Solar Eclipse 2017:
Preliminary Analog and Digital Analysis

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Gee, let's go *the other way!*

TOTAL SOLAR ECLIPSE ON AUGUST 21, 2017

National Aeronautics and Space Administration

This unique map shows the path of the moon's umbral shadow — in which the sun will be completely obscured by the moon — during the total solar eclipse of Aug. 21, 2017, as well as the fraction of the sun's area covered by the moon outside the path of totality. The lunar shadow enters the United States near Lincoln City, Oregon, at 9:05 a.m. PDT. Totality begins in the United States in Lincoln City, Oregon, at 10:16 a.m. PDT. The total eclipse will end in Charleston, South Carolina, at 2:48 p.m. EDT. The lunar shadow leaves the United States at 4:09 p.m. EDT. A partial eclipse will be visible throughout the United States.

EVERYONE IN NORTH AMERICA WILL BE ABLE TO EXPERIENCE THIS ECLIPSE.

EXPERIENCE THE 2017 ECLIPSE ACROSS AMERICA THROUGH THE EYES OF NASA
http://eclipse2017.nasa.gov

Lunar topography data from NASA's Lunar Reconnaissance Orbiter and the Japan Aerospace Exploration Agency's SELENE lunar orbiter were used to precisely calculate the location of the moon's shadow. Land shading is based on a global mosaic of images from NASA's Moderate Resolution Imaging Spectroradiometer, and elevations are based on data from NASA's Shuttle Radar Topography Mission. Planetary positions are from NASA's Jet Propulsion Laboratory Development Ephemeris 421.

Credit: NASA's Scientific Visualization Studio

Beaver Island

Home

www.nasa.gov

NP-2016-11-525-GSFC (Rev 4/17)

Off the Beaten Path

Solar Eclipse Computer

U.S. Naval Observatory
Astronomical Applications Department

Solar Eclipse of 2017 Aug. 21

Sun in Partial Eclipse at this Location

Beaver Island, MI (Longitude W 85° 29' 50.0", Latitude N 45° 39' 18.0", Height 180m)

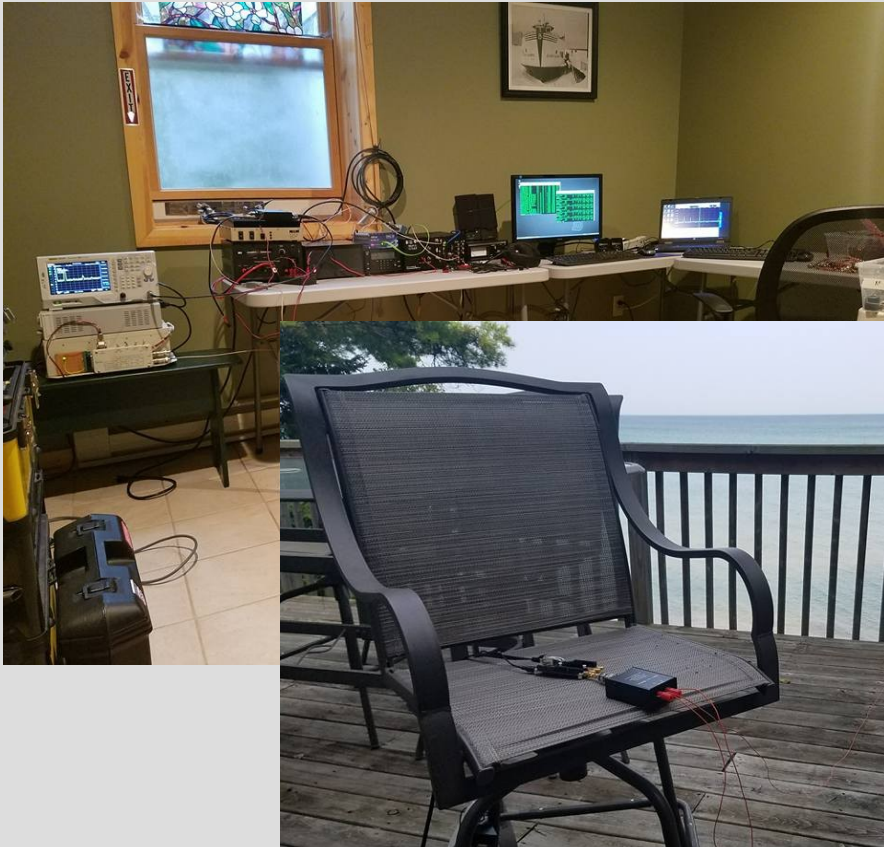August 21, 2017   Universal Time (UT1)   Delta T: 69.4s

Phenomenon	Day	Time (UT1)	Sun's Altitude (°)	Sun's Azimuth (°)	Position Angle (°)	Vertex Angle (°)
Eclipse Begins	21	16:58:20.3	54.8	159.9	277.8	292.1
Maximum Eclipse	21	18:19:31.1	55.4	195.0		
Eclipse Ends	21	19:38:14.3	48.5	224.5	126.4	96.4

Duration	2h 39m 53.9s
Magnitude	0.775
Obscuration	72.3%

Back to form

Eclipse Research Station Beaver Island

- Hermes (80, 40, 30, 20M)
- Atlas/Mercury (Kiss Konsole)
- Red Pitaya (AM BCB; also captured 160M)
- 43 foot vertical antenna (HF)
- ~50 foot slanted wire (BCB)
- FTS-4100 Cesium standard*
- Two i7 and one i5 computers

* What, you thought I could
do this without time-nuttery???

Mandatory Disclaimer...

*I'll show you **WHAT** I saw,
but don't ask me about **HOW** or **WHY**!*

So, what did we see?

(1 minute video; eclipse max is about 39 seconds in, tinted red. Start is about 1 hour before max.)

So, what did we see?

Solar Eclipse 2017 -- 80 Meters at EN75gp (N8UR)
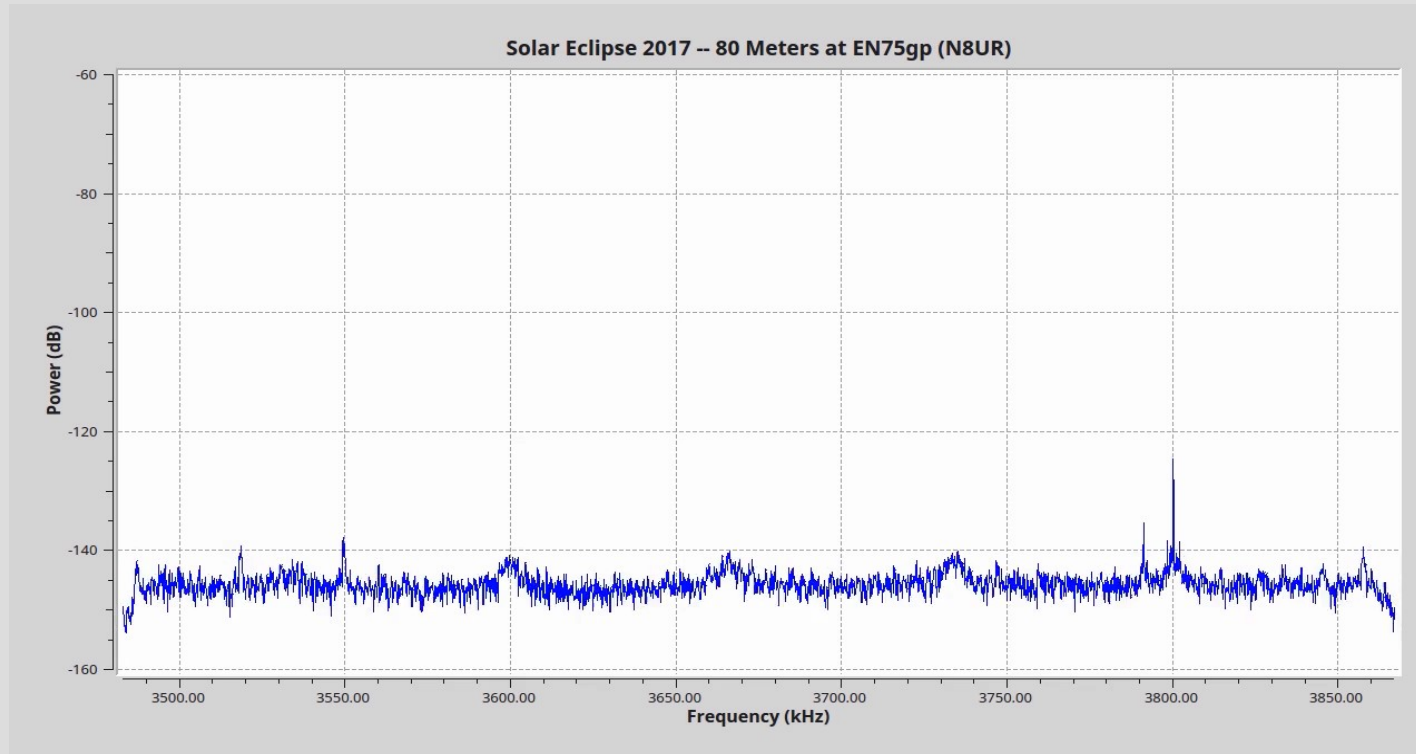
(1 minute video; eclipse max is about 39 seconds in, tinted red. Start is about 1 hour before max.)

10 MHz WWV Doppler Shift?
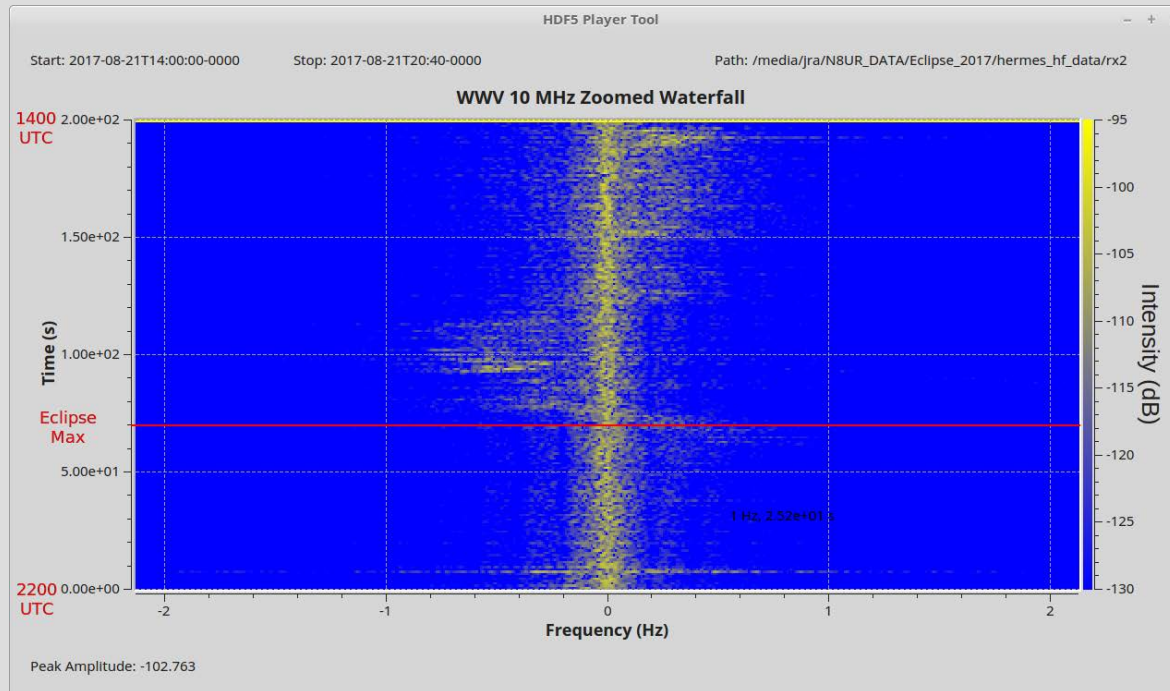
10 MHz WWV Amplitude vs. Time
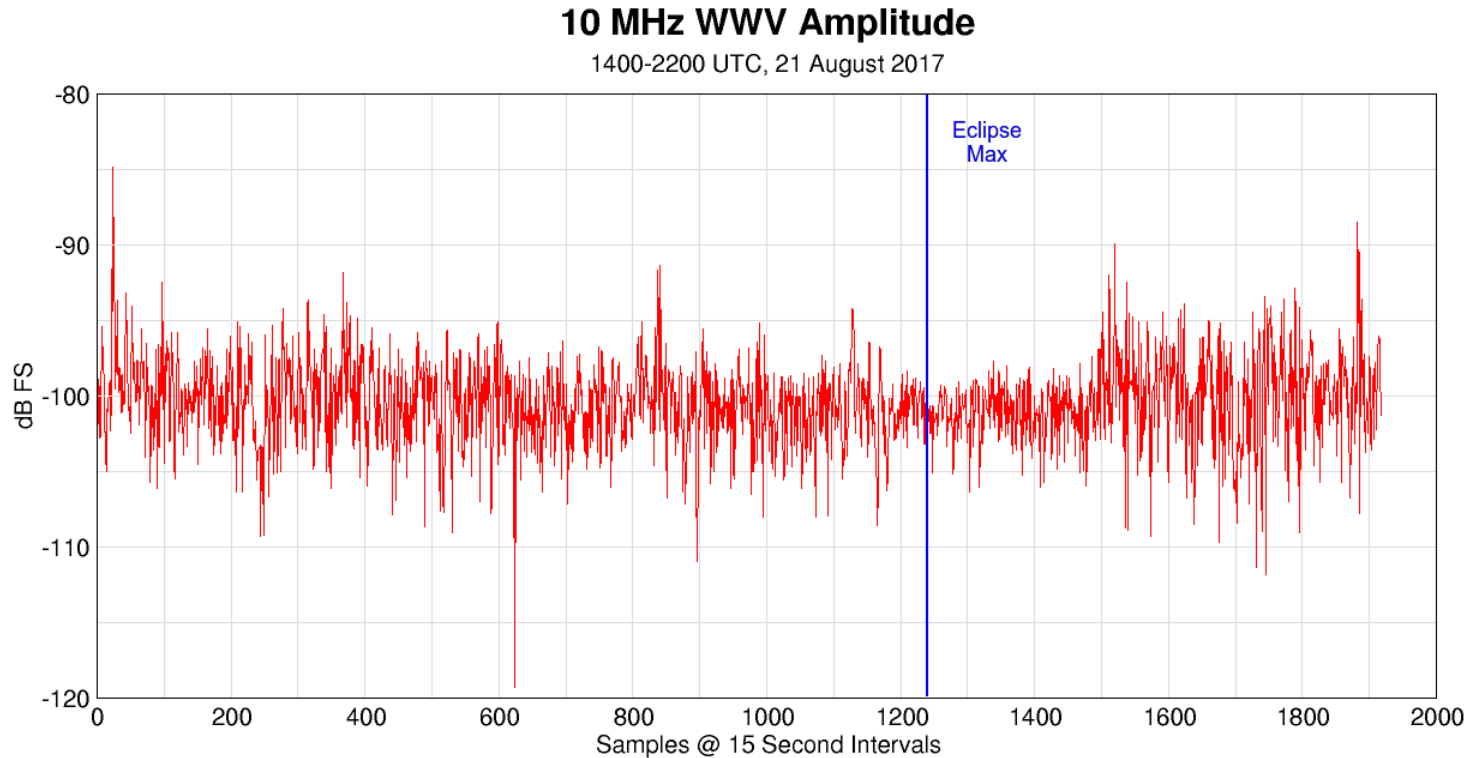
AM BCB Stations

Solar Eclipse 21 August 2017
Channel Power of Ten AM Broadcast Stations Seen at EN75gp
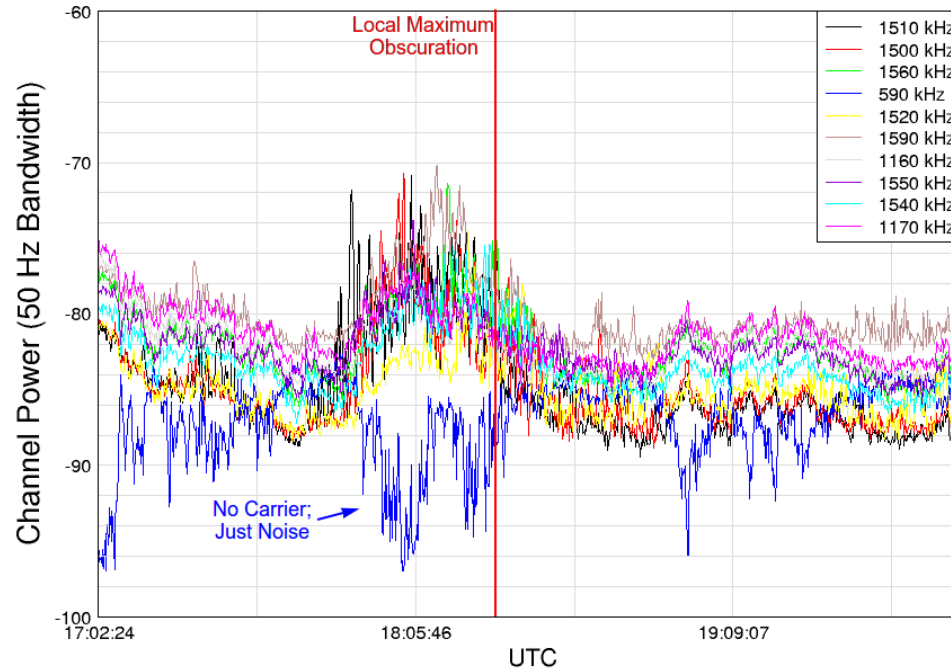
Moving From Analog to Digital: CW Spot Analysis

- Idea: Use VE3NEA's CW Skimmer software to post-process CW signals from the recorded data.
- Interesting challenges figuring out how to get Gnu Radio binary files read into CW Skimmer Server. Rick, N1GP, came through with the necessary software. ***Thanks, Rick!***
- Looked at five bands: 160, 80, 40, 30, 20 meters
    - No signals on 160
    - Minimal activity on 30 (not part of the SEQP)
    - So focused on 80, 40, 20M:
        - 80M: 1795 spots, 69 calls
        - 40M: 7693 spots, 286 calls
        - 20M: 12442 spots, 333 calls

Methodology

- Feed wideband data into Skimmer, one band at a time
- Start with one spots.txt file per band
- With many Linux tools:
  - Munge records into more usable format
  - Filter for bogus calls
  - Reduce to one spot per minute per call
- Merge geolocation data (thanks, Nathaniel!)
- Generate histogram – number of spots per minute
- Generate SNR – average SNR of all spots in each minute
- Perform further splitting (e.g., east and west of my location) and generate average SNR per minute
- Make pretty pictures

Spots Per Minute

Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)
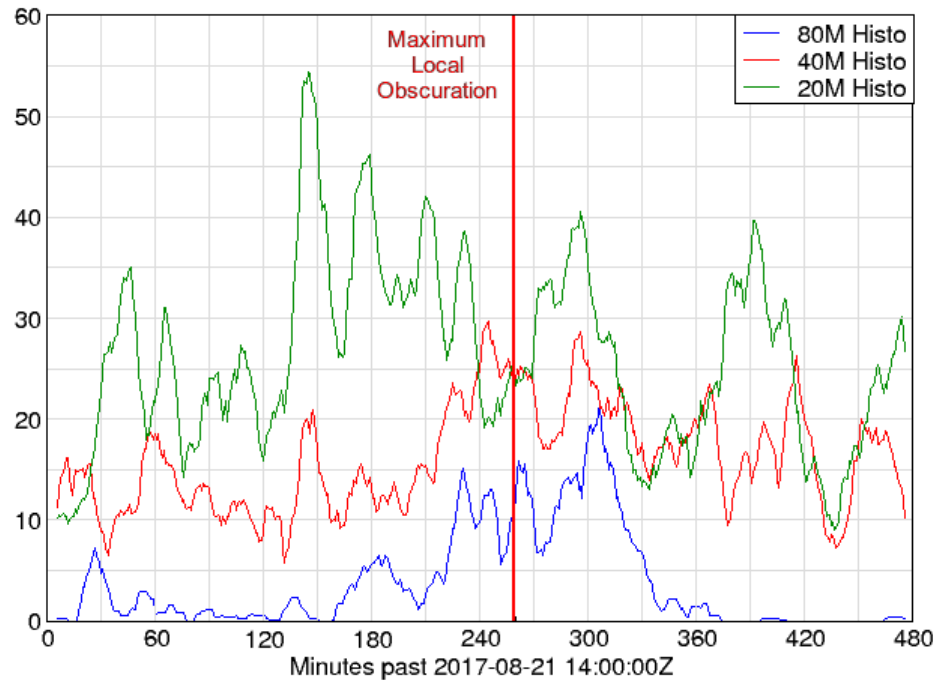
Average Signal-to-Noise Ratio

Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)
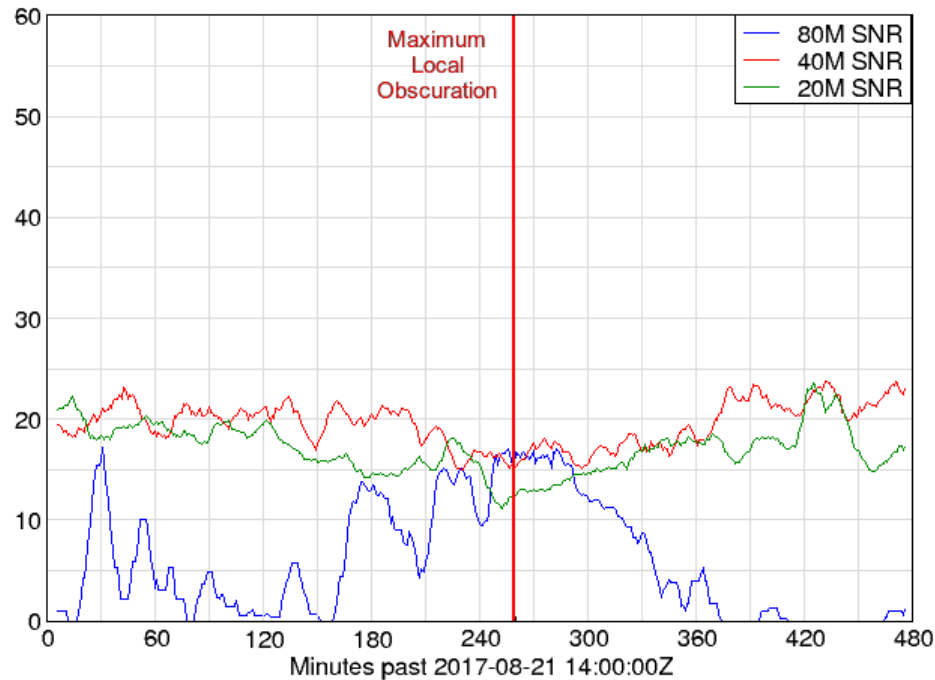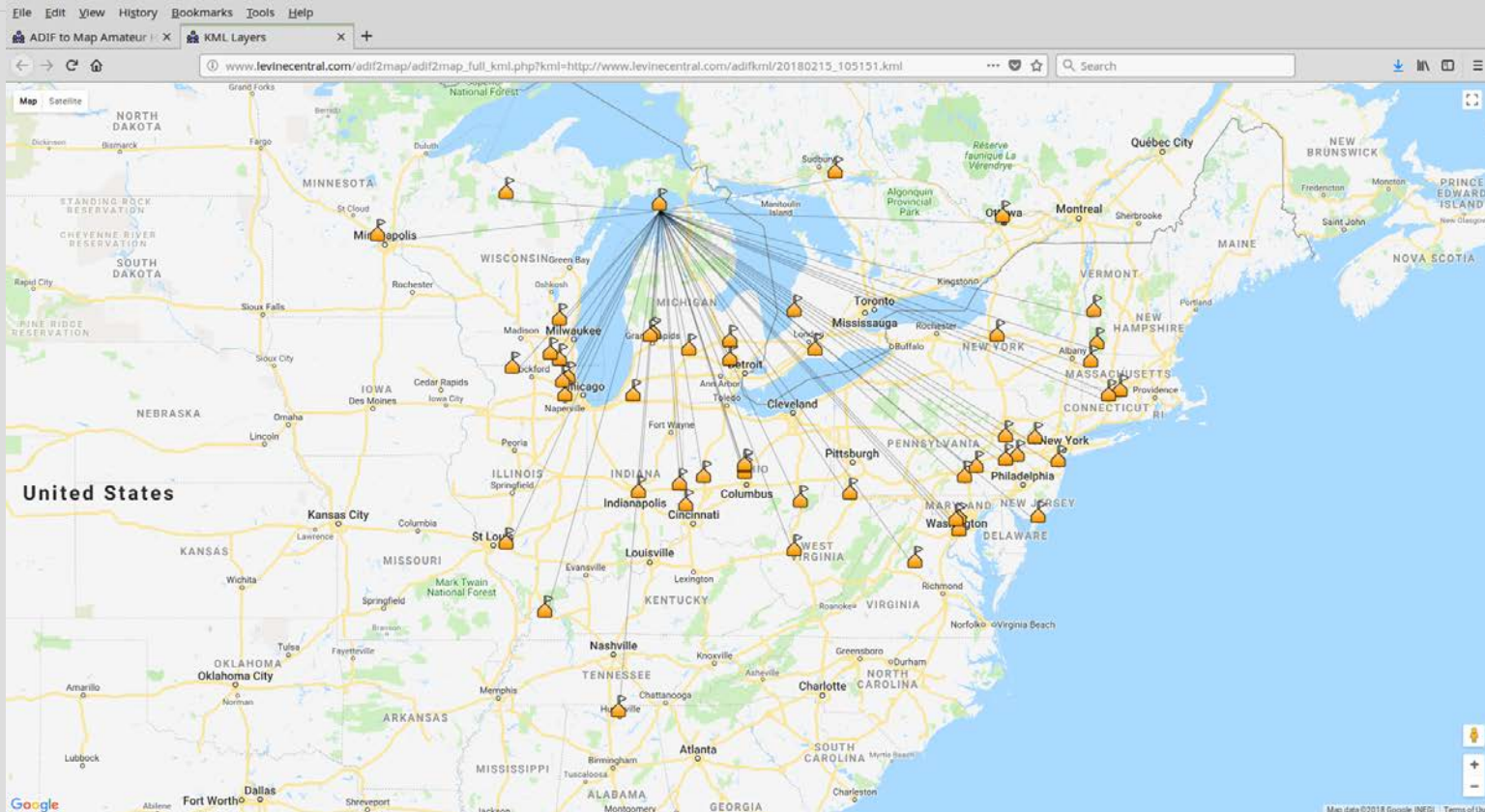
80M Stations Heard

80 Meters

Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)
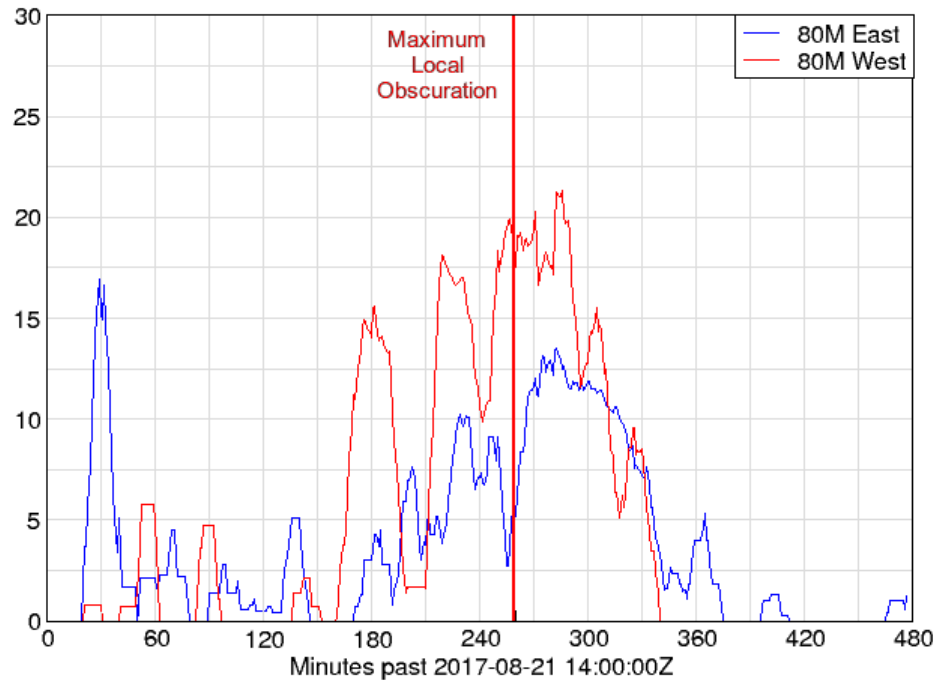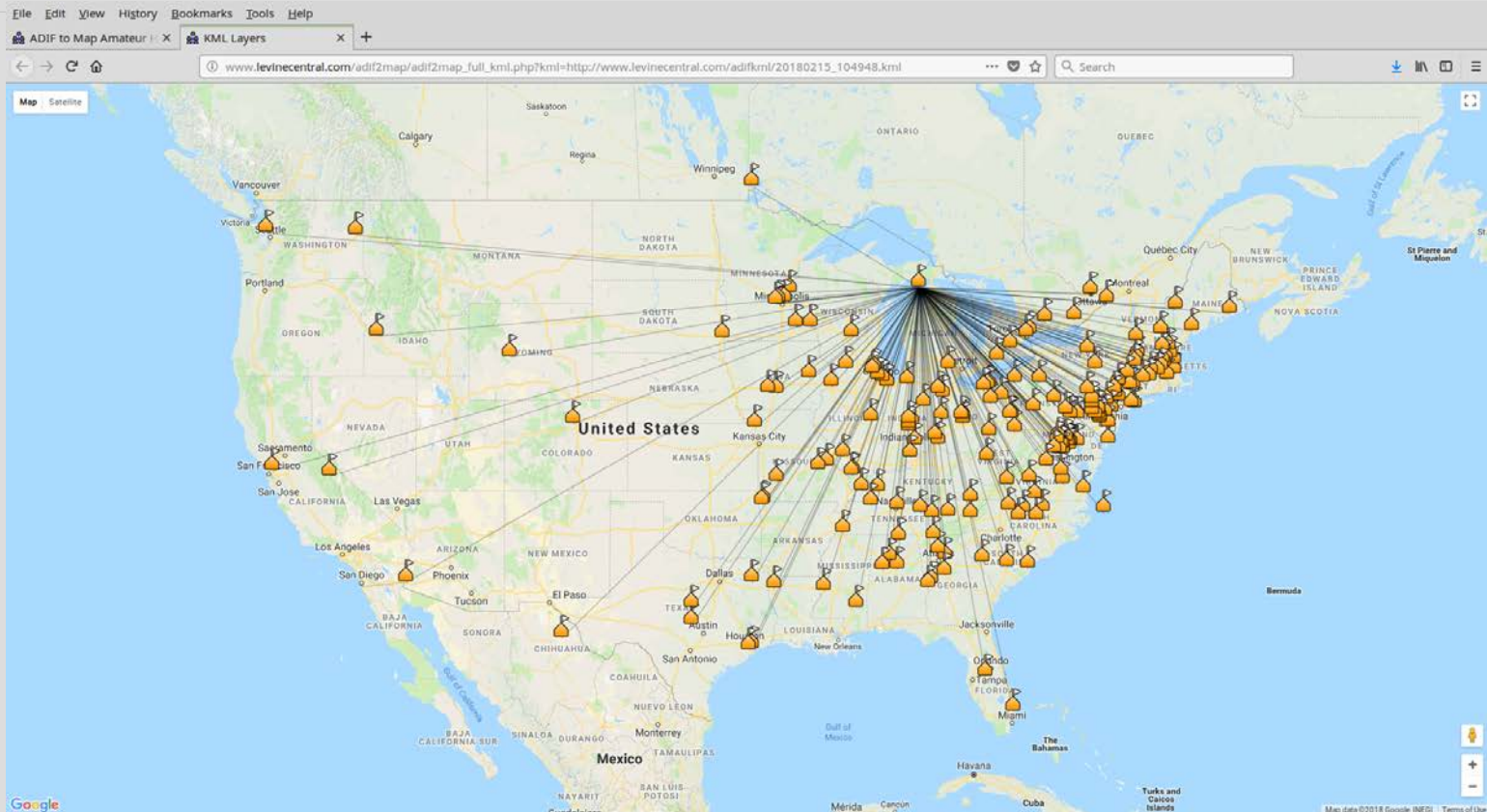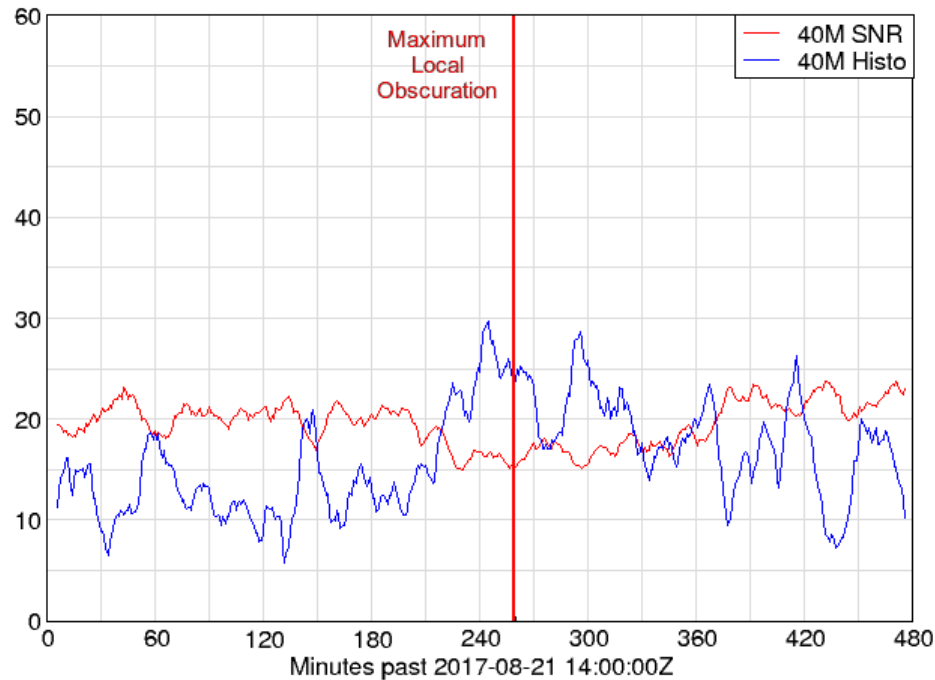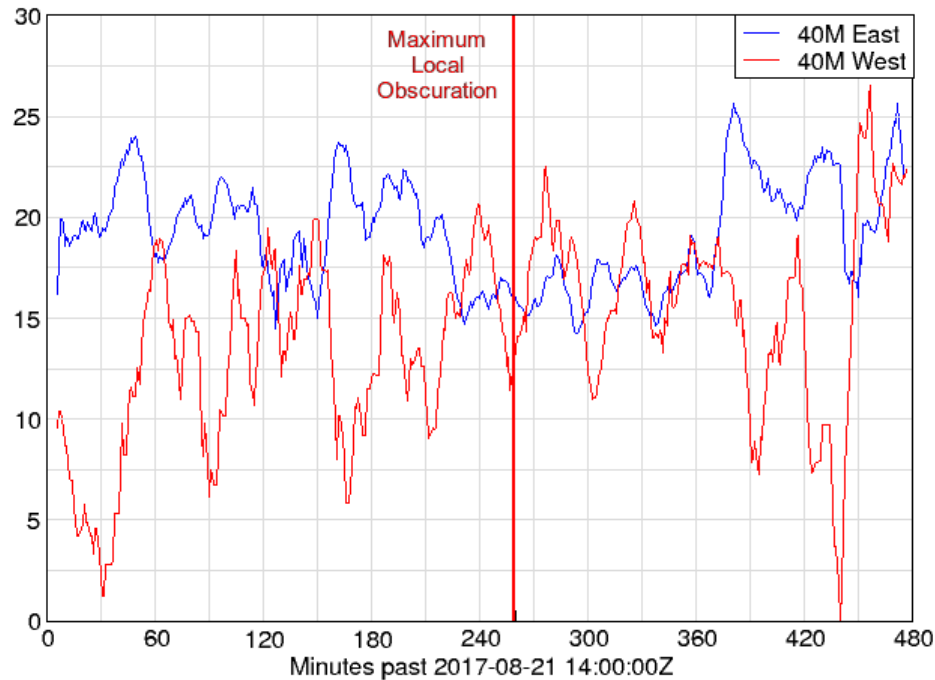Average SNR (dB) and 1 Minute Spot Histogram (Running Avg. = 10)
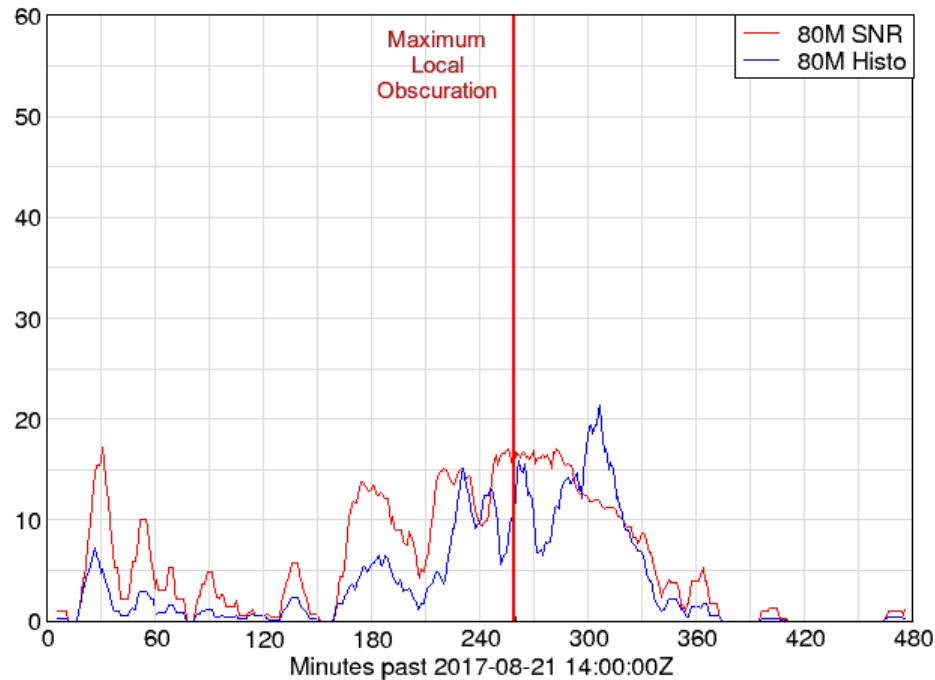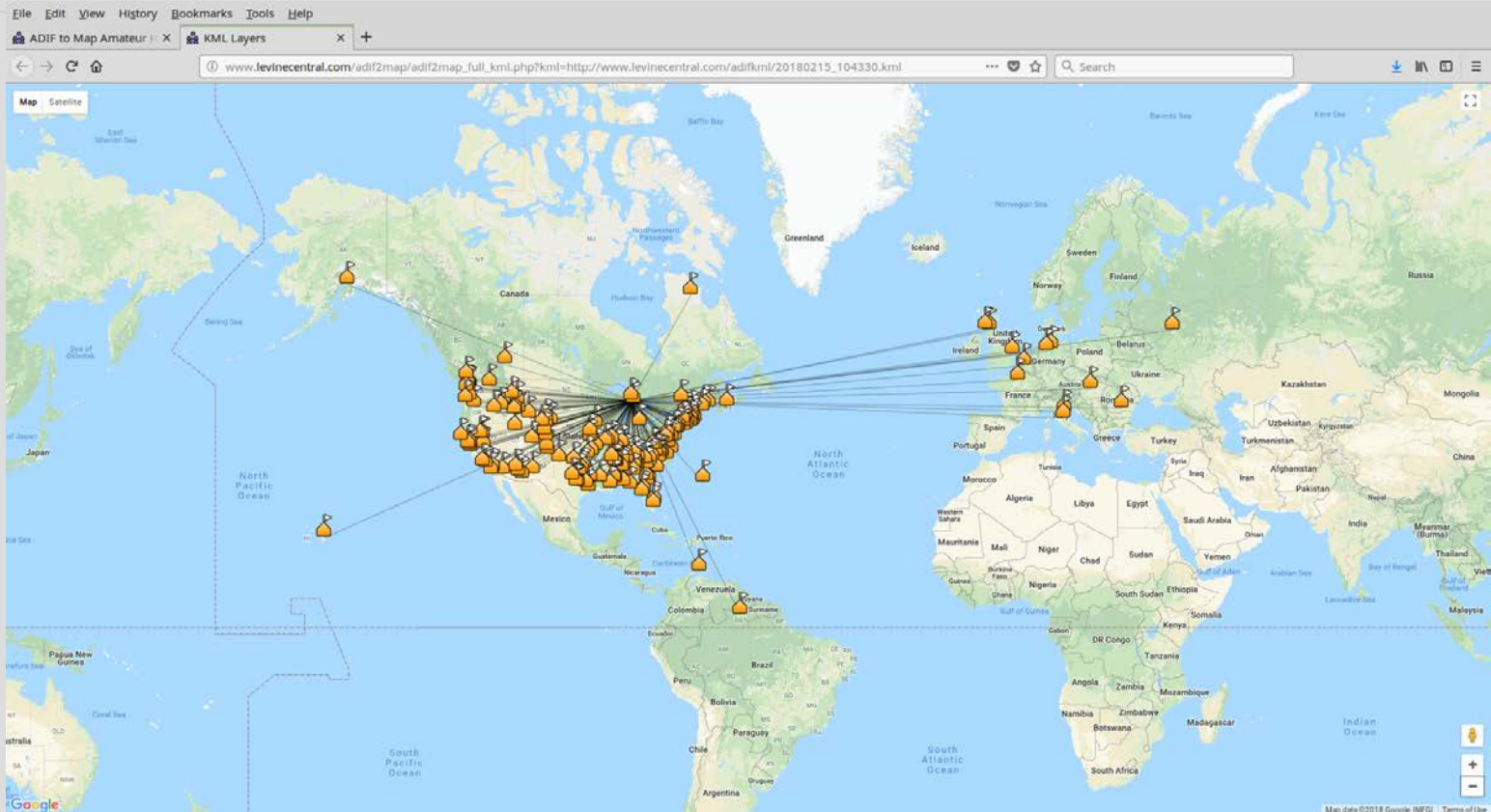
80 Meters

Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)

40M Stations Heard

40 Meters

Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)

40 Meters

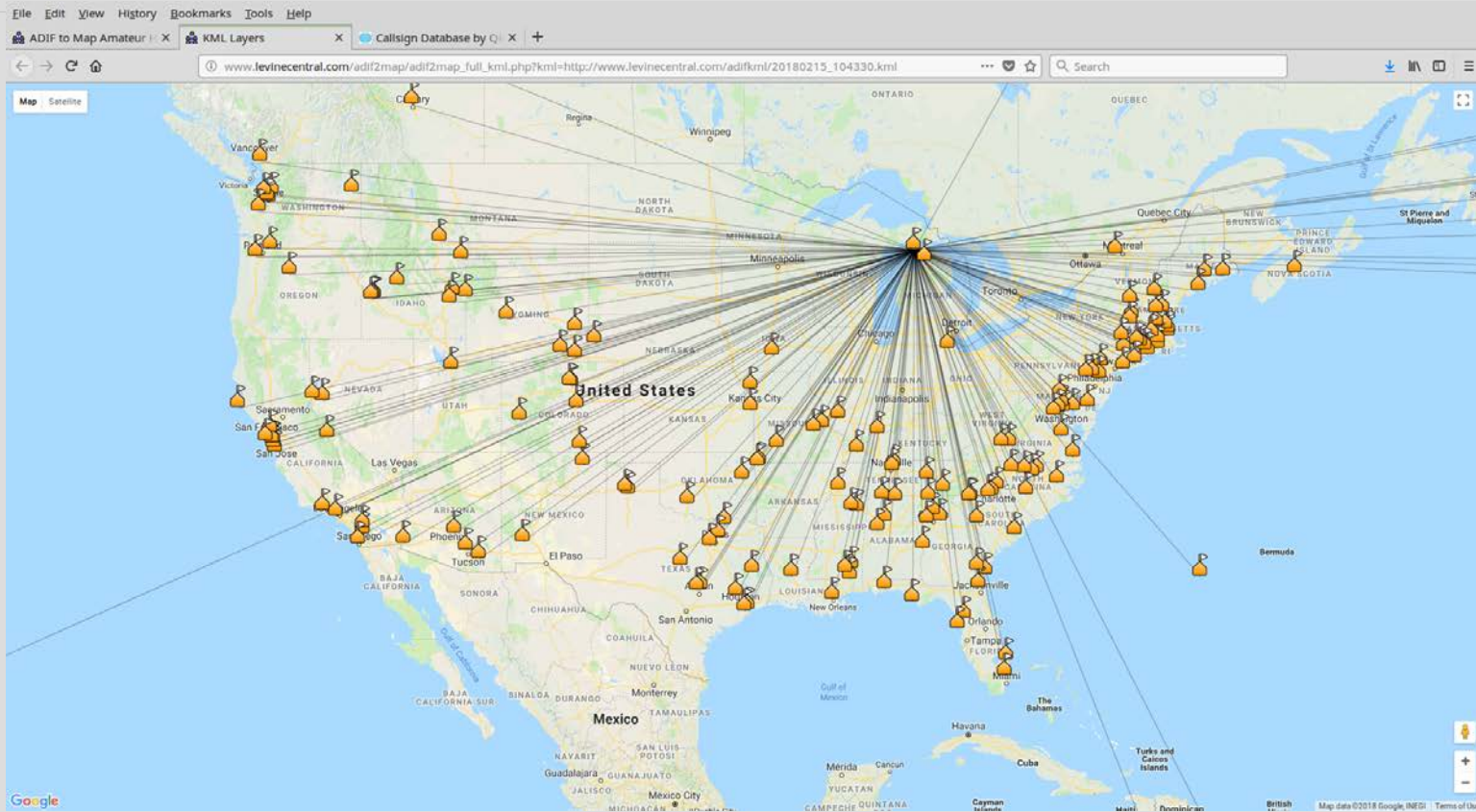Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)

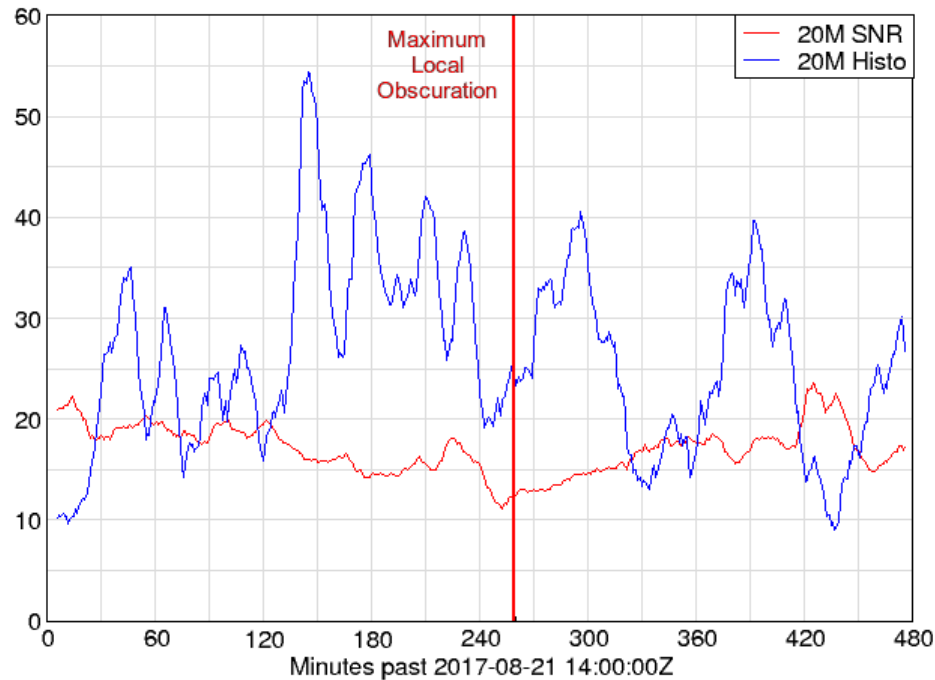# 20M Stations Heard

20M Stations Heard

20 Meters

Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)
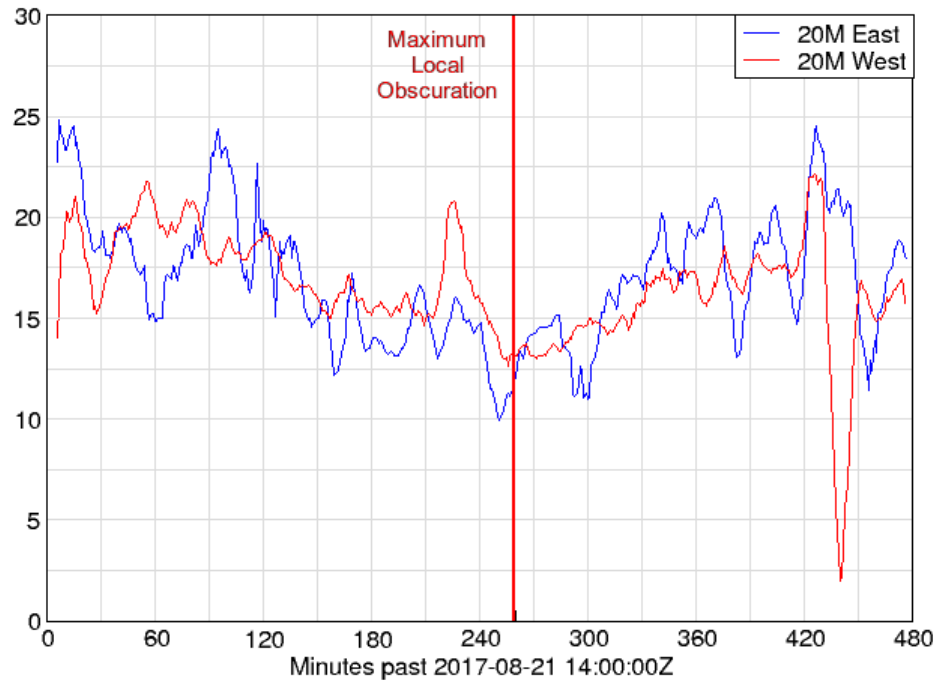Average SNR (dB) and 1 Minute Spot Histogram (Running Avg. = 10)

20 Meters

Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)

Most Prolific Senders

80M Pcnt/Count/Call			40M Pcnt/Count/Call			30M Pcnt/Count/Call			20M Pcnt/Count/Call		
13.370	240	K9DX	15.807	1216	N8PW	36.986	27	W0ERE	9.990	1243	N4BP
12.479	224	NQ6N	7.864	605	AA3B	8.219	6	WB2YIP	5.039	627	W6RW
10.529	189	K3PP	3.003	231	W1SJ	8.219	6	K1IMA	3.850	479	W7SE
8.412	151	W9XT	2.574	198	WB9HFK	5.479	4	N0FW	3.552	442	KS7T
6.908	124	VE3CV	2.548	196	K3WW	5.479	4	K5VR	3.134	390	K4BAI
5.738	103	VE3MGY	2.457	189	K1EEE	4.110	3	W9NT	2.966	369	K8TE/7
4.568	82	K8JQ	2.158	166	K2DSW	4.110	3	W5ZO	2.540	316	W6RDF
4.345	78	K3JT	2.132	164	NE3I	4.110	3	KA4KSB	2.258	281	N7S
3.175	57	K9BGL	2.080	160	K9BGL	4.110	3	K0ARS	2.194	273	W5TA
2.897	52	N8EA	2.002	154	K8JQ	2.740	2	WK0B	2.114	263	K5CM
2.451	44	K9UIY	1.989	153	K1BX	2.740	2	W0OPW	2.017	251	KE1B
2.284	41	K3ZO	1.742	134	W0ECC	2.740	2	N5VR	1.937	241	K6RB
1.950	35	K9ALP	1.612	124	N4N				1.881	234	W5GAD
1.838	33	AB9YC	1.599	123	K3JT				1.832	228	W5FMH
1.616	29	N0FW	1.547	119	VE3KP				1.712	213	W1UJ
1.448	26	W3IUU	1.547	119	N3HEE				1.656	206	W0ECC
1.170	21	W2ID	1.482	114	N4HAI				1.623	202	AA3B
1.114	20	W9RE	1.313	101	W7IY				1.543	192	N5EE
1.058	19	KB1W	1.313	101	K9KM				1.495	186	W8KA
1.003	18	NG2O	1.300	100	AE1T				1.479	184	WA1FCN

Conclusions

- Skimmer is a worthwhile analysis tool
  - But watch for busted calls
- 80M seems to show the greatest eclipse impact
- 40M shows general peak
- 20M doesn't show any real trends (at least from this data cut)
- I can't wait for the next eclipse!!!