



A Meteorologist Embedded with Engineers

Jan. 15th, 2020
Session 10A.4



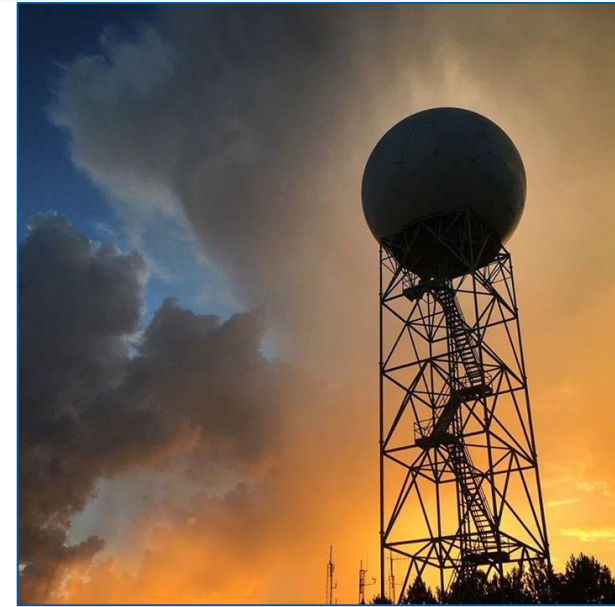
Jami Boettcher
Research Assistant
OU/CIMMS, NOAA/NSSL

Feng Nai
Research Scientist
OU/CIMMS, NOAA/NSSL



Beyond NEXRAD

- 2017 NSSL study: how varying radar designs effect base data quality
 - Onboard Meteorologist with NWS experience
- Two-way learning guided our studies
 - Results salient for NWS



My perspective of this work

Why Me?



Warning Decision Training Division

WDTD eLearning

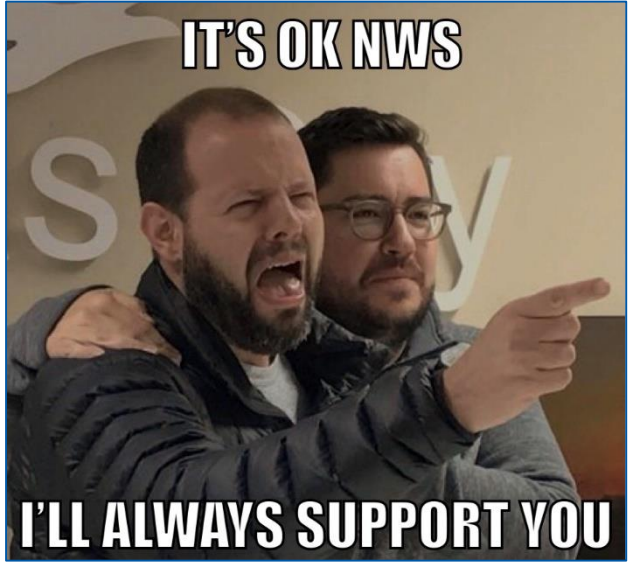
Jami Boettcher
Instructor

Base Data
Quality

Dual-Polarization Radar Operations Course

Dual-Polarization Radar Principles
RDA Build 12.0 Lesson 1

*AKA The **Really** Cool Stuff About Weather Radar*

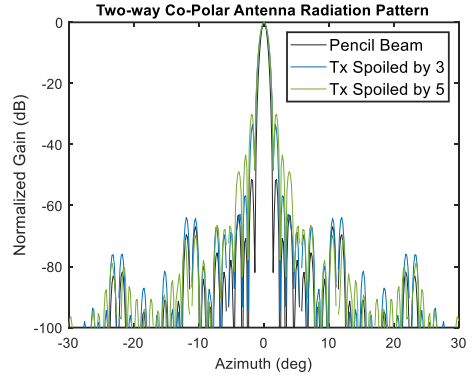
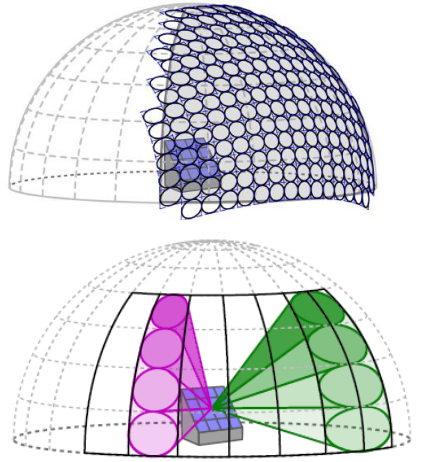
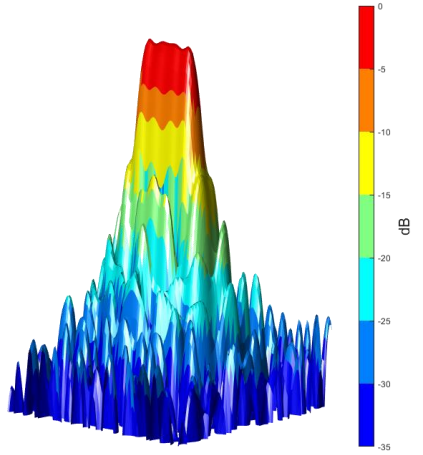
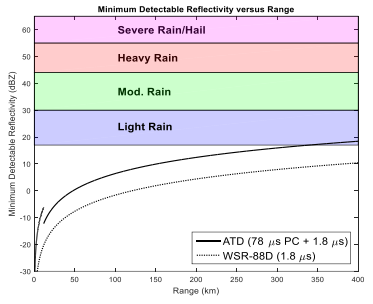


- Jami 2.0
 - Range sidelobes
 - Pulse compression
 - Resolution \neq spatial sampling

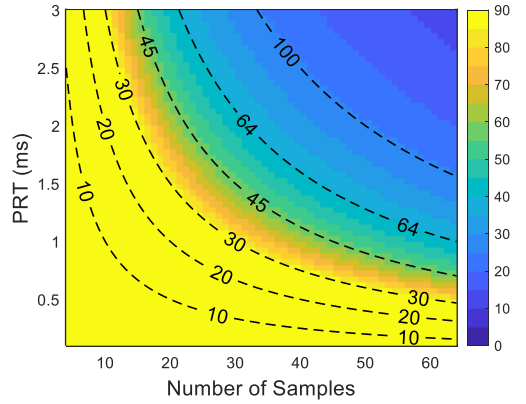
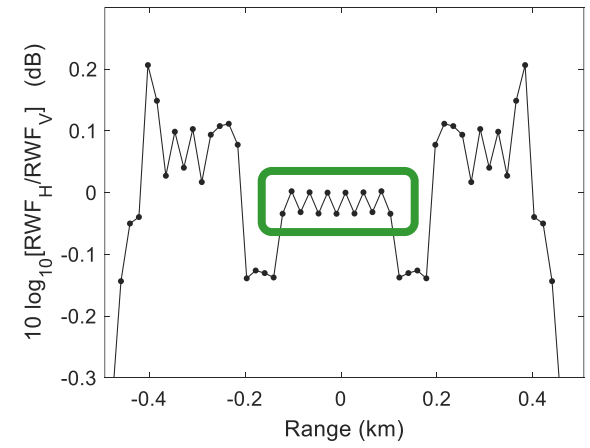


Advanced Radar Techniques (ART) Team

- Yes, they are that good

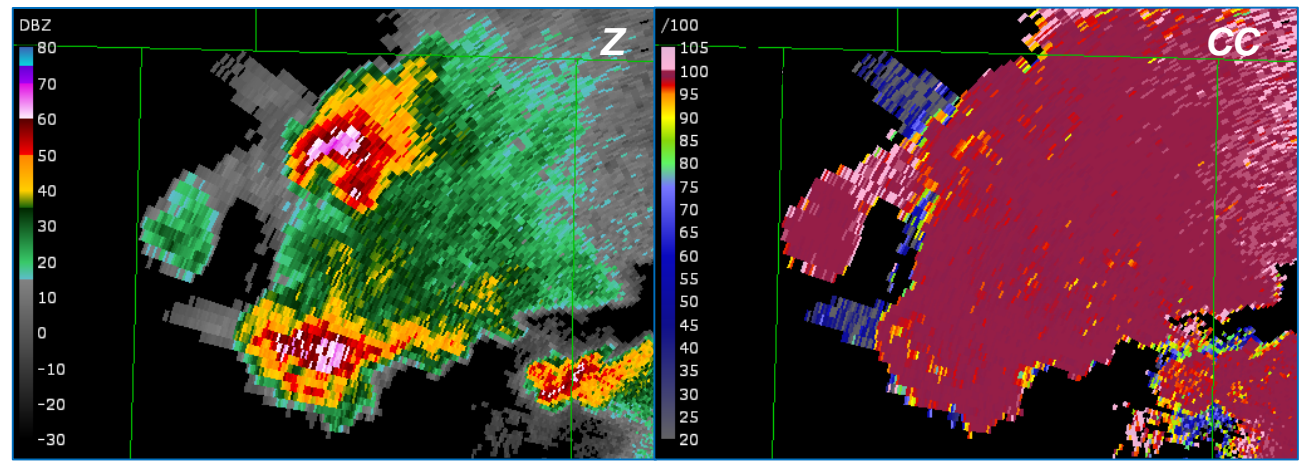
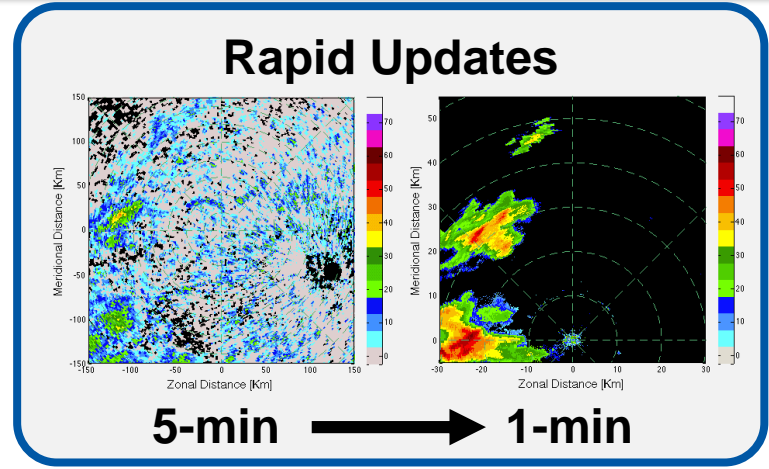


RWF Ratio after minimizing the Polarization Mismatch



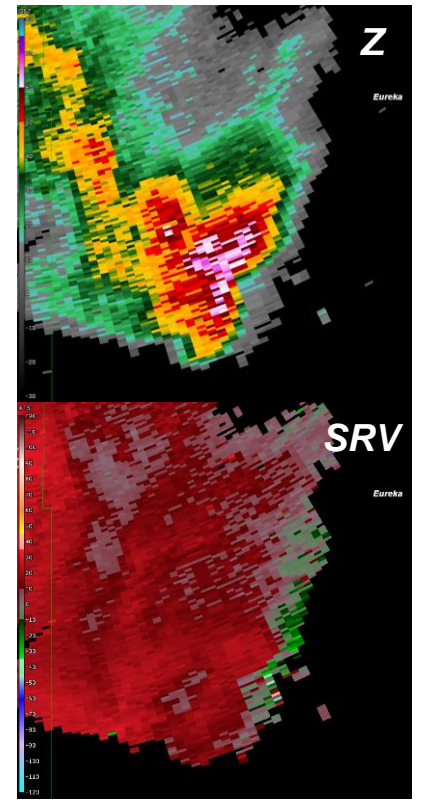
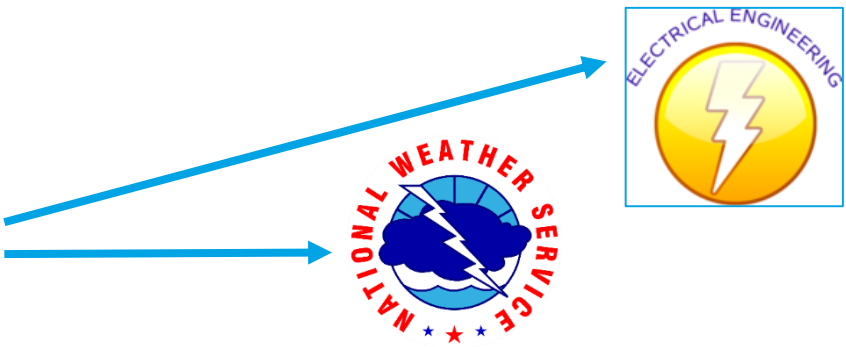
Meteorologists and Radar:

- Show me the data
 - I want it fast
 - I want it clean
 - Without artifacts
 - Except the ones I like



Series of Studies Using SPARC Simulator*

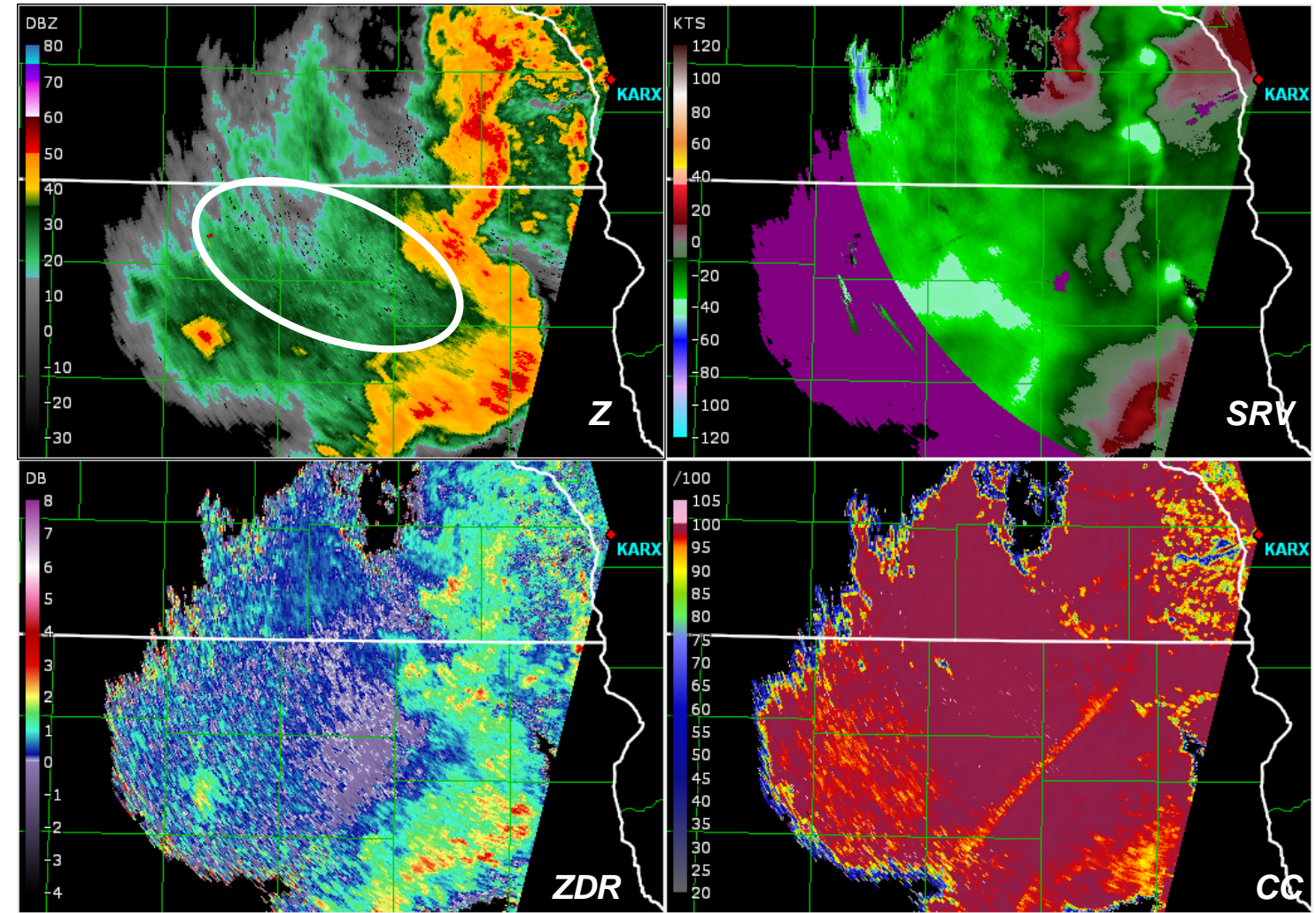
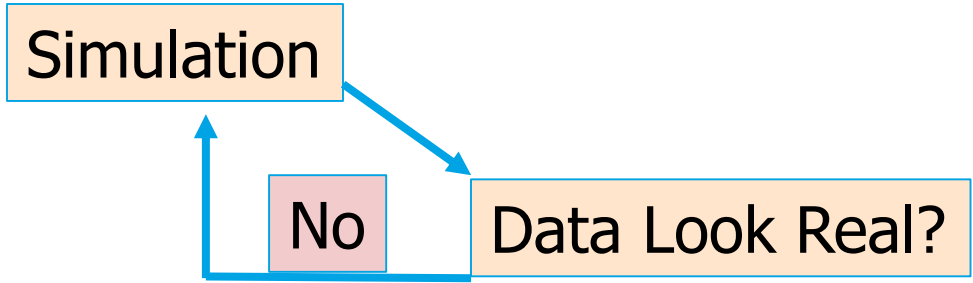
- I found weather cases that stress
 1. Sensitivity
 2. Resolution
 3. Spatial sampling
 4. Antenna Sidelobes
- Each case
 - Simulations: systematic incremental changes (Nai)
 - Impacts on NWS data interpretation (Jami)



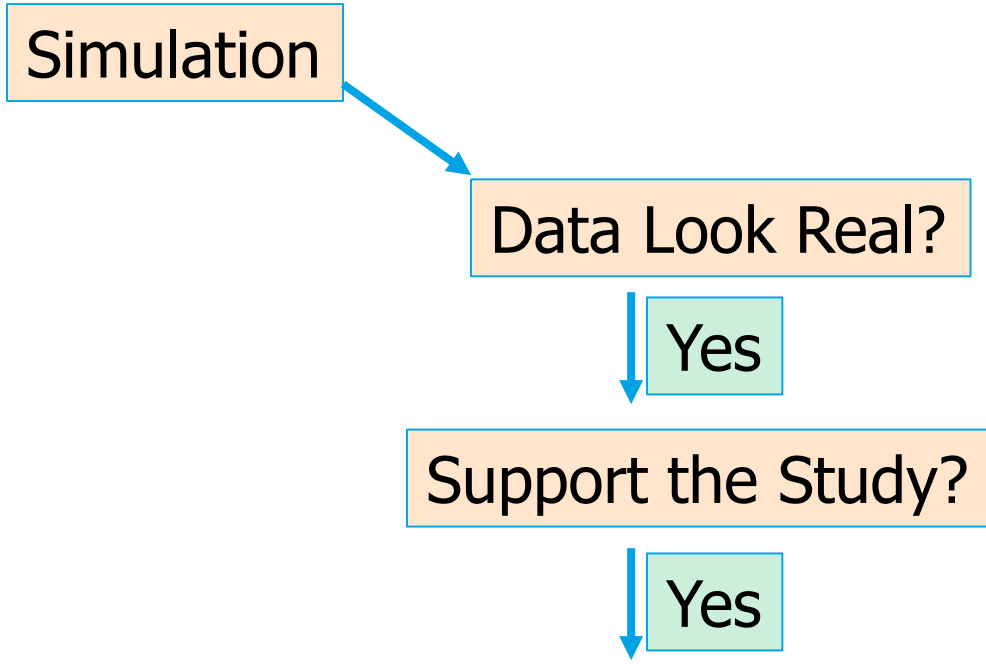
* Signal Processing and Radar Characteristics (SPARC) Simulator: A Flexible Dual-Polarization Weather-Radar Signal Simulation Framework Based on Preexisting Radar-Variable Data
David Schwartzman and Christopher D. Curtis



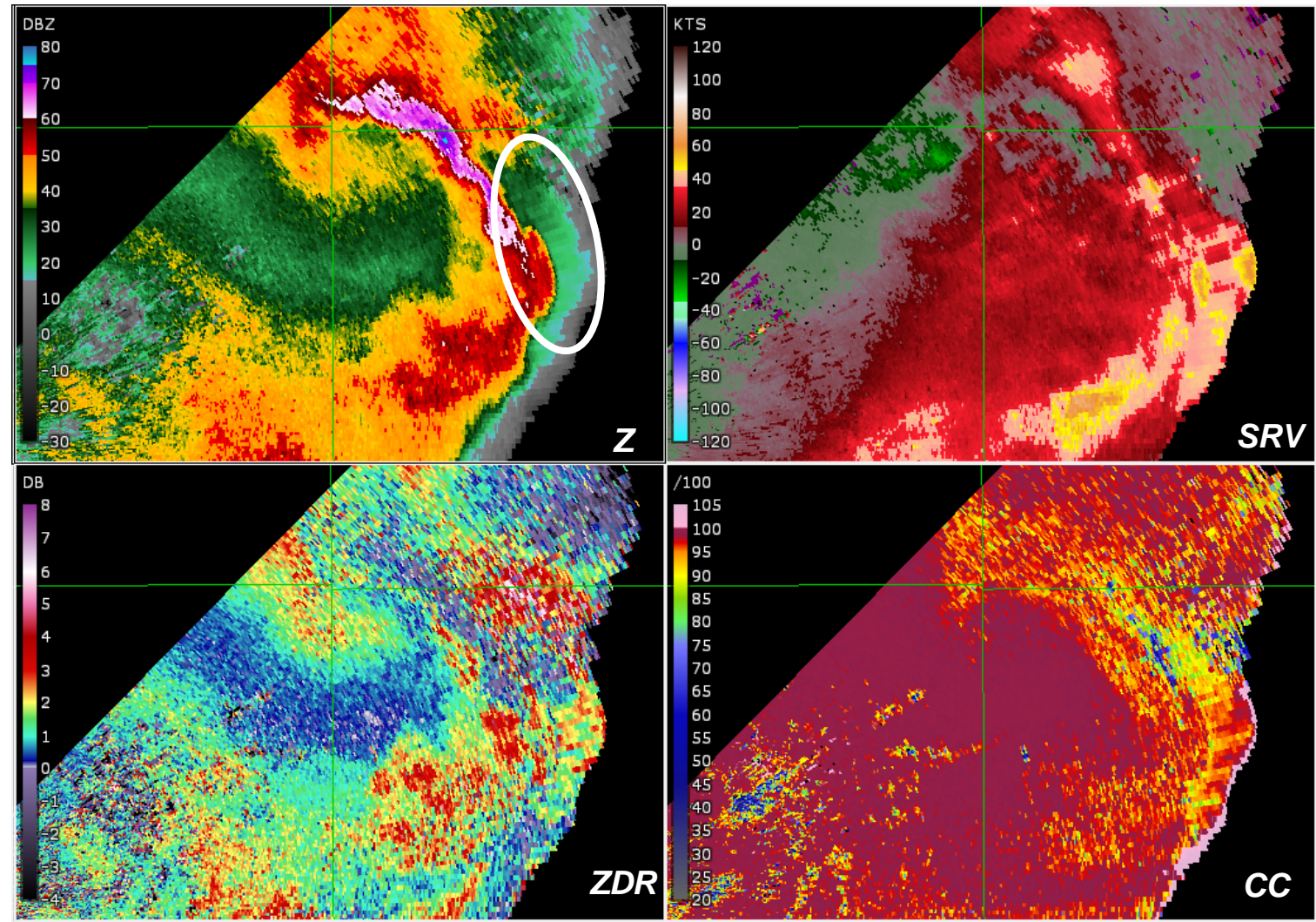
Initial Process



Initial Process #2

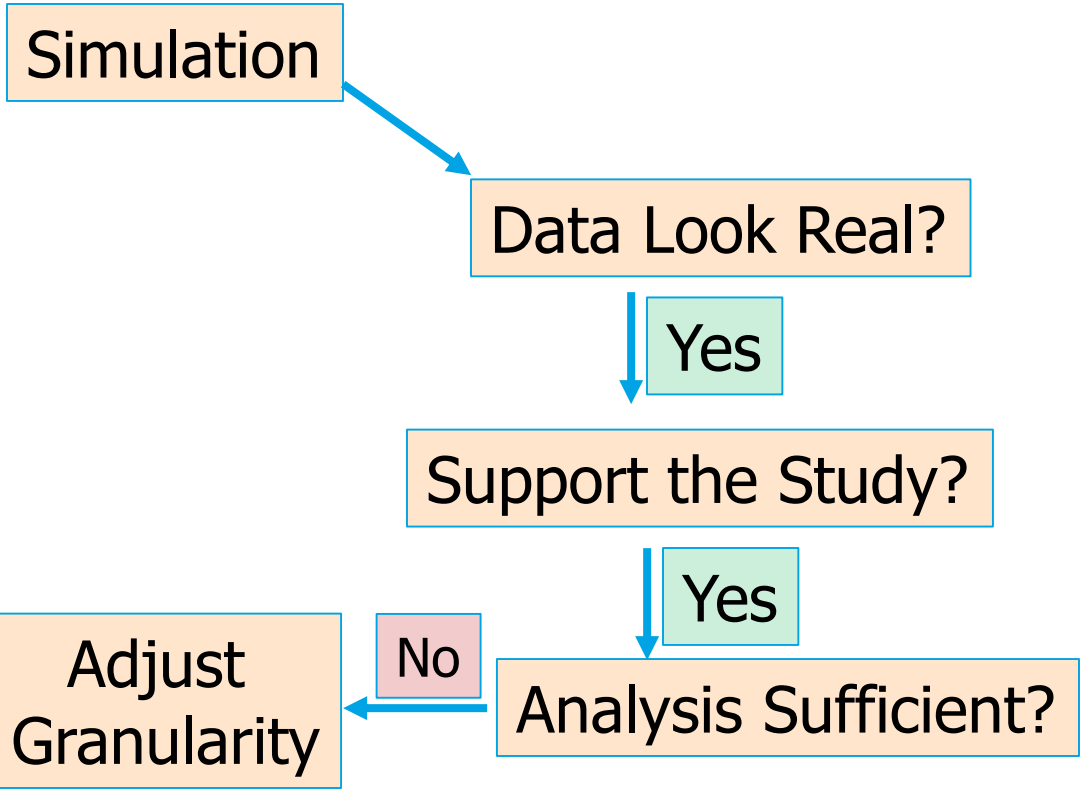


Range Sidelobes





Initial Process #3



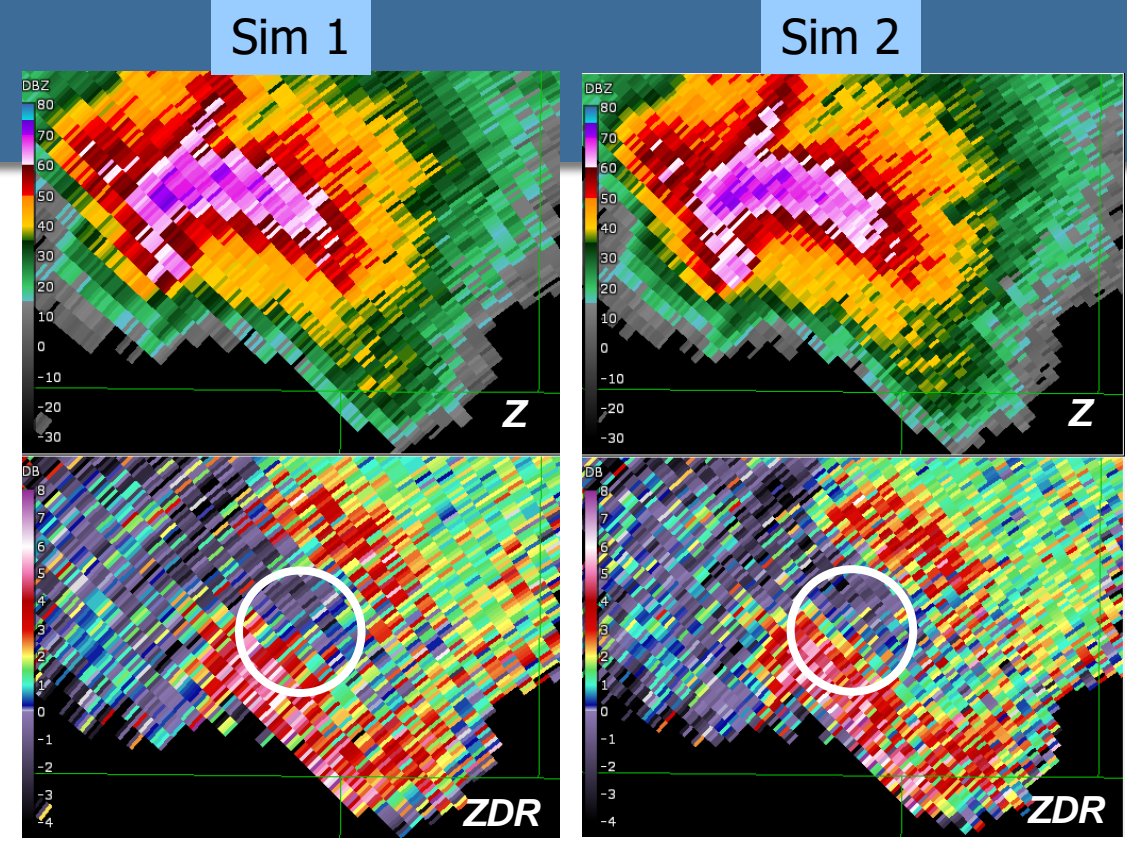
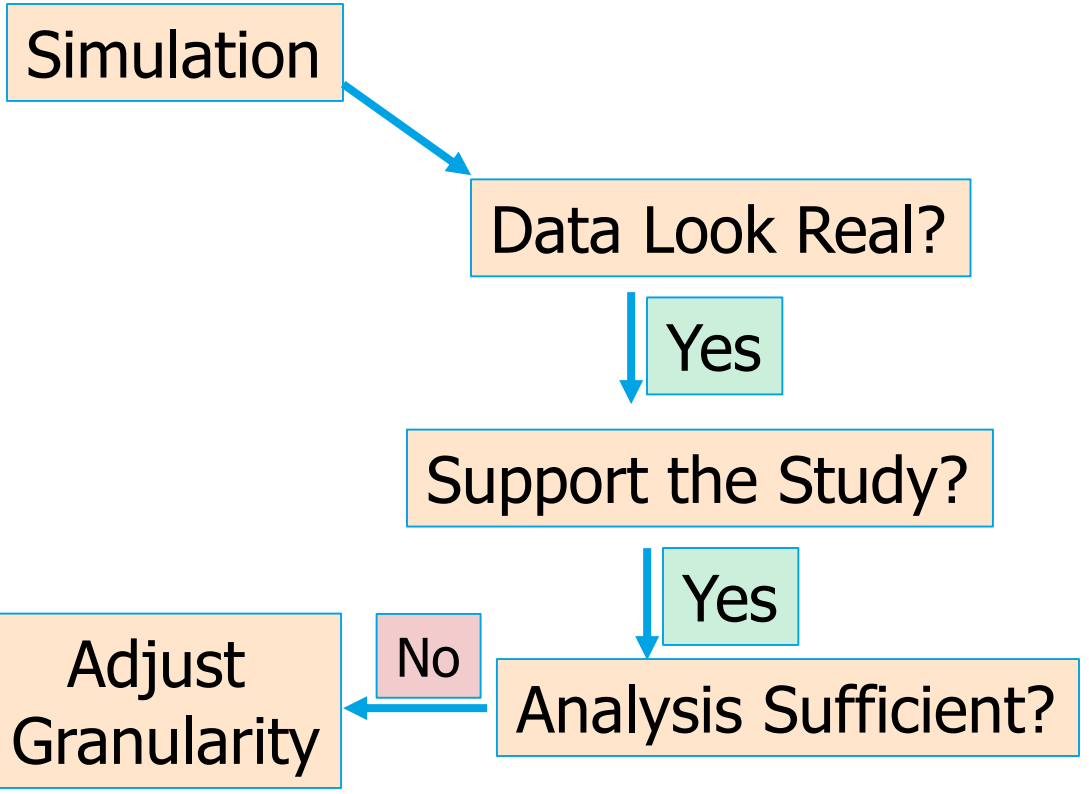
Simulator Analysis: **Range Sidelobes; 24 simulations**
 KMPX 11June 2017, 14:23Z

Acceptable	Marginal	Unacceptable
21:34	21:42*	21:31
21:35	21:59*	21:32
21:36	22:00*	21:33
21:40		21:37
21:41		21:38
21:46		21:39
21:47		21:43
21:54		21:44
21:58		21:45
		21:55
		21:56
		21:57

Spatial Sampling
 KTWX Sept 10, 2015, 23:25Z storm at 317°/56 nm
 Focus is the area of big drops adjacent to the hail core, not the portion of the storm toward the radar. Assessment is based on the ability to see that interface clearly, which is oriented along the radial. Thus varying spatial sampling may enhance this interface.

Sim 1 vs. Sim 2	Same	Which One Better?	Notes/Unexpected Findings
Broadside		Sim 2	Gradient across BD to HA interface is visually more apparent
Midway		Sim 2	Gradient across BD to HA interface is visually more apparent
Edge		Sim 2	Gradient across BD to HA interface is visually more apparent

Initial Process #3



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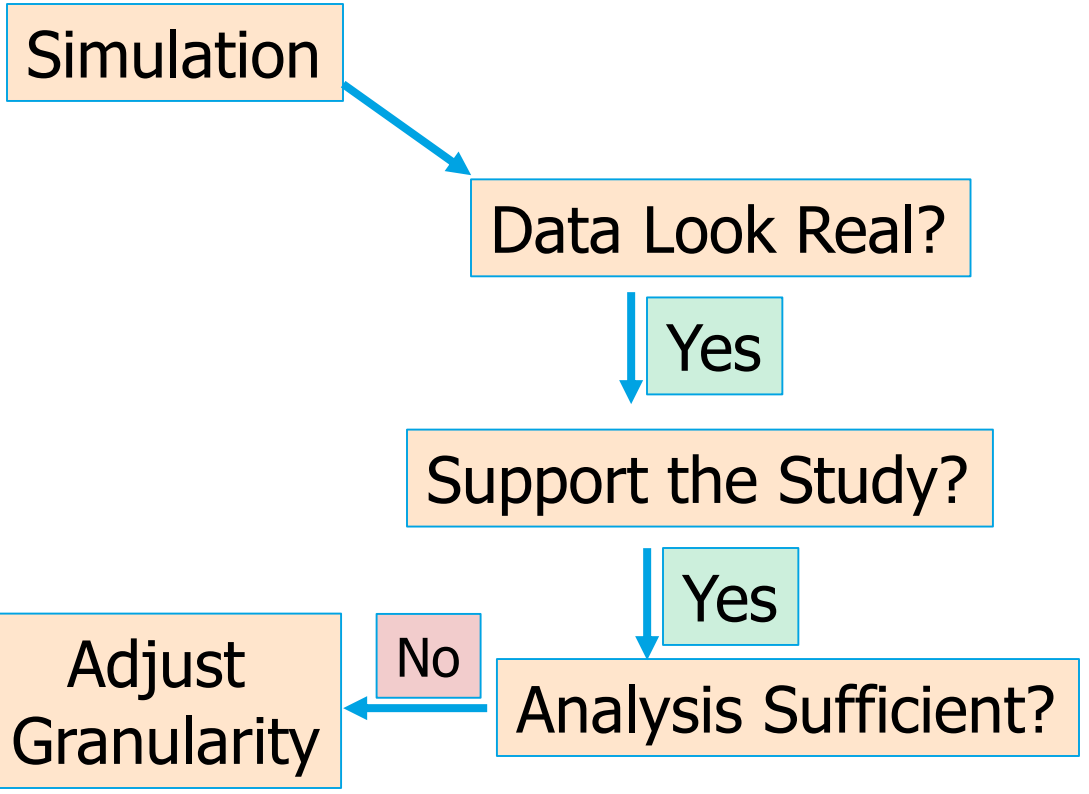
Initial Process: Elevation Sidelobe #1

Elevation Sidelobes (aka Vertical)

2D Sidelobe Simulation Analysis: KTWX 9/18/15 01:20Z
Azran 26° / 47 nm; Storm motion 281° @ 24 kts

- 1: fully acceptable; no data quality distractions
- 2: acceptable; minimal data quality distractions
- 3: ambiguous; impact of data quality distraction would vary significantly among individuals
- 4: unacceptable; sufficient data quality distractions to affect nearly all individuals
- 5: completely unacceptable; dramatic data quality distractions for decision making or features obscured

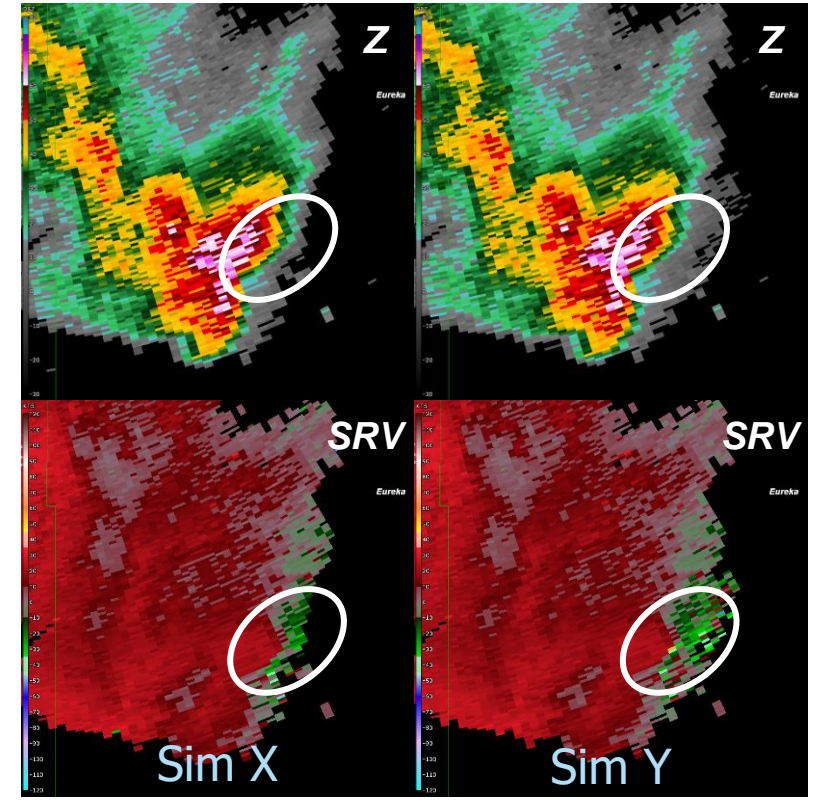
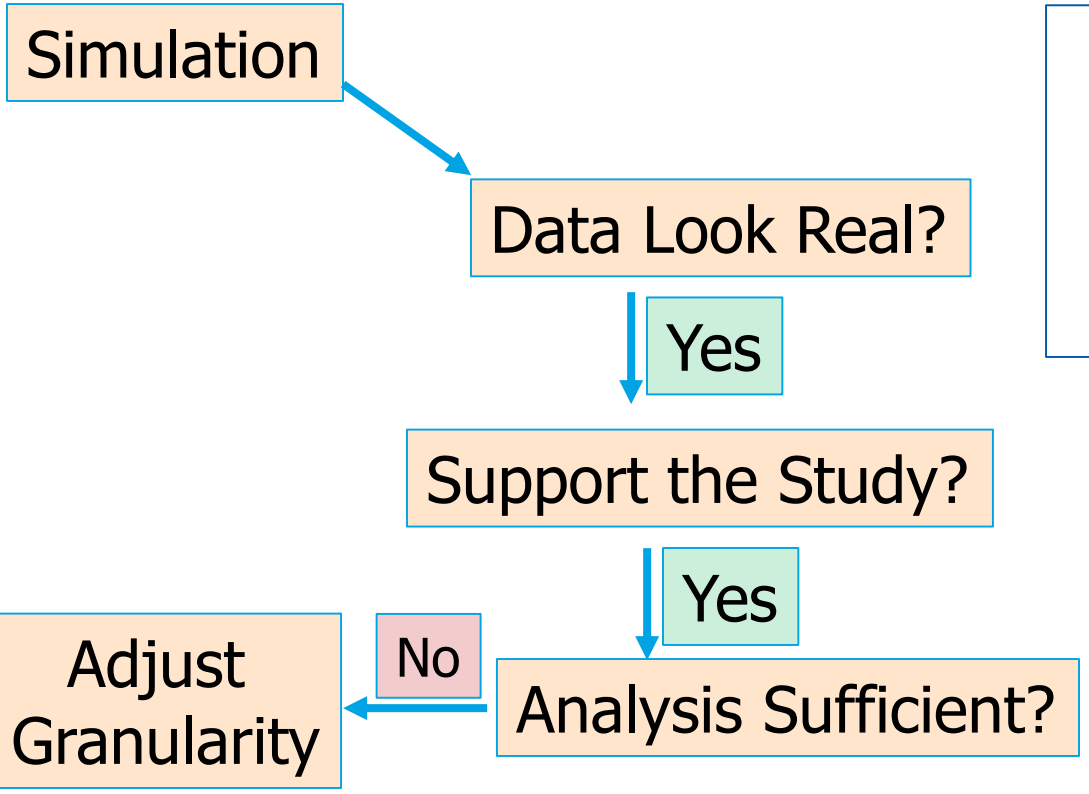
Simulation	Rating	Notes
A	5	-Faint, but noticeable circle of enhanced spectrum width at 0.5° - Faint, but noticeable circle of enhancement in all data* 0.9° - 1.3°
B	2	-Velocity data are a tad noisy at 0.5°
C	5	- Not so faint circle of enhancement of all data* for all simulated elevations
D	2	-Velocity data are a tad noisy at 0.5°
E	5	- Faint circle of enhancement of all data* for all simulated elevations
F	5	- Varying circle of enhancement of all data* for all simulated elevations
G	1	No DQ distractions
H	3	-Faint, barely noticeable circle of enhanced spectrum width, only on the 0.5° elevation -Storm data presents very well
I	1	No DQ distractions
J	4	- Very faint circle of enhancement of almost all data* for all simulated elevations



Initial Process: Elevation Sidelobe #2

Elevation Sidelobes

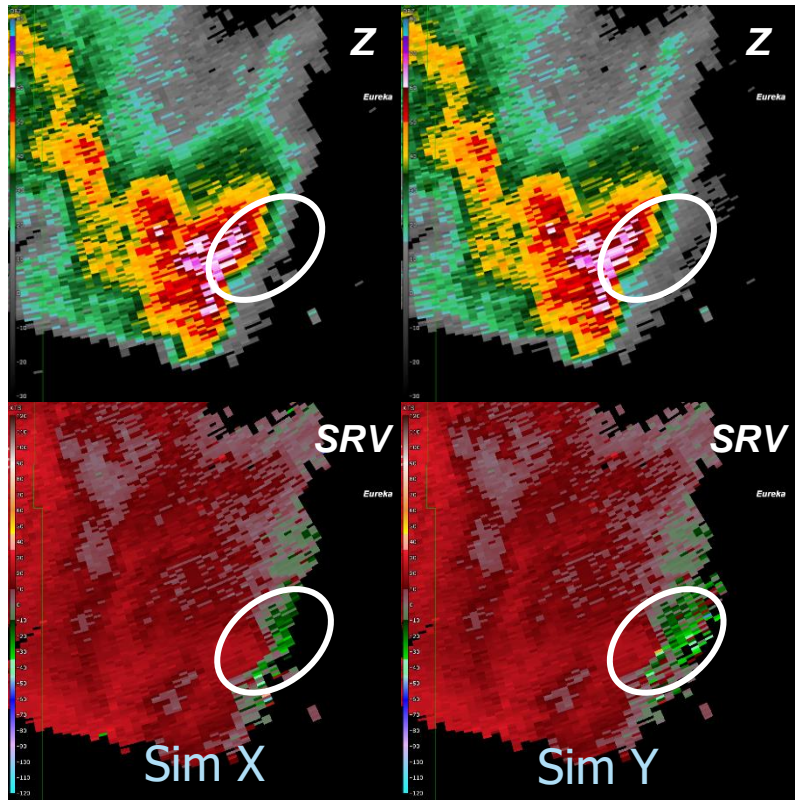
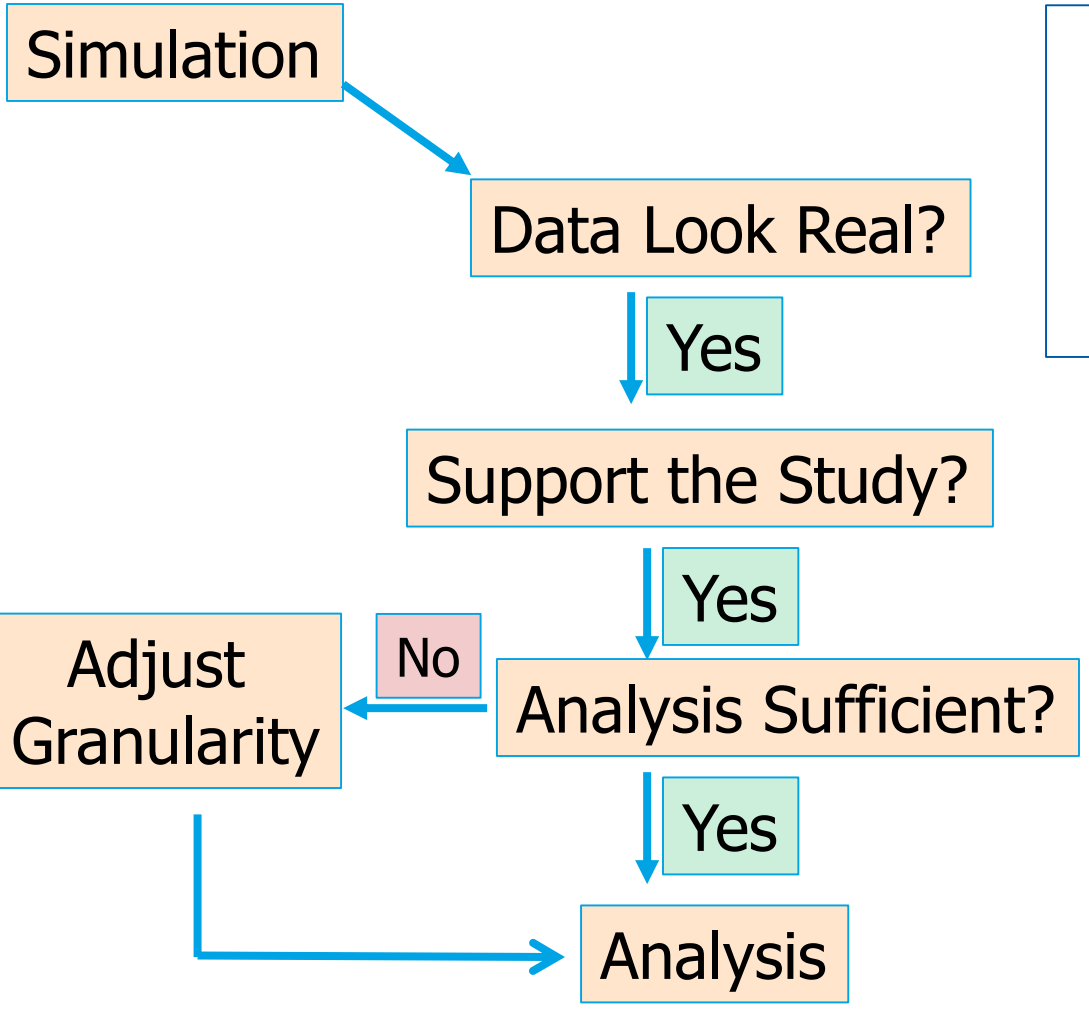
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Elevation Sidelobes Ready for Analysis

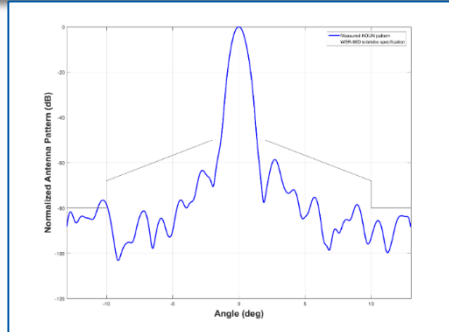
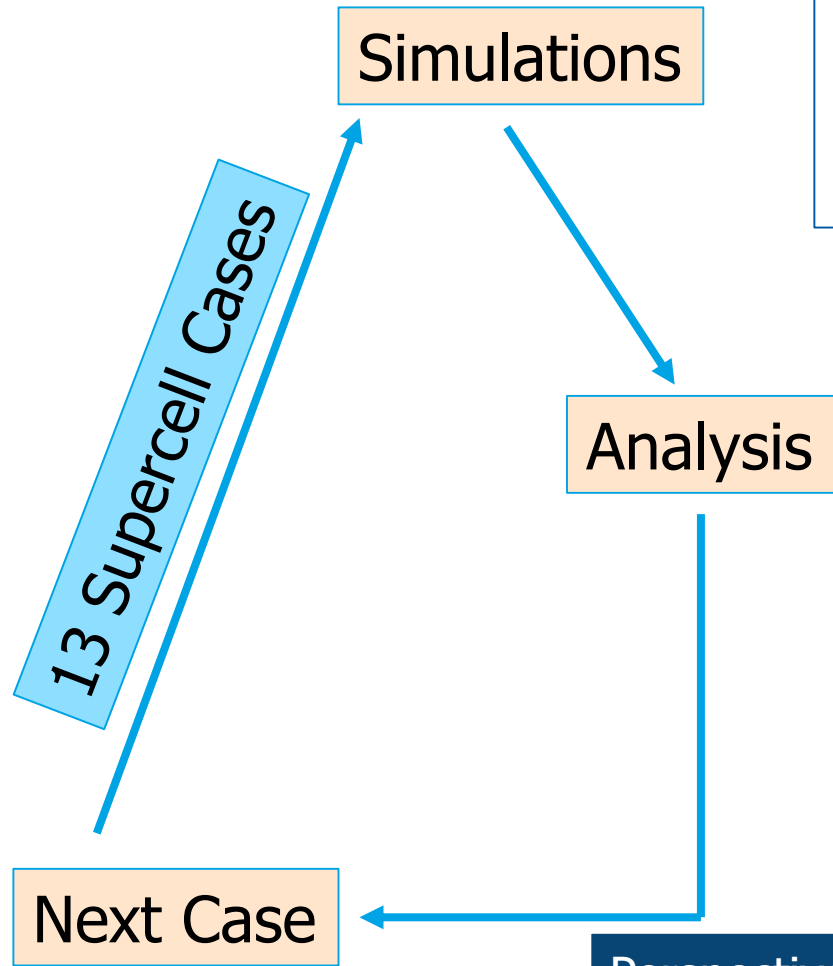
Elevation Sidelobes

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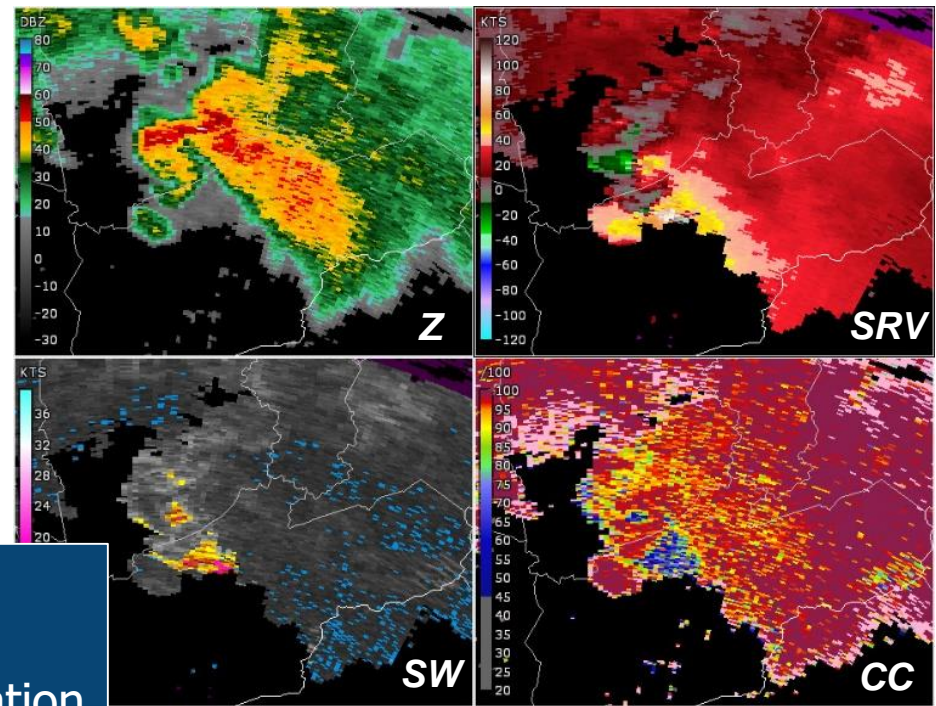
Analysis Process: Elevation Sidelobes

Location
Knoxville, TN
Rapid City, SD
Topeka, KS
Boston, MA
Rapid City, SD
Hastings, NE
Fort Worth, TX
Topeka, KS
Dyess AFB, TX
Laughlin AFB, TX
Elko, NV
Goodland, KS
Pocatello, ID



10 Antenna Patterns

8 Elevations (0.5° – 5.1°)

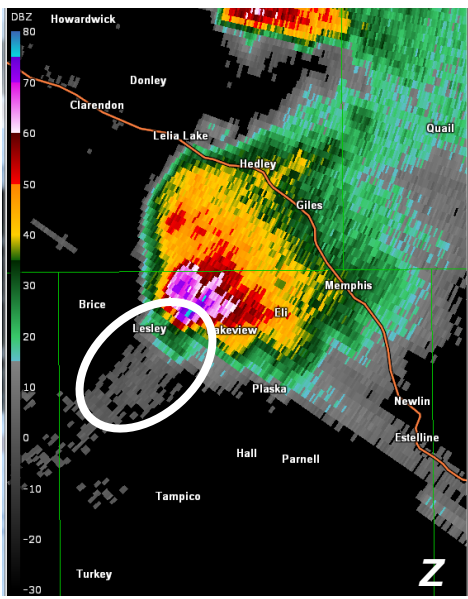


Perspective:
 - Real Time
 - NWS Population

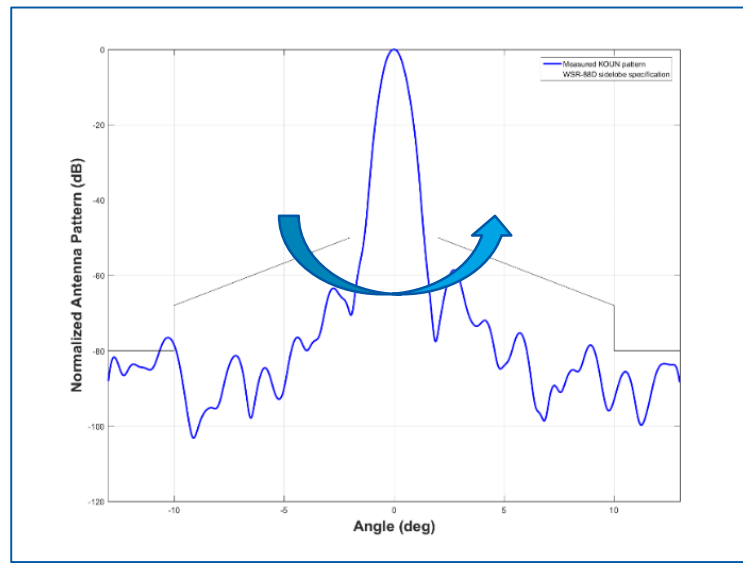
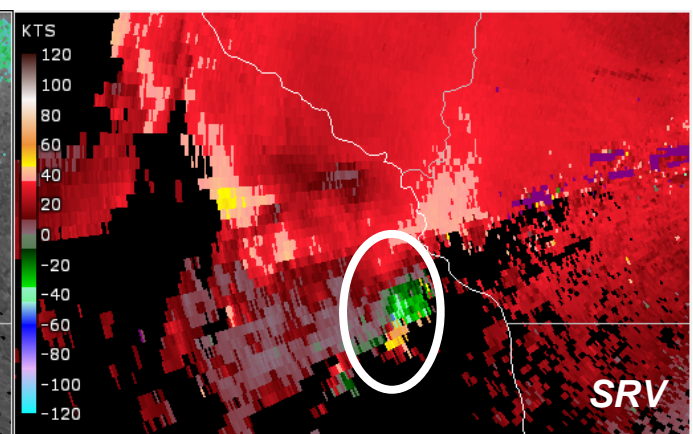
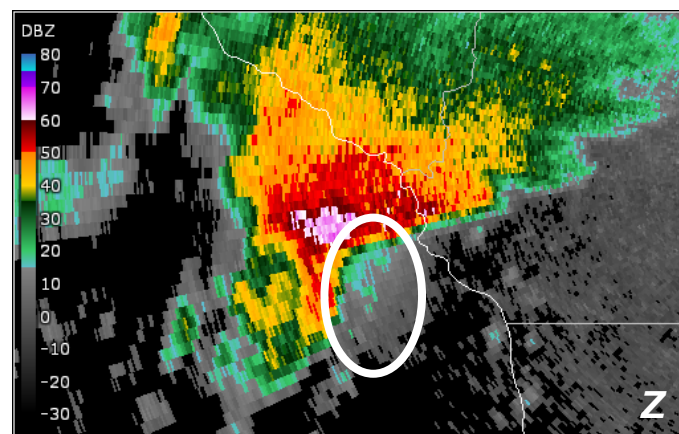
Sidelobes: Bridge Built!



- User-based language: "azimuthal" vs. "elevation"

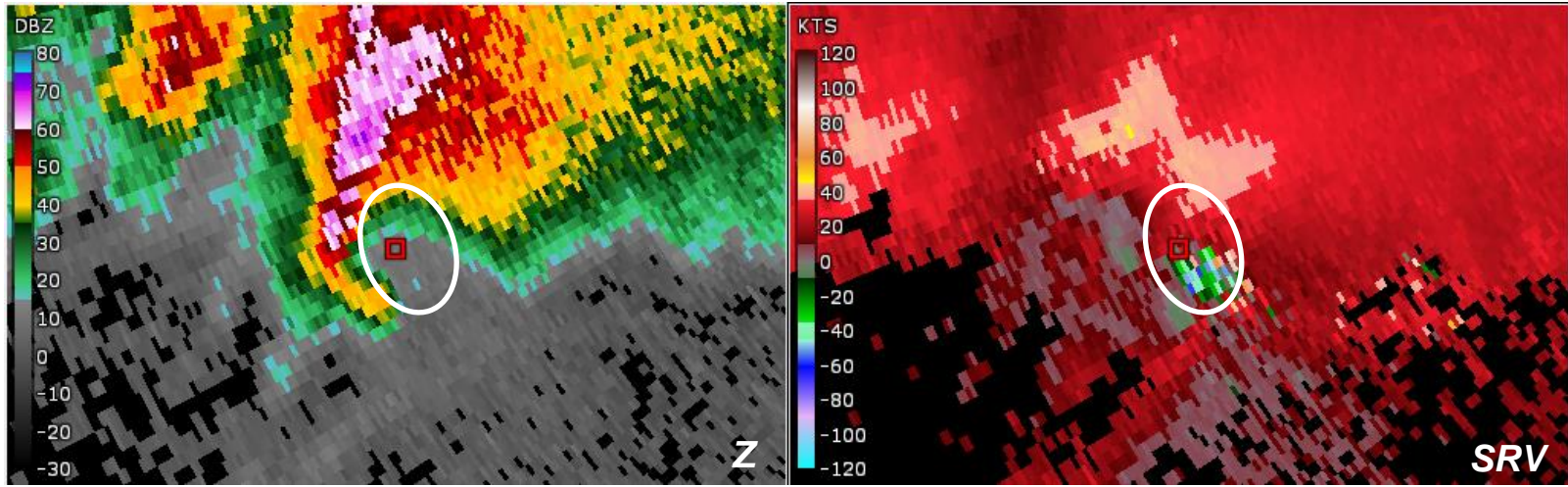


Captures user's perception of **source** of contamination

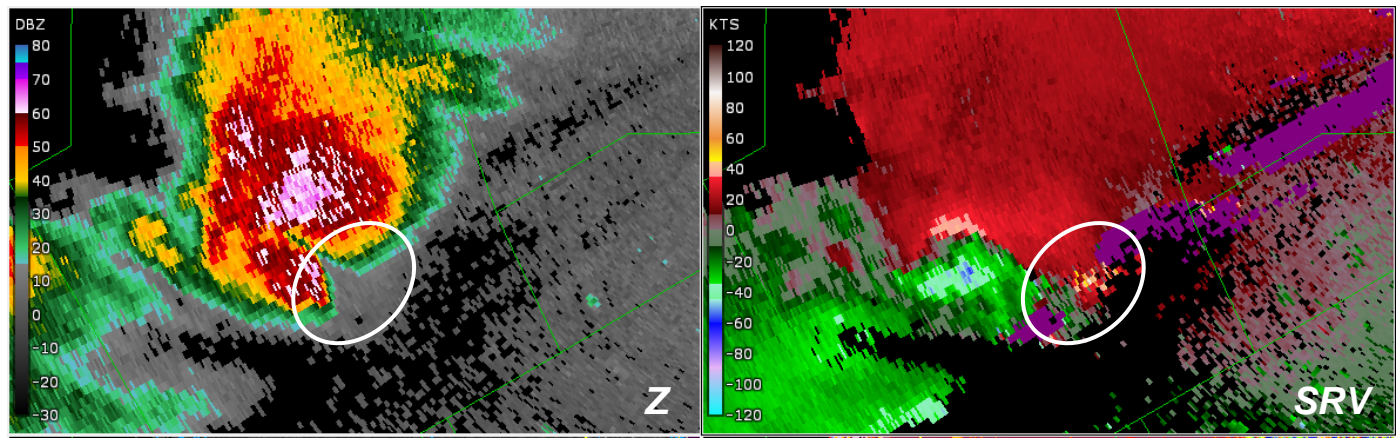


How Elevation Sidelobe Contamination Presents Itself

- Possible circulation; high stakes
 - Difficult to diagnose in real time



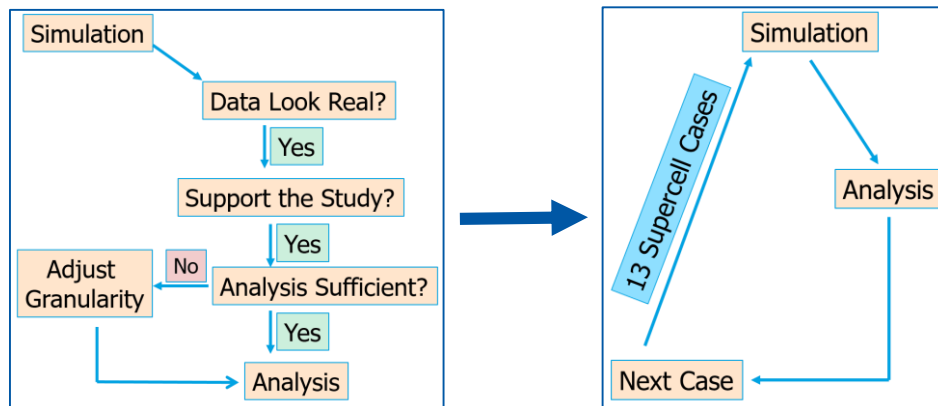
- Inflow region noisy velocity; mentally filtered
 - “junk in the inflow”



Unique Collaboration

- Streamlined process

1. Sensitivity
2. Resolution
3. Spatial sampling
4. Antenna Sidelobes



- Results salient for NWS

- Sidelobes: “Azimuthal” vs. “Elevation”

10A.4 A METEOROLOGIST EMBEDDED WITH ENGINEERS: BRINGING NWS PERSPECTIVES TO THE DESIGN OF FUTURE OPERATIONAL WEATHER RADAR SYSTEMS

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