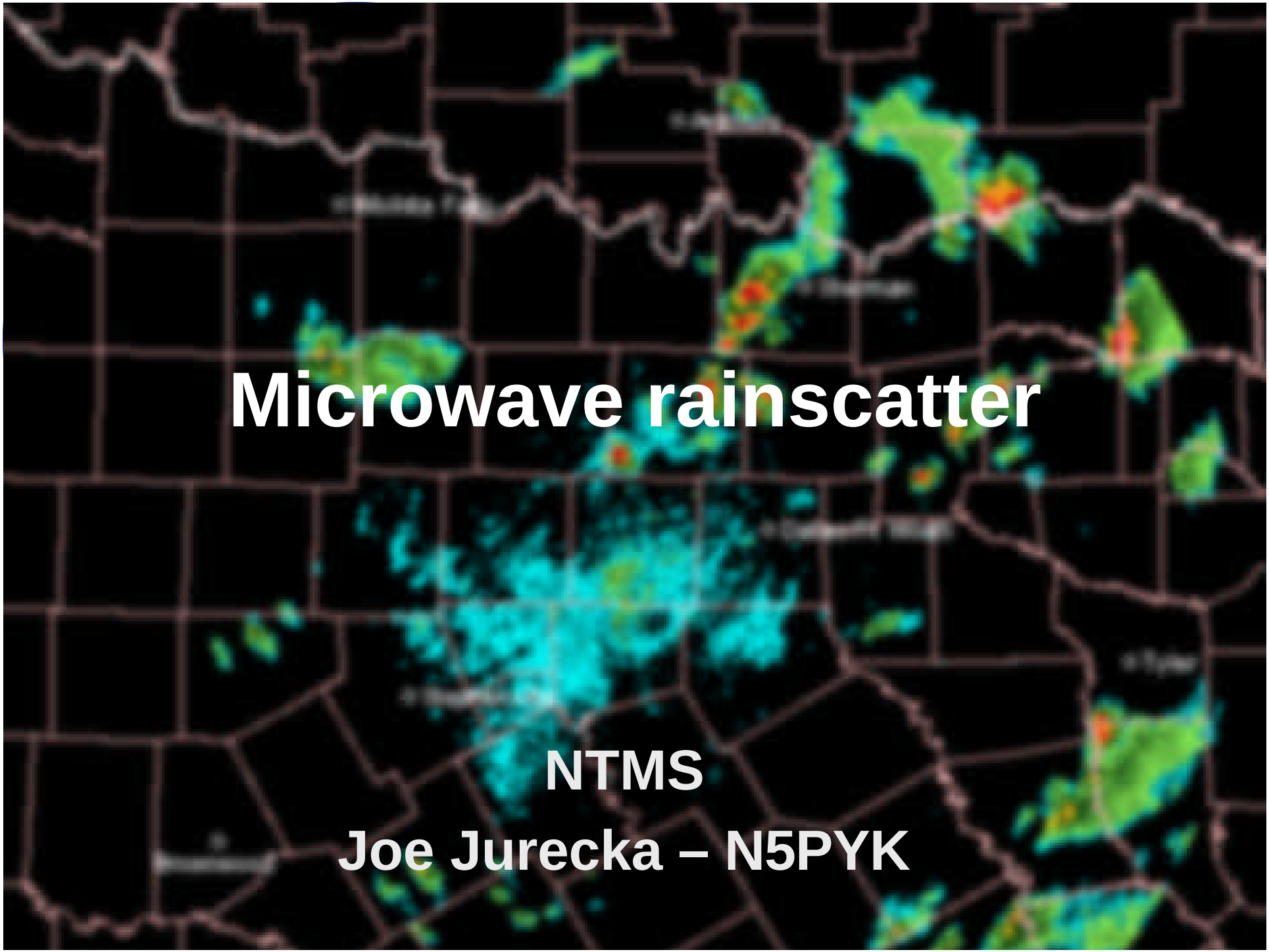
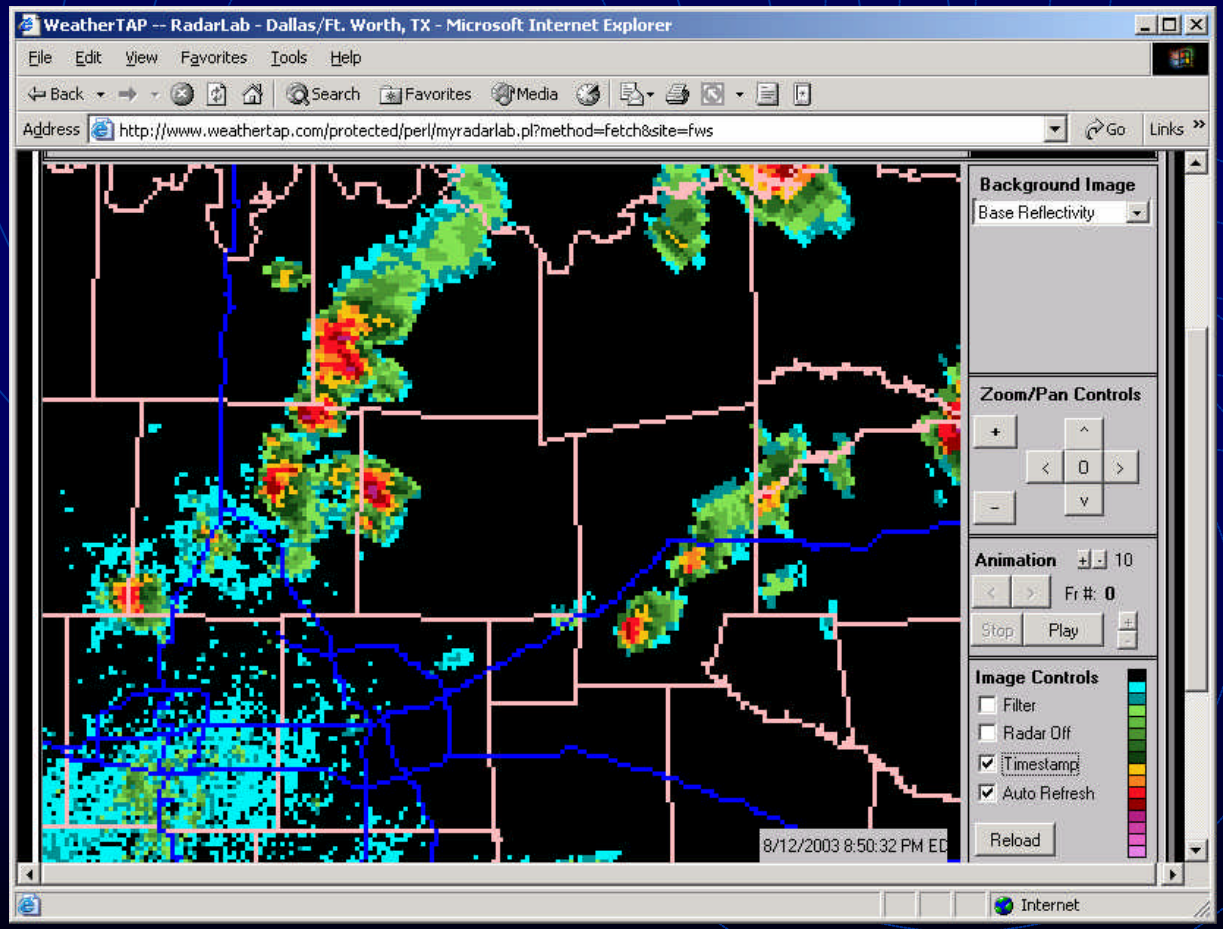


Microwave rainscatter

NTMS

Joe Jurecka – N5PYK

Garden variety thunderstorms at 10cm



Best rainscatter cells typically have cores of highest reflectivity.

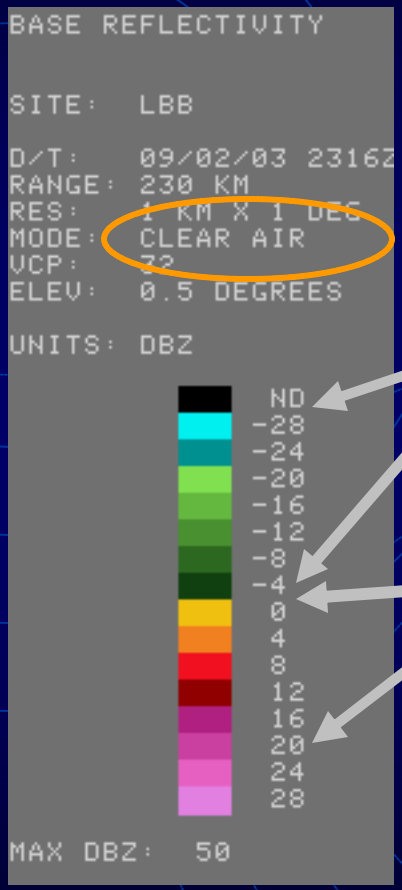
Reflectivity is measured in dBZ.

dBZ Scale

dBZ	Rainfall rate (in/hr)
65	16+
60	8.00
55	4.00
52	2.50
47	1.25
41	0.50
36	**0.25**
30	0.10
20	Trace

The "Z" in dBZ is equivalent reflectivity.

The WSR-88D operates in two modes with different colorations. It is important to know what you are looking at. Rainscatter is most feasible when in preciptation mode…where cells are 40dbZ or more



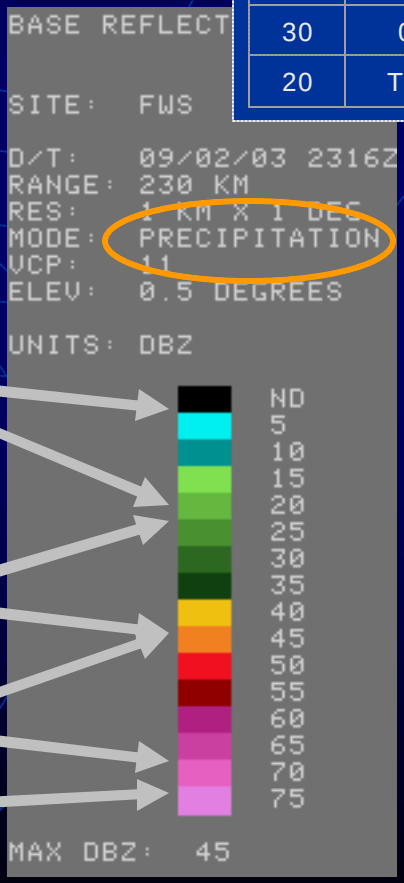
Clouds/bugs/airmass boundaries

Light rain/drizzle

Moderate rain

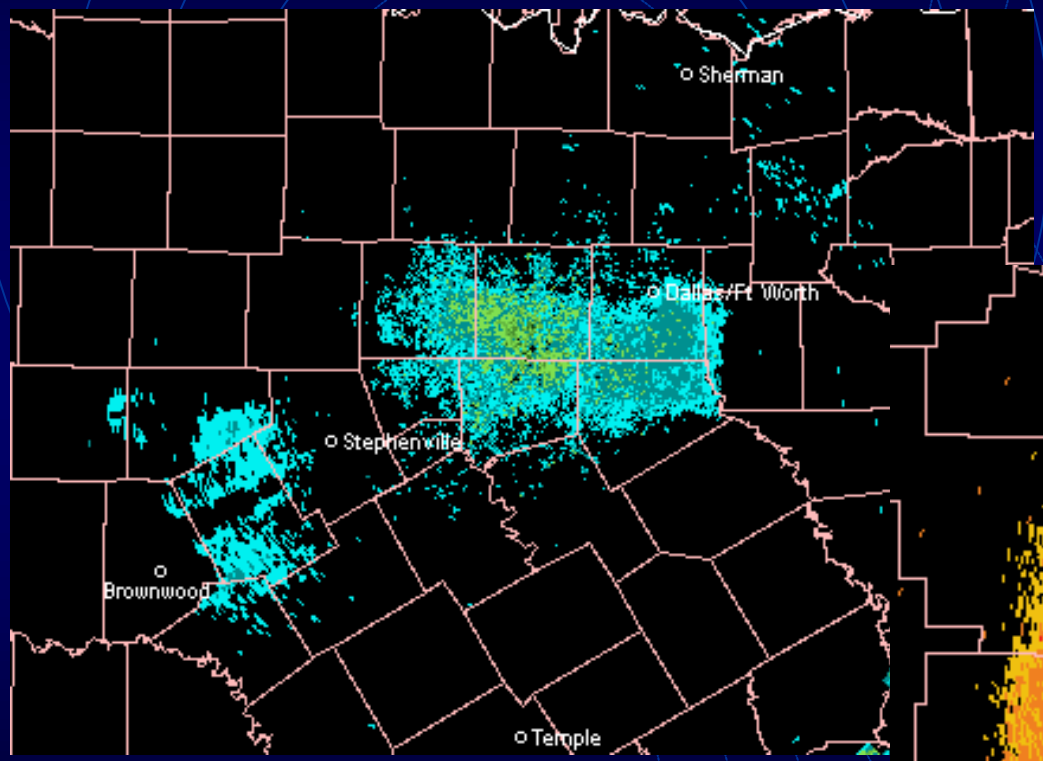
Thunderstorm

Nasty hail

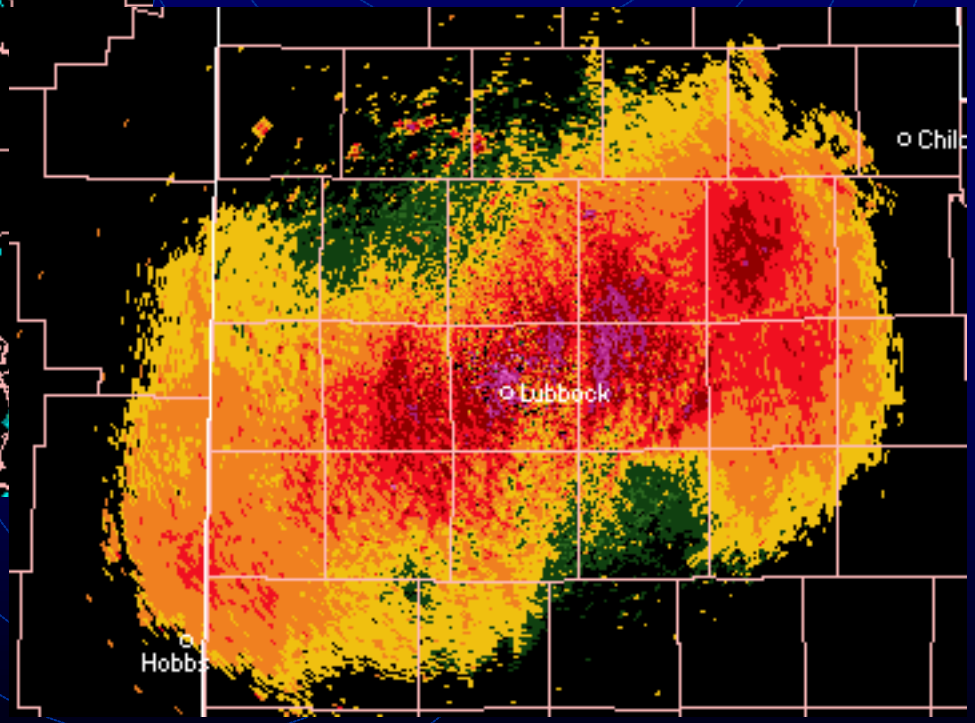


Z[dBZ] = 10 . 10log(Z [mm^6/m^3])
Basically, a measure of how much liquid is in a given volume

Comparison of non-precip detection



Precip mode



Clear air mode

Station requirements

- At least 100mW to 30dB dish
- Reasonable noise figures ok (<5dB)
- Aviation weather radar can easily see strong cells out to 300nm with 1W average power and 300kHz IF bandwidths.
- Narrow band weak signal has a strong edge!
- 10 GHz ***IS*** the optimal RS band

Geometry

- Best propagation via rain scatter is in a straight line, forward or reflected. Side scatter is less effective, but usable.

Distances achievable

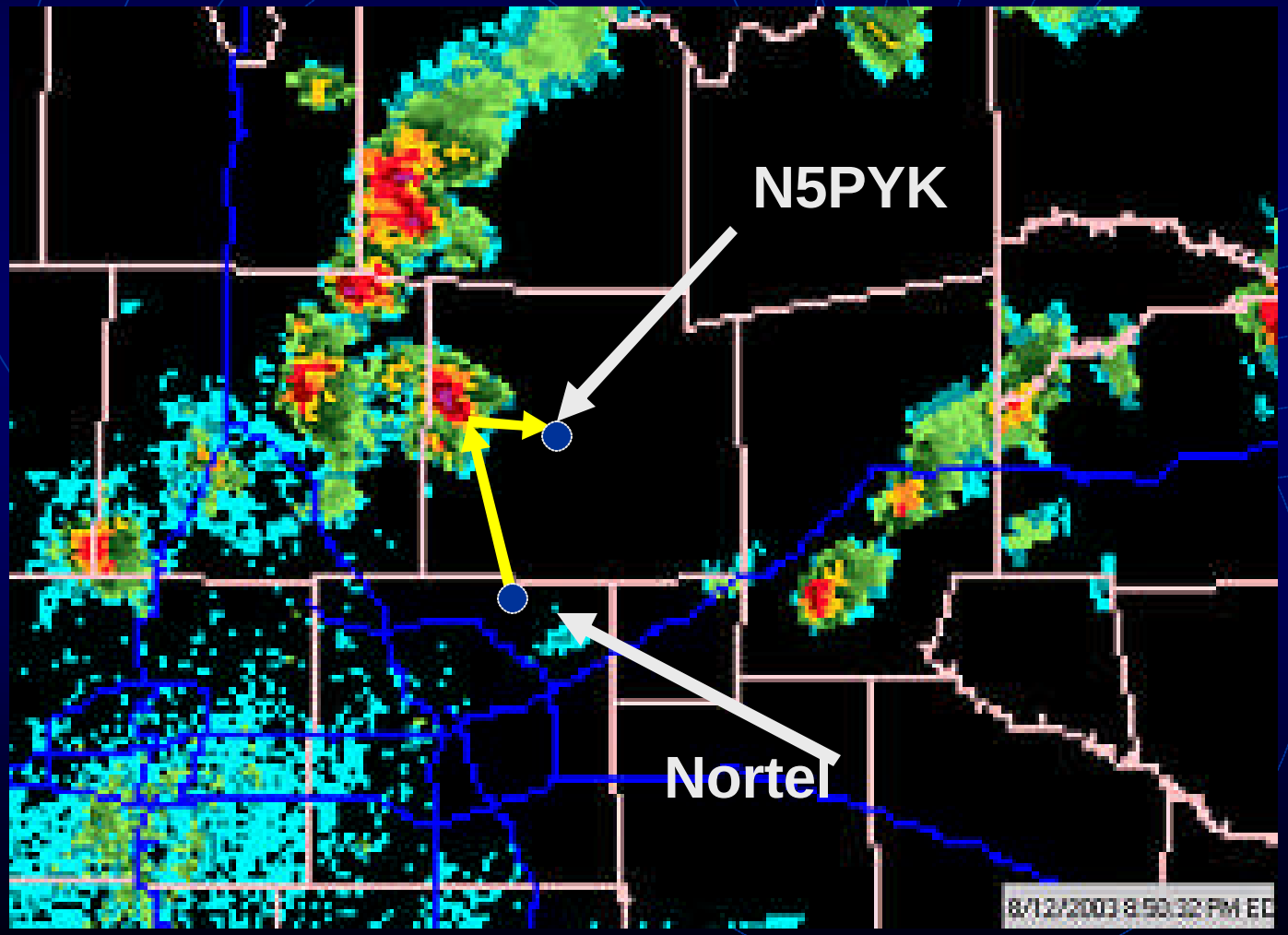
- A good springtime cell, with 60K tops can provide usable signals so long as both stations can “see” the cell
- “Line of sight (mi) ” ~ 1.4 * sqrt [tops (ft))

1.4*sqrt(60000) = 340 mi

Contacts near 700 mi may be possible if the geometry is right and the cell is intense!

The range equation states we should be able to do upwards of 50mi to a 1meter target with a typical rover setup. Just imagine the return from a thunderstorm with a square miles of intense precipitation!

Example rainscatter



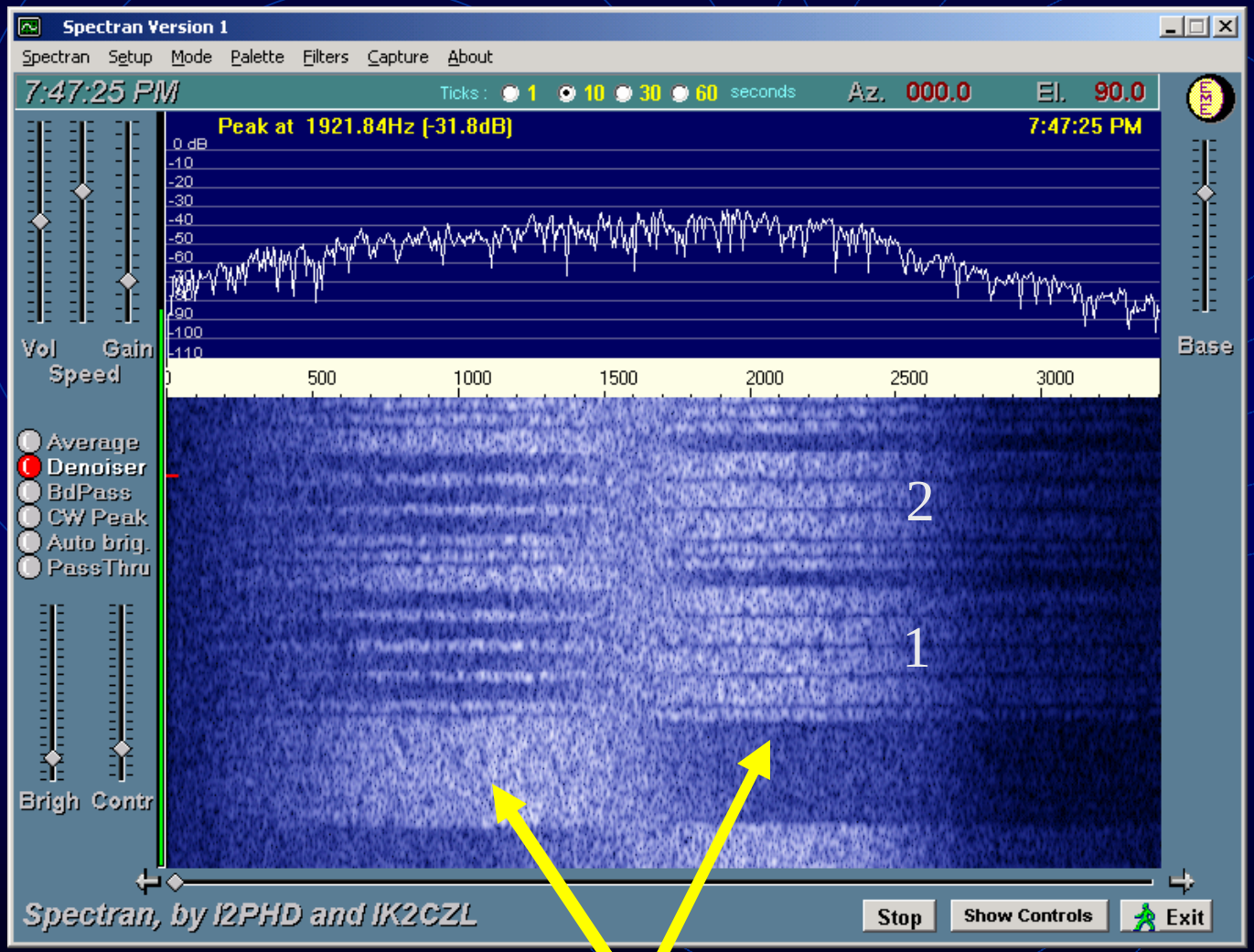
The geometry was certainly not optimum, but signal levels were very strong due to the proximity.

Total path: ~20 miles

Almost no direct signal

Looking WNW from shack

Ok, so what is the signal like?



Substantial spreading of the signal can be expected with rainscatter. SSB is not the mode of choice…CW is king here.

Signals at least 20dB out of noise

Mark and space of NT5NT Beacon

I’d like to try it…what do I do?

Easy!

Get your 10 GHz station operational!

Know at least a little CW

then…

Call up another microwaver when rain is in the general area!

Useful links

- Radar range applet
  http://www.comappls.com/tonyt/Applets/Monostatic/Monostatic.html
- Radar equation
  http://www.rfcafe.com/references/electrical/radar_eqn.htm
- Radar imagery in the USA
  http://www.srh.noaa.gov/ftproot/radar1/mosaic/DS.p19r0/ar.us.conus.shtml
- College of DuPage radar mosaics
  http://weather.cod.edu/analysis/analysis.1km.html
- WA1MBA Rainscatter description
  http://www.wa1mba.org/10grain.htm
- OZ1FF Paper on rain scatter in Europe
  http://www.oz1ff.dk/Pages/Presentations/Rain_Scatter.PDF