulations calculated from the radar are compared with surface precipitation instruments (left)
- Reflectivity from the CSAPR is compared with the 2D video disdrometer calculated radar reflectivity (right)



(Left) 60-minute accumulations from the CSAPR vs. surface precipitation instruments. (Right) CSAPR and 2DVD reflectivity comparison

- Surface precipitation instruments were analyzed to determine past performance relative to one another to better profile future comparisons with the radars

Average percentage of total precipitation measured compared with a "truth" instrument **()** for 2011. **[#]** indicates the number of events recorded for each instrument.

	VDIS	DISDROMETER	ORG	PWD	TPS	RAIN+
SGP C1 **(vs. MET TBRG)**	81.5% **[47]**	103.8% **[77]**	84.6% **[74]**	58.3% **[77]**	-	127.3% **[77]**
TWP C3 **(vs. MET TBRG)**	110.2% **[92]**	106.2% **[146]**	98.2% **[146]**	102.0% **[146]**	-	166.5% **[141]**
TWP C1 **(vs. MET TBRG)**	67.3% **[249]**	-	111.0% **[247]**	62.5% **[248]**	-	169.4% **[240]**
NSA C1 **(vs. MET PWD)**	-	-	-	-	47.1% **[53]**	-
GAN M1* **(vs. Local Obs)**	84.8% **[43]**	-	199.5% **[62]**	71.3% **[62]**	-	90.3% **[61]**

*GAN data was taken from 10/01/2011 to 2/9/2012
+Data from the RAIN instrument had a moving average of 15 minutes applied to it

Standard deviation of average percentage for 2011. Lower values indicate instrument was more consistent in its measurements

	VDIS	DISDROMETER	ORG	PWD	TPS	RAIN+
SGP C1 (vs. MET TBRG)	**0.42**	**0.78**	**1.02**	**0.67**	**-**	**2.08**
TWP C3 (vs. MET TBRG)	**0.81**	**0.62**	**0.83**	**0.50**	**-**	**2.86**
TWP C1 (vs. MET TBRG)	**0.45**	**-**	**0.36**	**0.51**	**-**	**2.98**
NSA C1 (vs. MET PWD)	**-**	**-**	**-**	**-**	**0.49**	**-**
GAN M1* (vs. Local Obs)	**0.53**	**-**	**1.04**	**0.29**	**-**	**0.93**

*GAN data was taken from 10/01/2011 to 2/9/2012
+Data from the RAIN instrument had a moving average of 15 minutes applied to it