Gee, let’s go the other way!
### 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)

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Day</th>
<th>Time (UT1)</th>
<th>Sun’s Altitude (°)</th>
<th>Sun’s Azimuth (°)</th>
<th>Position Angle (°)</th>
<th>Vertex Angle (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eclipse Begins</td>
<td>21</td>
<td>16:58:20.3</td>
<td>54.8</td>
<td>159.9</td>
<td>277.8</td>
<td>292.1</td>
</tr>
<tr>
<td>Maximum Eclipse</td>
<td>21</td>
<td>18:19:31.1</td>
<td>55.4</td>
<td>195.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eclipse Ends</td>
<td>21</td>
<td>19:38:14.3</td>
<td>48.5</td>
<td>224.5</td>
<td>126.4</td>
<td>96.4</td>
</tr>
</tbody>
</table>

**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?

(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

10 MHz WWV Amplitude
1400-2200 UTC, 21 August 2017

Eclipse Max
AM BCB Stations

Solar Eclipse 21 August 2017
Channel Power of Ten AM Broadcast Stations Seen at EN75gp

Local Maximum Obscuration

Channel Power (50 Hz Bandwidth)

UTC

Mon Dec 4 09:39:12 2017
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)
Spots Per Minute (Running Avg. = 10)

Maximum Local Obscuration

Minutes past 2017-08-21 14:00:00Z
Average Signal-to-Noise Ratio

Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)
Average SNR (dB) (Running Avg. = 10)

- Maximum
- Local Obscuration
- 80M SNR
- 40M SNR
- 20M SNR

Minutes past 2017-08-21 14:00:00Z
Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)

Average SNR (dB) and 1 Minute Spot Histogram (Running Avg. = 10)

Maximum
Local
Obscuration

80M SNR
80M Histo

Minutes past 2017-08-21 14:00:00Z
Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)

SNR (Running Avg. = 10)

- Maximum
- Local Obscuration

Graph showing band activity with blue and red lines representing 80M East and 80M West respectively.

Minutes past 2017-08-21 14:00:00Z
40M Stations Heard
40 Meters

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

Maximum
Local Obscuration

Minutes past 2017-08-21 14:00:00Z
Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)
SNR (Running Avg. = 10)

Maximum Local Obscuration

Minutes past 2017-08-21 14:00:00Z

40 Meters
20M Stations Heard
20M Stations Heard
Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)

Average SNR (dB) and 1 Minute Spot Histogram (Running Avg. = 10)

- Maximum Local Obscuration
- 20M SNR
- 20M Histo

Minutes past 2017-08-21 14:00:00Z
Solar Eclipse 2017 -- Band Activity at N8UR (EN75GP)

SNR (Running Avg. = 10)

Minimum Local Obscuration

- 20M East
- 20M West

Minutes past 2017-08-21 14:00:00Z
Most Prolific Senders

<table>
<thead>
<tr>
<th>80M Pcnt/Count/Call</th>
<th>40M Pcnt/Count/Call</th>
<th>30M Pcnt/Count/Call</th>
<th>20M Pcnt/Count/Call</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.370 240 K9DX</td>
<td>15.807 1216 N8PW</td>
<td>36.986 27 W0ERE</td>
<td>9.990 1243 N4BP</td>
</tr>
<tr>
<td>12.479 224 NQ6N</td>
<td>7.864 605 AA3B</td>
<td>8.219 6 WB2YIP</td>
<td>5.039 627 W6RW</td>
</tr>
<tr>
<td>10.529 189 K3PP</td>
<td>3.003 231 W1SJ</td>
<td>8.219 6 K1IMA</td>
<td>3.850 479 W7SE</td>
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<tr>
<td>8.412 151 W9XT</td>
<td>2.574 198 WB9HFK</td>
<td>5.479 4 N0FW</td>
<td>3.552 442 K57T</td>
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<tr>
<td>6.908 124 VE3CV</td>
<td>2.548 196 K3WW</td>
<td>5.479 4 K5VR</td>
<td>3.134 390 K4BAI</td>
</tr>
<tr>
<td>5.738 103 VE3MGY</td>
<td>2.457 189 K1EEE</td>
<td>4.110 3 W9NT</td>
<td>2.966 369 K8TE/7</td>
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<tr>
<td>4.568 82 K8JQ</td>
<td>2.158 166 K2DSW</td>
<td>4.110 3 W5ZO</td>
<td>2.540 316 W6RDF</td>
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<tr>
<td>4.345 78 K3JT</td>
<td>2.132 164 NE3I</td>
<td>4.110 3 KA4KSB</td>
<td>2.258 281 N7S</td>
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<tr>
<td>3.175 57 K9BGL</td>
<td>2.080 160 K9BGL</td>
<td>4.110 3 K0ARS</td>
<td>2.194 273 W5TA</td>
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<tr>
<td>2.897 52 N8EA</td>
<td>2.002 154 K8JQ</td>
<td>2.740 2 WK0B</td>
<td>2.114 263 K5CM</td>
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<td>2.451 44 K9UIY</td>
<td>1.989 153 K1BX</td>
<td>2.740 2 W0OPW</td>
<td>2.017 251 KE1B</td>
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<tr>
<td>2.284 41 K3ZO</td>
<td>1.742 134 W0ECC</td>
<td>2.740 2 N5VR</td>
<td>1.937 241 K6RB</td>
</tr>
<tr>
<td>1.950 35 K9ALP</td>
<td>1.612 124 N4N</td>
<td>1.881 234 W5GAD</td>
<td>1.832 228 W5FMH</td>
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<tr>
<td>1.838 33 AB9YC</td>
<td>1.599 123 K3JT</td>
<td>1.832 228 W5FMH</td>
<td>1.712 213 W1UJ</td>
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<tr>
<td>1.616 29 N0FW</td>
<td>1.547 119 VE3KP</td>
<td>1.656 206 W0ECC</td>
<td>1.623 202 AA3B</td>
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<tr>
<td>1.448 26 W3IUU</td>
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<td>1.495 186 W8KA</td>
<td>1.543 192 N5EE</td>
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<tr>
<td>1.170 21 W2ID</td>
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<td>1.479 184 WA1FCN</td>
<td>1.495 186 W8KA</td>
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<tr>
<td>1.114 20 W9RE</td>
<td>1.313 101 W7IY</td>
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<td>1.314 251 KE1B</td>
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<td>1.058 19 KB1W</td>
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<td>1.314 251 KE1B</td>
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<td>1.003 18 NG2O</td>
<td>1.300 100 AE1T</td>
<td>1.314 251 KE1B</td>
<td>1.314 251 KE1B</td>
</tr>
</tbody>
</table>
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!!!