California Rainscatter 8/15 & 8/16 2020

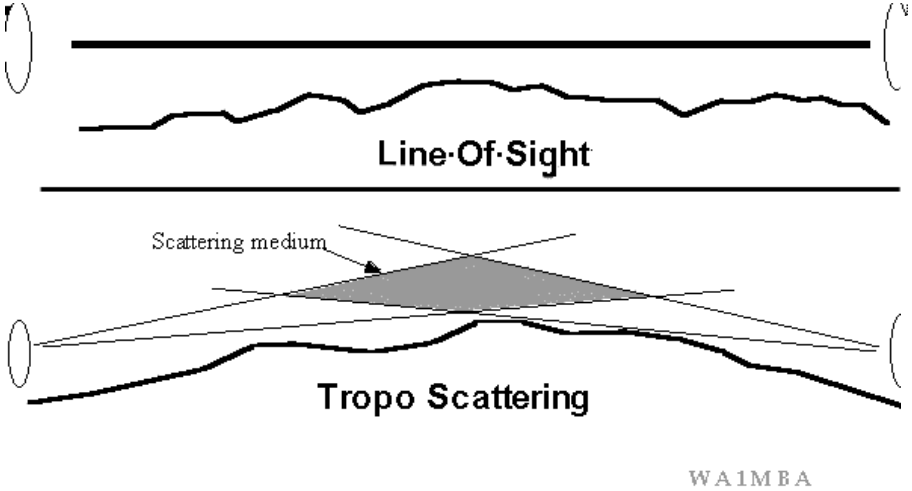
Jim Moss (N9JIM)

9/1/2020

What's in Here?

- What is rainscatter?
  - Reflection Geometry
  - Phase distortion
- How far can it go? Records, theory. Multi reflection. Altitude vs Range
- Can we predict it? WINDY and other weather forecasts with thunderstorm options
- How do we use it? Reflections: Side/Back/Forward, AZ & EL Point at storm cells
- Rainscatter 1.70 software (K0SM) java. Storm height available. Common coverage areas
- Rainscatter.com (K0SM) in Beta. Shows storm height.
- Any smartphone Radar App: look for RED!
- Distance Records
- What does it sound like? CW & FM (not SSB or current digital modulations)
- 3 QSO's from August 2020 10G and Up contest
- Post mortem analysis: NOAA databases
- Resources: wa1mba.org/10grain.htm

How does it work?



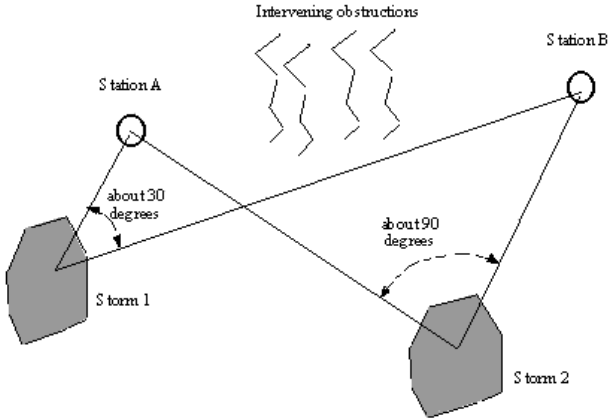


Figure 3. An example situation. The two stations are much more likely to communicate via storm 1 than storm 2 because storm 2 presents a 90 degree angle. WA1MBA

- Signals bounce off of raindrops & reflect in multiple directions
- Like a 10's of thousands high reflector, overcoming obstacles & earth curvature
- There is attenuation, but not like the pile of dirt in the way!
- 10GHz reflection from rain is fairly efficient

http://www.wa1mba.org/10grain.htm

Images Credit: WA1MBA

Doppler vs NO Doppler Shift

$$f_d = \frac{V_r f}{c} \quad \text{or} \quad V_r = \frac{f_d c}{f}$$

Vr = relative Velocity

Fd = doppler Freq shift

WA1MBA

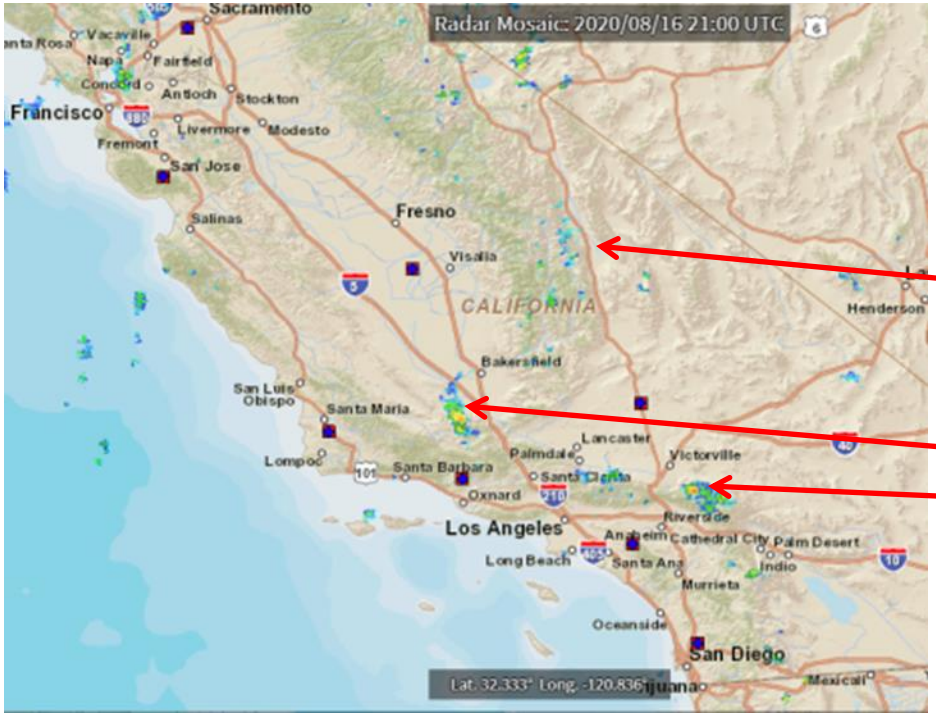
- Doppler Shift
  - Changing path length results in Doppler shift Backscatter & Sidescatter, when angles are not small. 2x shift on true backscatter
  - Note this is NOT the wind speed in the cloud, but the movement in location of the storm cell (disagrees with Tom's page)
  - Spreading: is due to motion of raindrops in cloud moving in shear being illuminated
- Little/no Doppler Shift
  - Scattering at small angles, basically straight through, the path length is not varying much
  - Spreading: (observed less… why? Lower precip in specific cases?)
  - Long haul with storm cell directly between stations

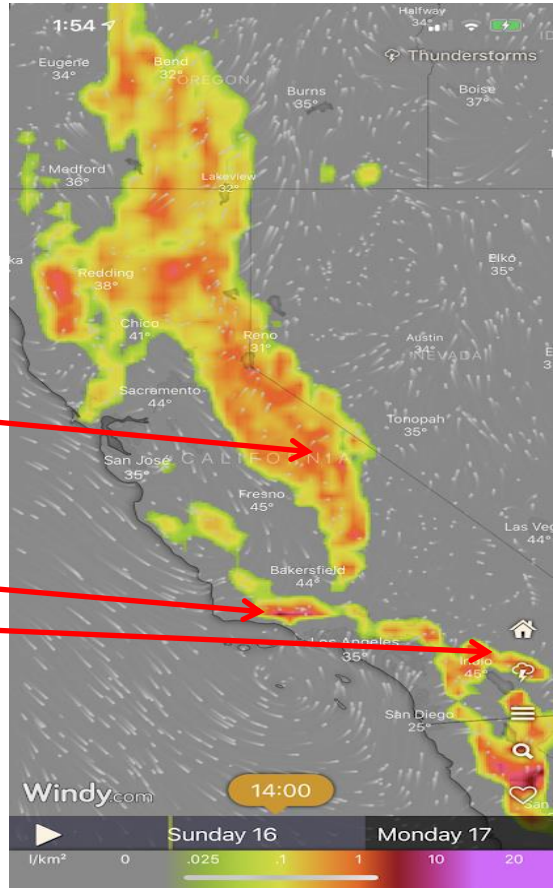
Image Credit: WA1MBA

Storm Prediction

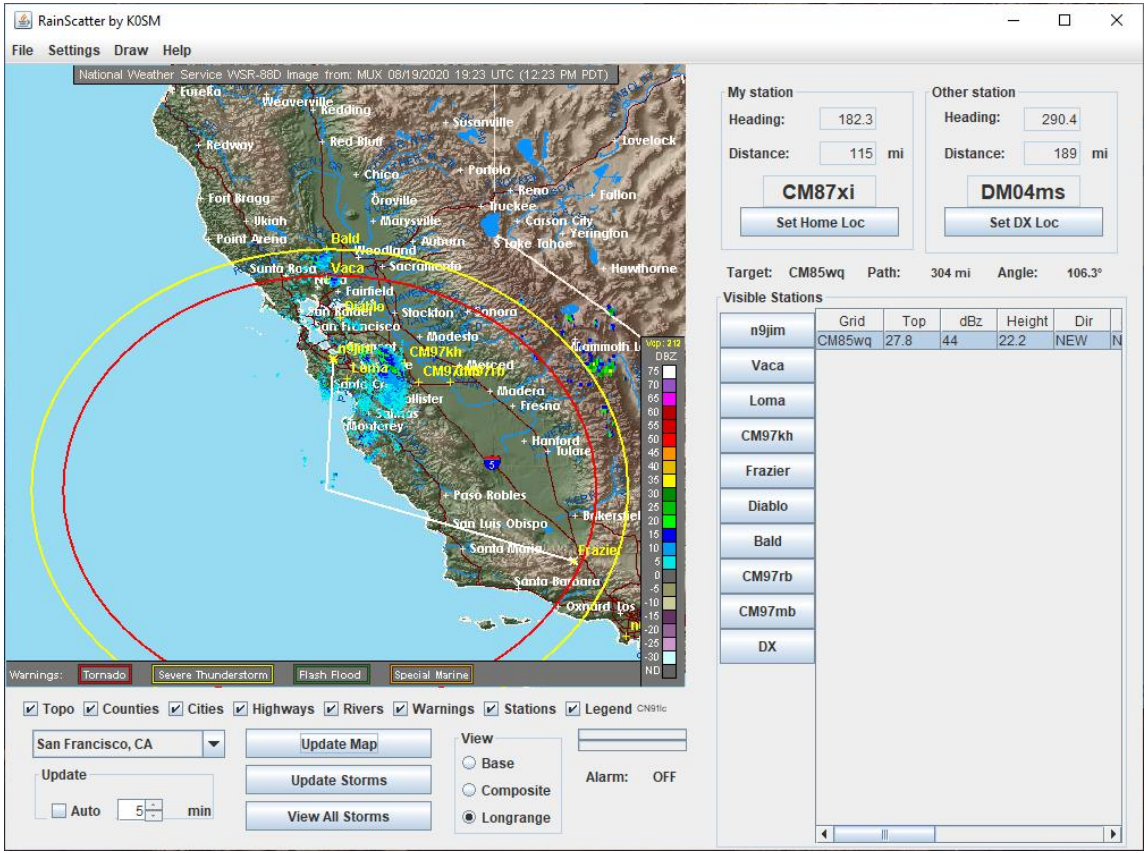
WINDY App: Tstorm likelihood map for Sunday 2PM

RED – very likely



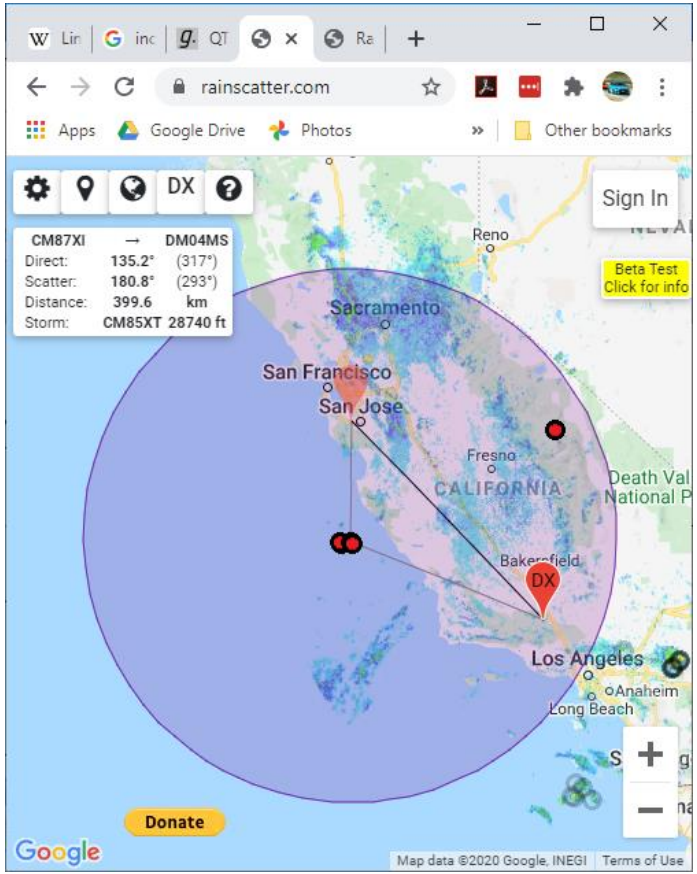


Rainscatter Software



- JAVA BASED
- Setup
  - stations
  - radar sources
- Download at:
- http://www.frontiernet.net/~aflowers/rainscatter/
- Author: K0SM Andy Flowers

Rainscatter.com



- Similar functionality as the JAVA software. But can run this from anywhere via the web.
- Little hard to do on smartPhone
- Author: K0SM Andy Flowers

ARRL Rainscatter Records

km	Miles	Record
1008	626.3	10GHz record
848	526.9	10GHz 2nd longest
79	49.1	10g 7th area
660	410.1	10g 6th area
283	175.8	24Ghz record

I’m SURE the 79km w7 record has been broken this weekend. WA6CDR worked many stations in SCAL off Tstorms. Maybe AD7OI did also.

24 GHz Records

24 GHz			
Rain Scatter	283	KM0T (EN13vc) - W0ZQ/0 (EN35ab)	31-Dec-05
Rain Scatter	218	KM0T (EN13vc) - W0ZQ/0 (EN15wb)	02-Apr-06
Rain Scatter	195	KD7TS (CN87ui) - W7SZ (CN85uo)	28-Sep-07
Rain Scatter	119	KM0T (EN13vc) - N0DQS (EN22ge)	26-Aug-03
Tropo (C)	543	W5LUA (EM13qc) - WW2R/5 (EM41hc)	07-Sep-02
Tropo (C)	526	WB6CWN/6 (DM04ms) - AD6FP/6 (CM88ws)	21-Aug-10
Tropo (C)	412	KC6QHP/6 (DM04ms) - AD6FP/6 (CM98qf)	22-Aug-10
Tropo (C)	375	K6GZA/6 (CM97hm) - AD6FP/6 (DM04ms)	16-Sep-00
Tropo (C)	375	AD6FP/6 (CM97hm) - W6QI/6 (DM04ms)	20-Aug-05
Tropo (C)	313	W6QI/6 (DM04ms) - AD6FP/6 (DM07dm)	21-Aug-05
Tropo (C)	311	N1JEZ/1 (FN44ig) - KA1OJ/1 (FN41ll)	19-Aug-12
Tropo (C)	290	KB8VAO/6 (DM04ms) - W6QI/6 (DM07gi)	20-Sep-04
Tropo (C)	285	N1JEZ/1 (FN44ig) - KA1OJ/1 (FN51av)	17-Sep-06

Rainscatter does exist on 24G.

N9JIM & W6QIW completed a 285km (177miles) 24GHz QSO
8/15/2020 18:52 local… was it rainscatter or tropo? Was on direct path.

Radio Range at Altitude

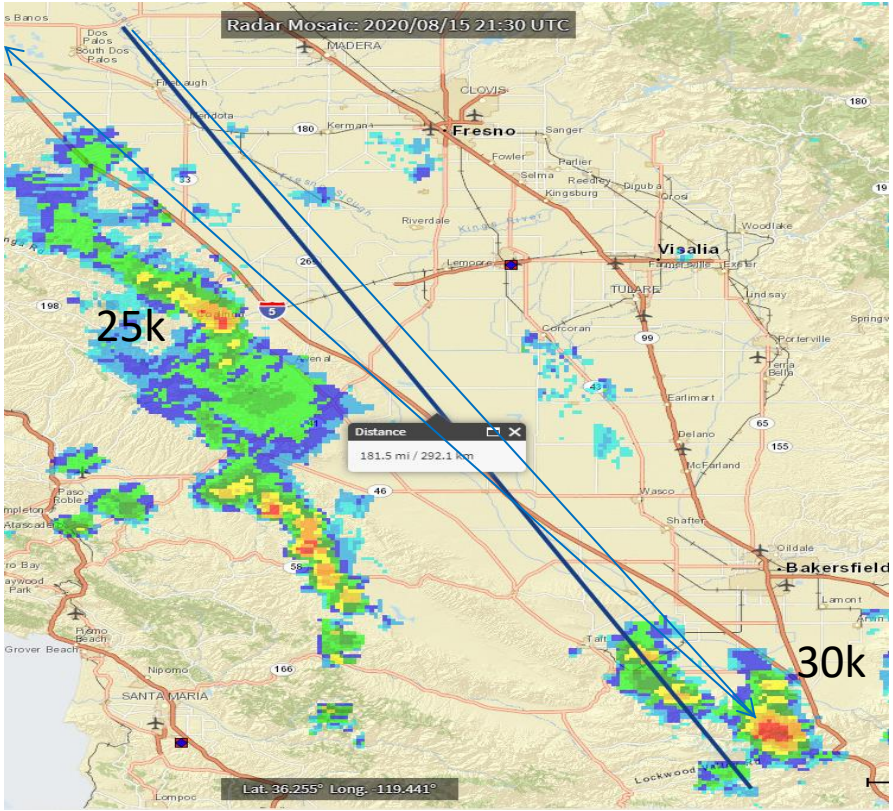
km	Miles	Altitude
321	199.5	20000'
360	223.7	25000'
394	244.8	30000'
425	264.1	35000'
455	282.7	40000'
482	299.5	45000'

dr (radio) km = 4.12 * sqrt(height mtrs)

dl (LOS) km = 3.57* sqrt(height mtrs)

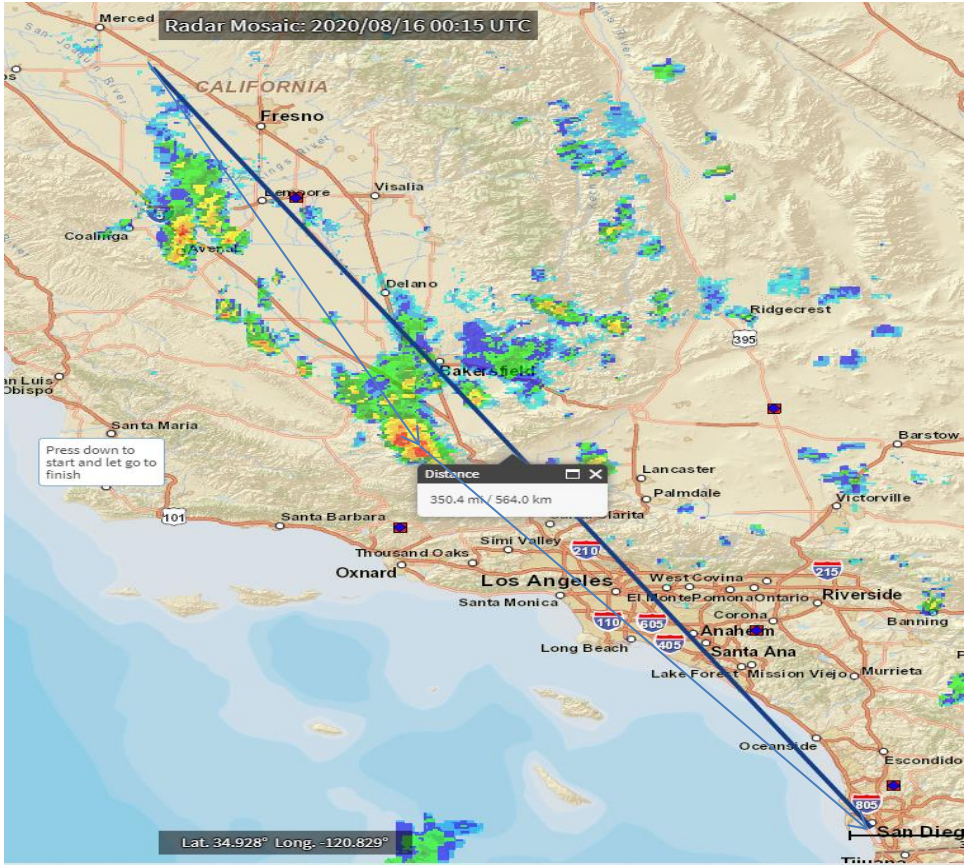
N5BF & K6MG

- Recording from N9JIM in CM97mb
- N5BF at DM04ms (Frazier) 312km from n9jim
- K6MG at CM97pb, 22km from n9jim
- 8/15/2020 about 14:30 local, 300km aso



N5bf-k6mg.m4a

AF6NA – N9JIM

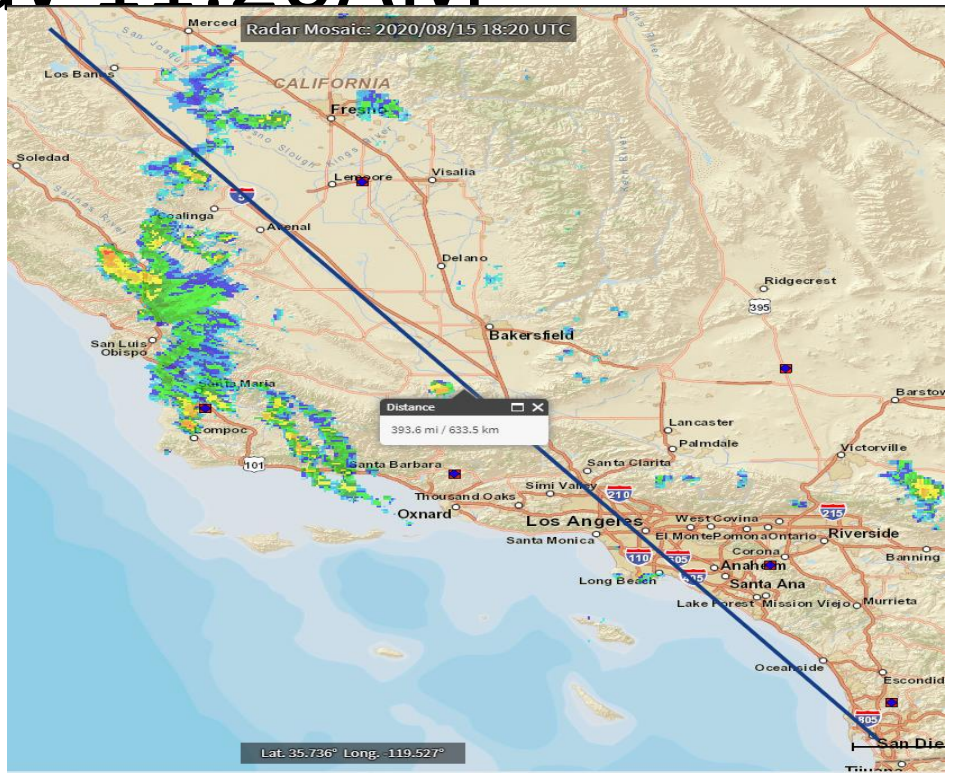


- Recording from N9JIM CM97rb
- AF6NA in DM12JS (San Diego)
- 8/15/2020 17:15 local, 566km
- 8/16/2020 00:15z
- Heading was W of Frazier

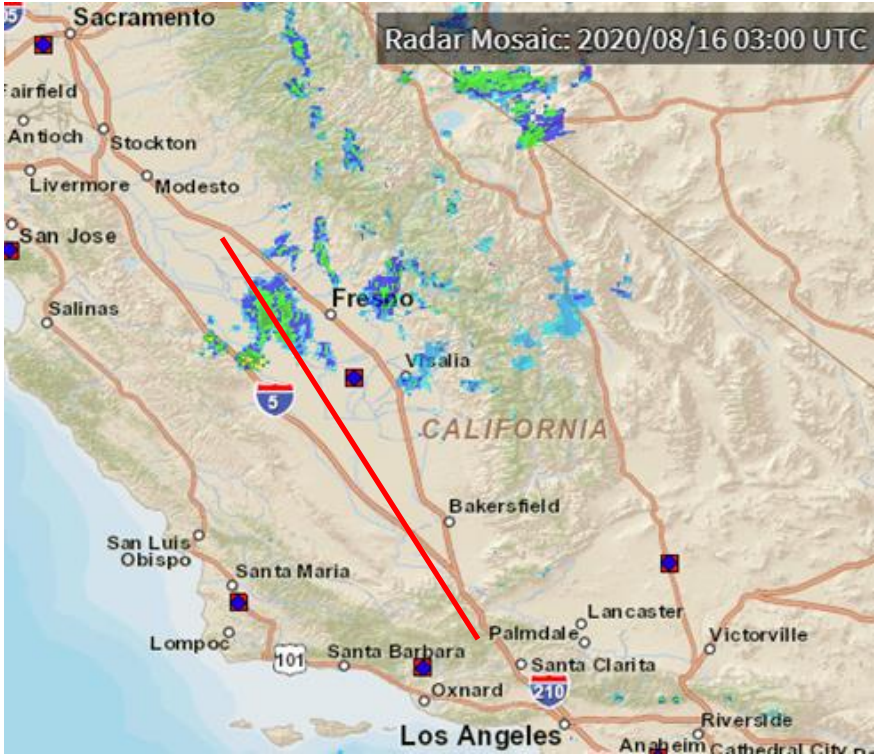
AF6NA DM12JS - N9JIM CM97RB.m4a

AF6NA – N9JIM
Saturday 11:20AM

- Was it tropo or rain?
- Rain is too far?
- Blip at end of valley?
- 2 hits?



24GHz W6QIW – N9JIM 285 km



8/15/2020 18:52 local
N9JIM & W6QIW completed
a 285km (177miles) 24GHz QSO

NEW 24GHz record!

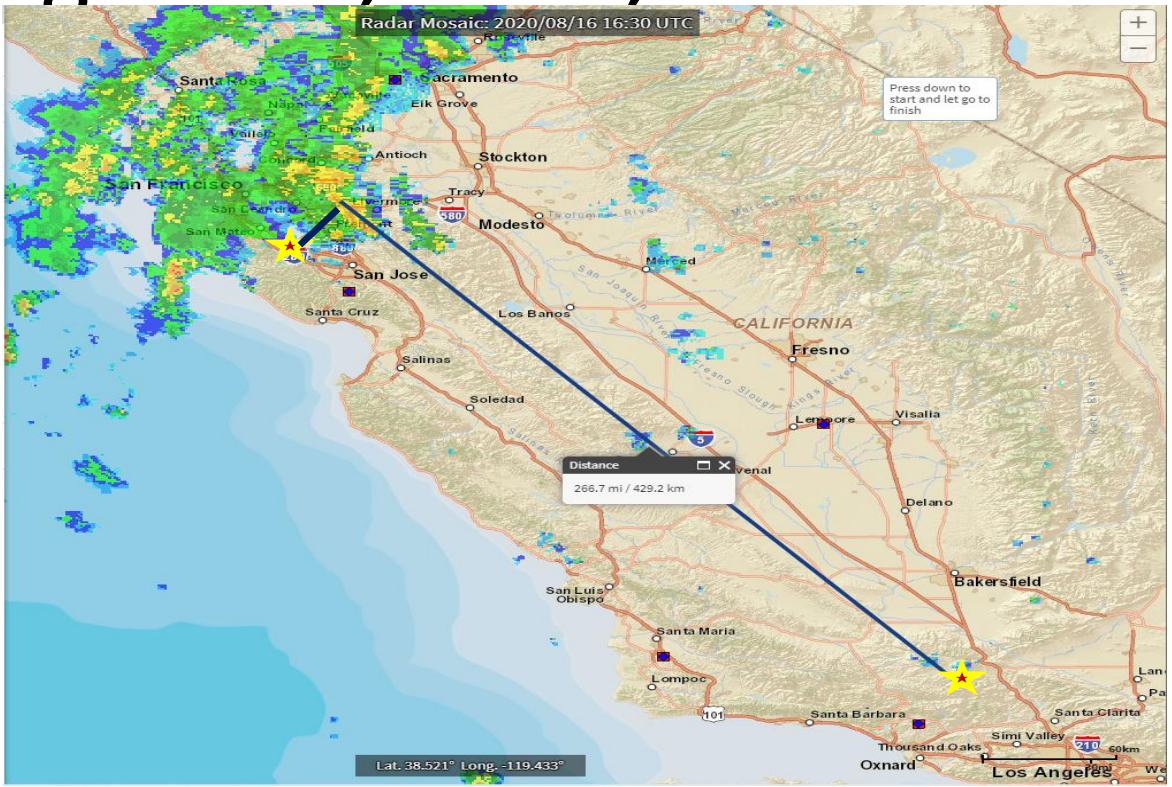
1) Weak signals
2) Minor distortion
3) Heading was direct
4) Small uptilt (<3 deg at N9JIM)
5) 8000’ Radio range is 203 km
   (LOS = 176km)

N9JIM – W6QIW 10GHz
Sunday 9:30AM

- Sunday Aug 16, 09:30 local
- Using thunder cells N of San Francisco
- Recording N9JIM in CM87uk (Canada College) pointing North towards the storm about 20 miles NNE. That's away from W6QIW
- W6QIW at Frazier DM04ms, also pointing at the storm over 260 miles. Doable from 8000'! With a >27k ft alt reflection from the storm
- There were some >30k at the time
- QSO distance: 422km (262 miles)
- AD6IW also completed with W6QIW from the valley floor (<50ft) setup on his balcony!

W6QIW DM04MS- N9JIM CM87UK.m4a

N9JIM – W6QIW 10GHz
August 16, 2020, 9:30AM local

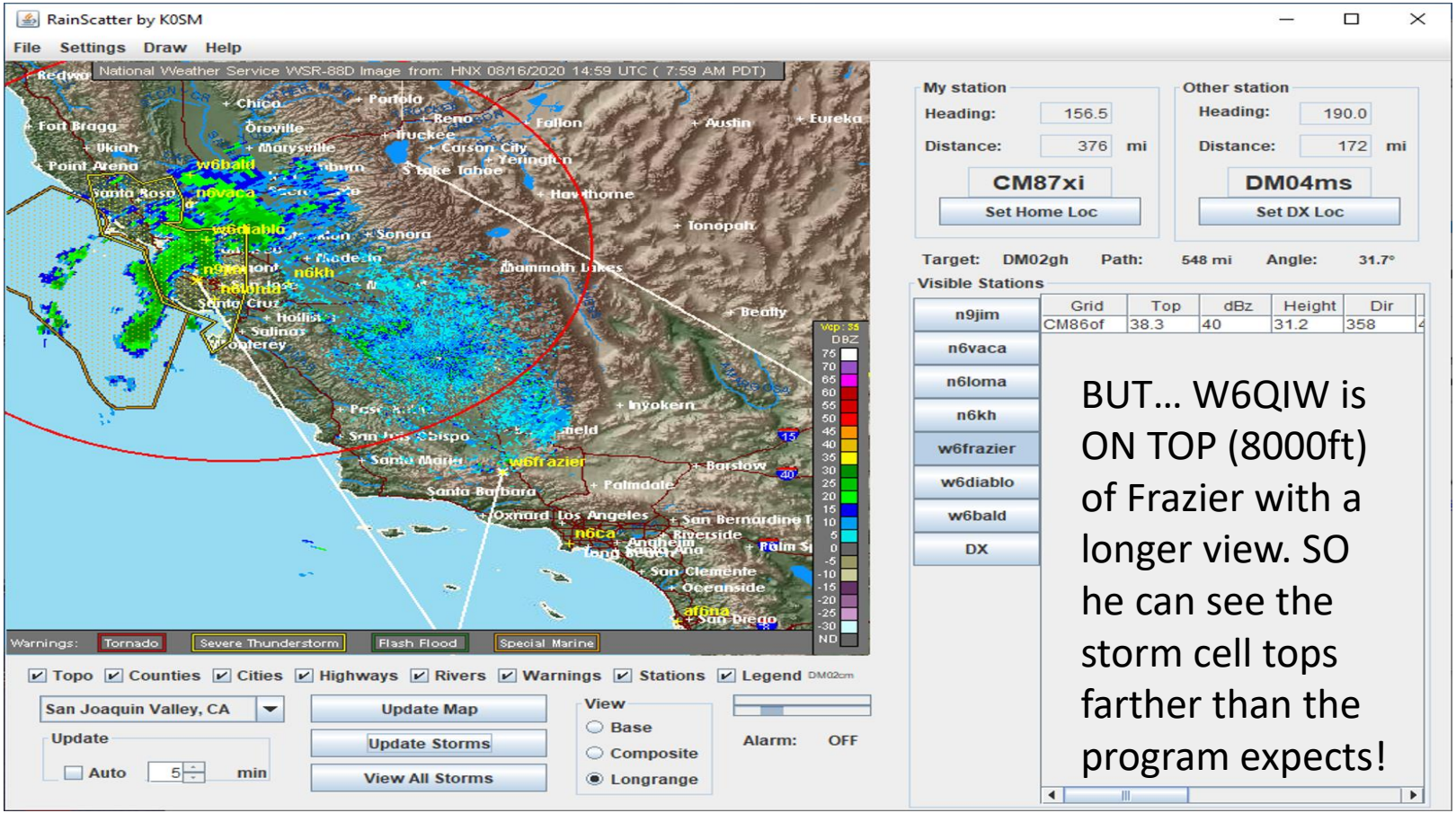


N9JIM at CM87uk

Uptilt was 5 degrees.

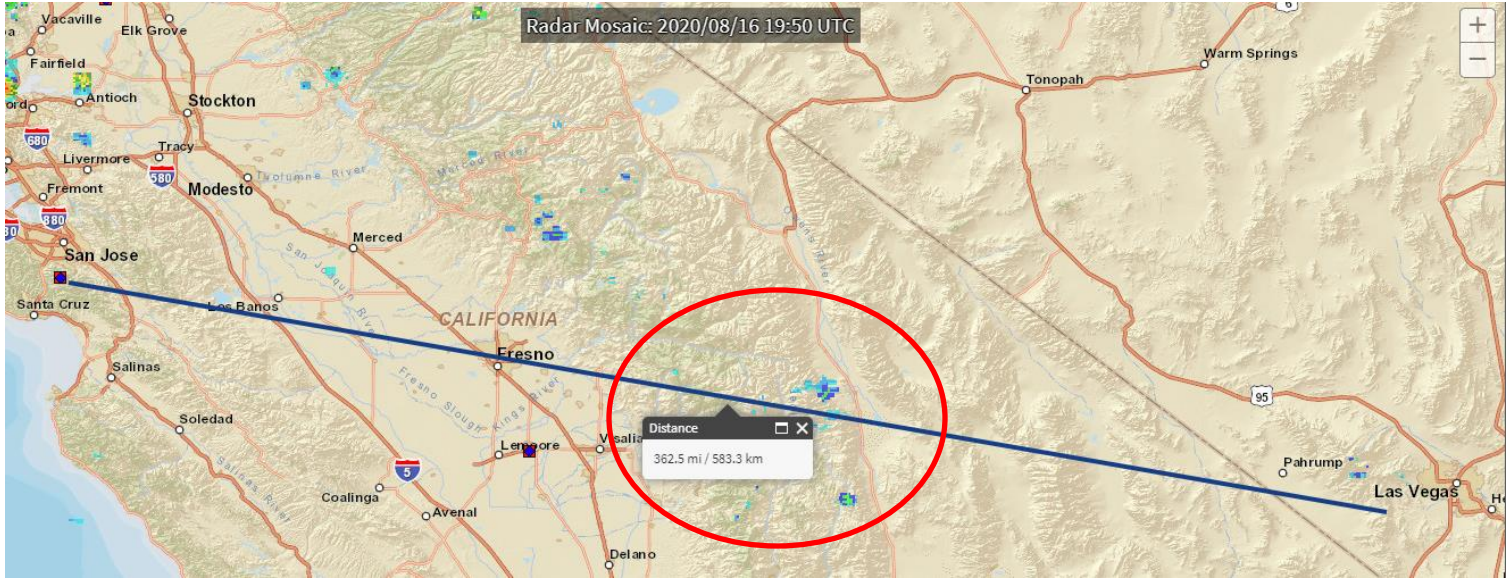
Horizon is -18 deg on meter

1.5 hours before – Rainscatter Software



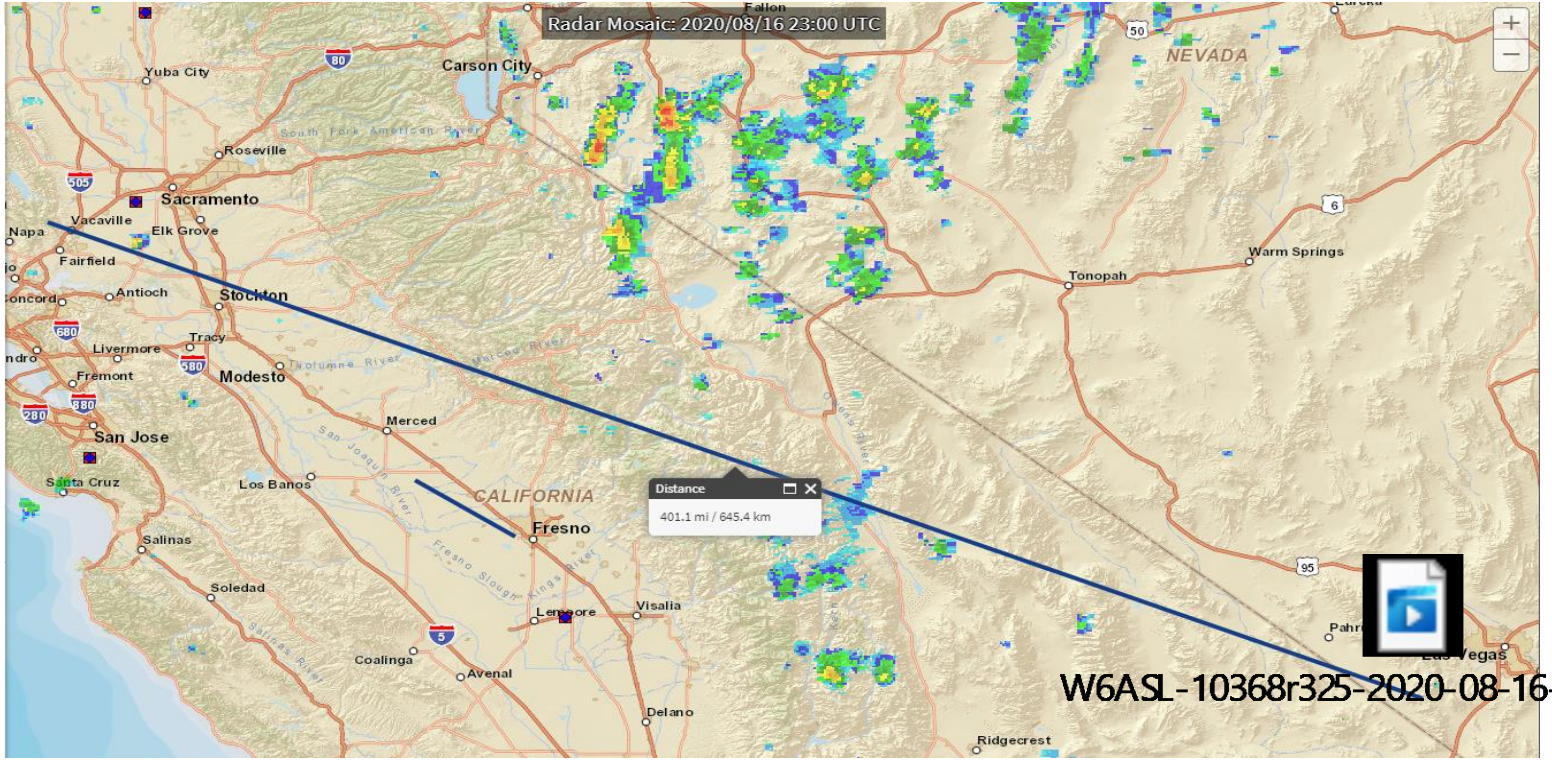
WA6CDR (DM25gw)-N9JIM (CM97BC)

- 8/16/2020 12:50PM SUPER strong FM signals, some light distortion
- Some mid-path reflection but not very strong radar returns

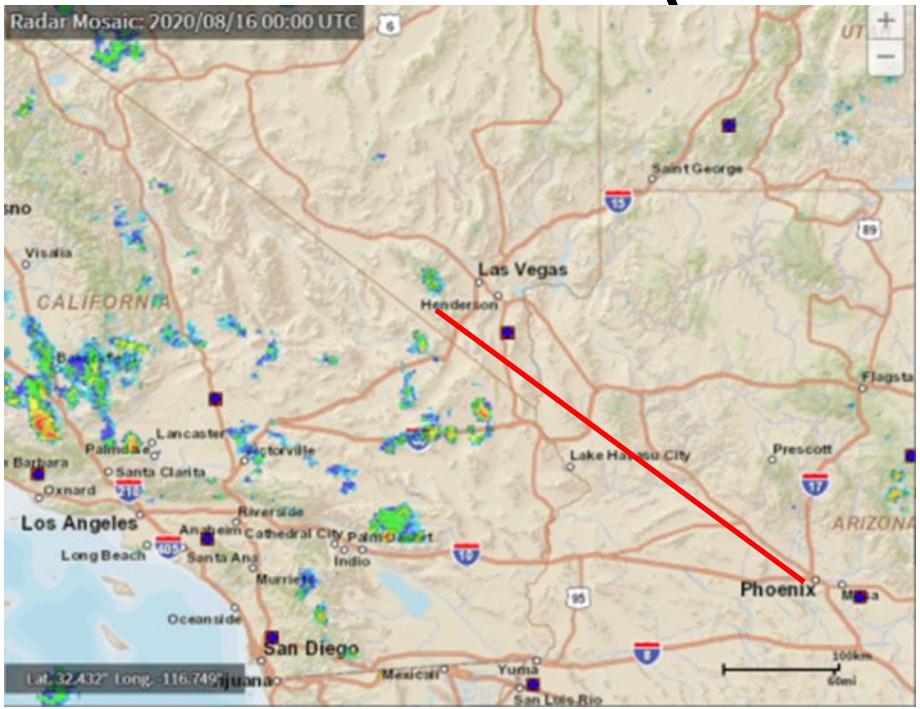


Vaca Beacon – WA6CDR (Potosi)

- About 4PM? Radar shows till 7PM!
- Last time Beacon heard.. Not heard since the LNU Lightning Complex fire.



WA6CDR (Potosi) to W7ATN/b



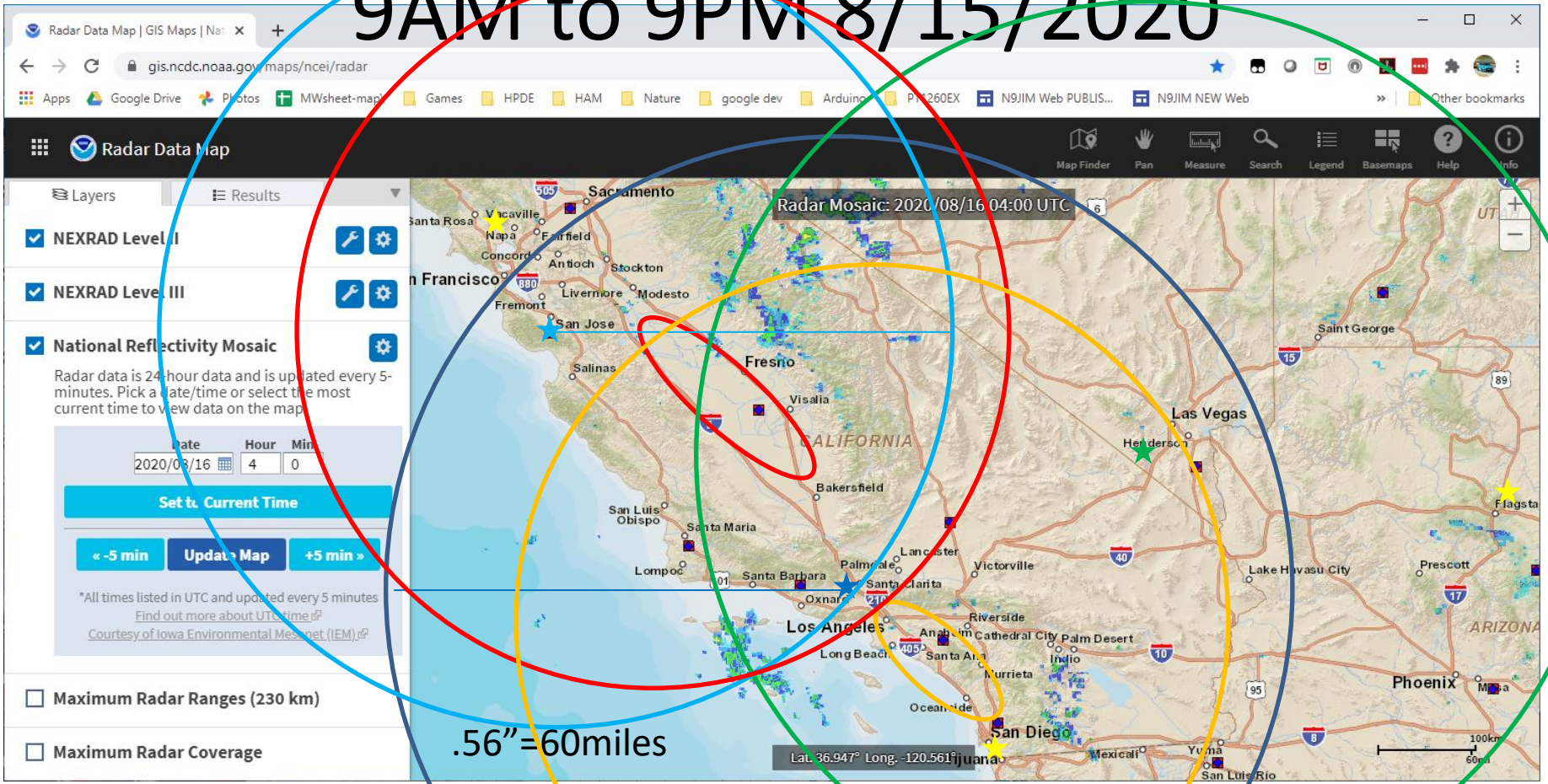
- Recorded on high Potosi at 1630 local
- DM25gw – DM33rn 306km (109 mi)
- Path?

W7ATN 10368r375 BCN 2020-08-16 FROM POTOSI.mp3

Historic radar plots

- https://gis.ncdc.noaa.gov/maps/ncei/radar
- https://www.ncdc.noaa.gov/data-access/radar-data
- August Contest WX Radar Plots follow

9AM to 9PM 8/15/2020



.56”=60miles

9AM to 9PM 8/16/2020