

HamSCI and the 2017 Total Solar Eclipse

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Outline

- I. What is Ham Radio & HamSCI?**
- II. Eclipse Experiments**
 - I. 2017 Total Solar Eclipse &
The Ionosphere**
 - II. Ham Radio Data Sources**
 - III. Observations**
- III. Summary & Conclusions**



Amateur/Ham Radio

- Hobby for Radio Enthusiasts
 - Communicators • Builders • Experimenters
- Wide-reaching Demographic, Technically Able
 - All ages & walks of life
 - Over 730,000 US hams [http://www.arrl.org/arrl-fact-sheet]
 - ~3 million World Wide



- Hobbyists routinely use HF-VHF transionospheric links.
- Often ~100 W into dipole antennas.

Frequency	Wavelength
1.8 MHz	160 m
3.5 MHz	80 m
7 MHz	40 m
10 MHz	30 m
14 MHz	20 m
18 MHz	17 m
21 MHz	15 m
24 MHz	12 m
28 MHz	10 m
50 MHz	6 m

HamSCI

The Ham radio Science Citizen Investigation is:



hamsci.org/dayton2017

An organization that allows university researchers to collaborate with the amateur radio community in scientific investigations.

Objectives:



1. **Advance** scientific research and understanding through amateur radio activities.
2. **Encourage** the development of new technologies to support this research.
3. **Provide** educational opportunities for the amateur community and the general public.

Total Solar Eclipse

21 August 2017

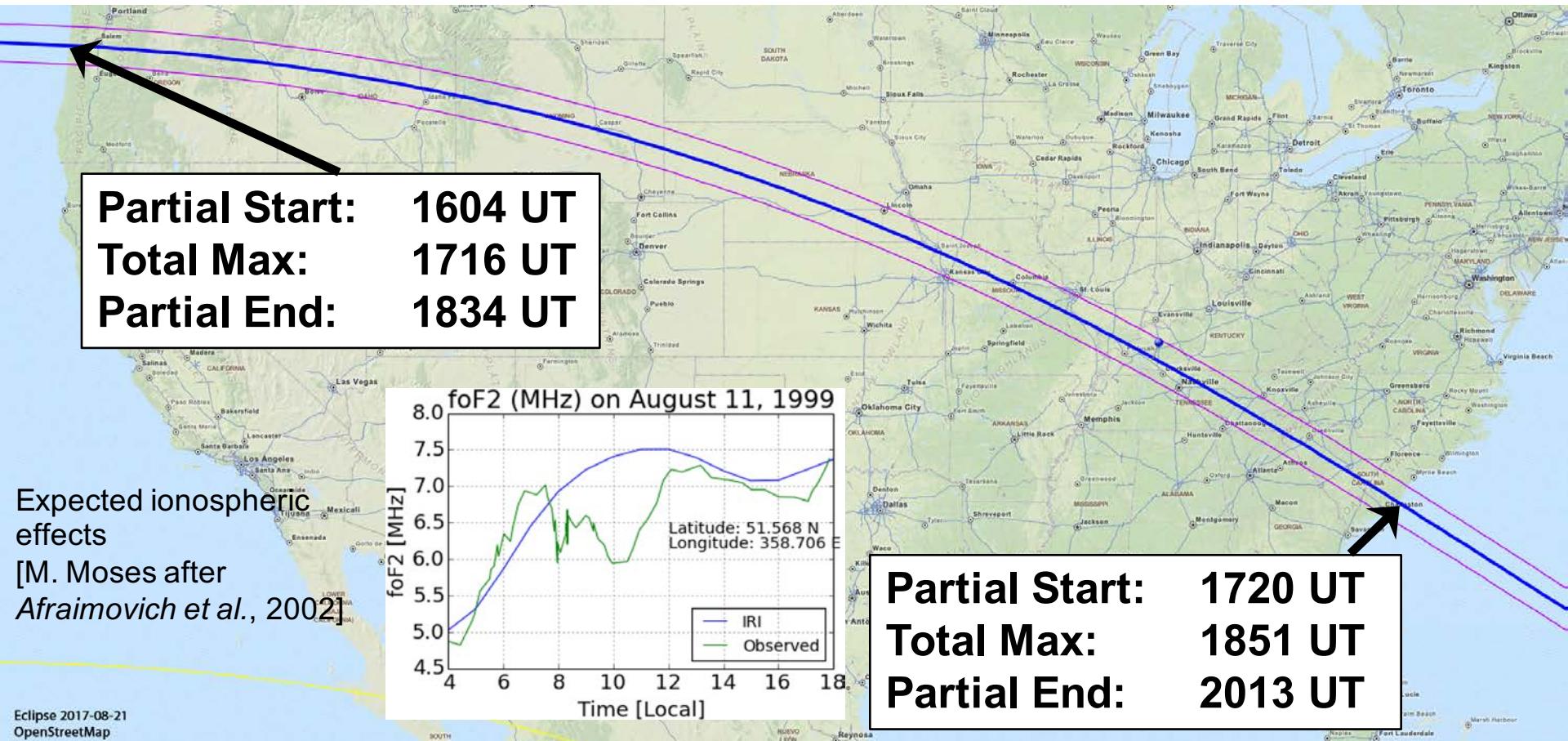


Figure: W. Strickling, Wikipedia

HamSCI Eclipse Research Questions

- What are the temporal and spatial scales of eclipse-induced ionospheric effects?
- How does the eclipse affect HF propagation?



J. Sackerman, KC2ZFK



W. Engelke, AB4EJ

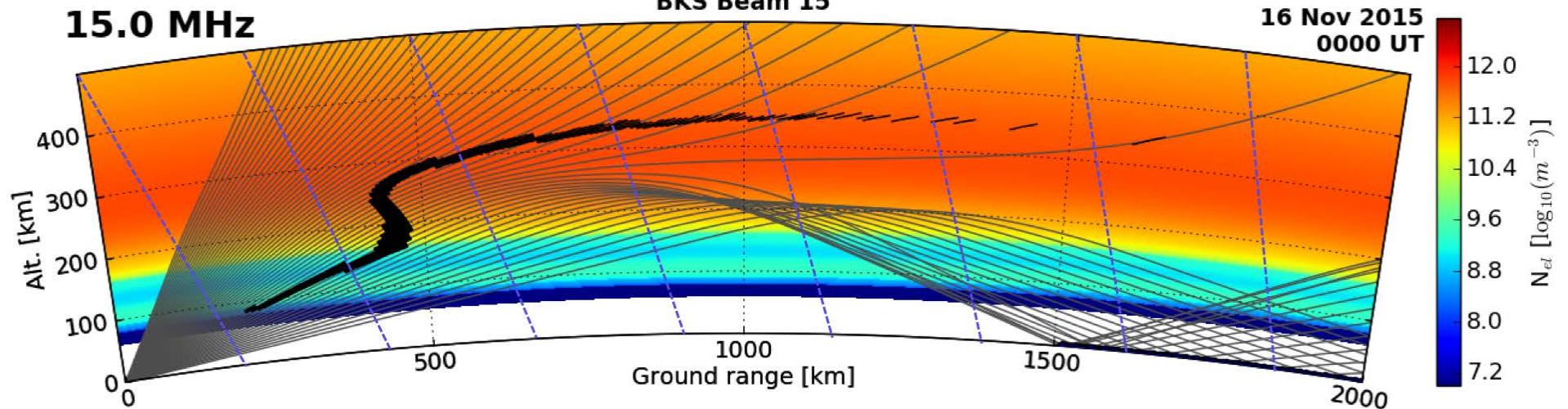


HF Propagation & The Ionosphere

15.0 MHz

BKS Beam 15

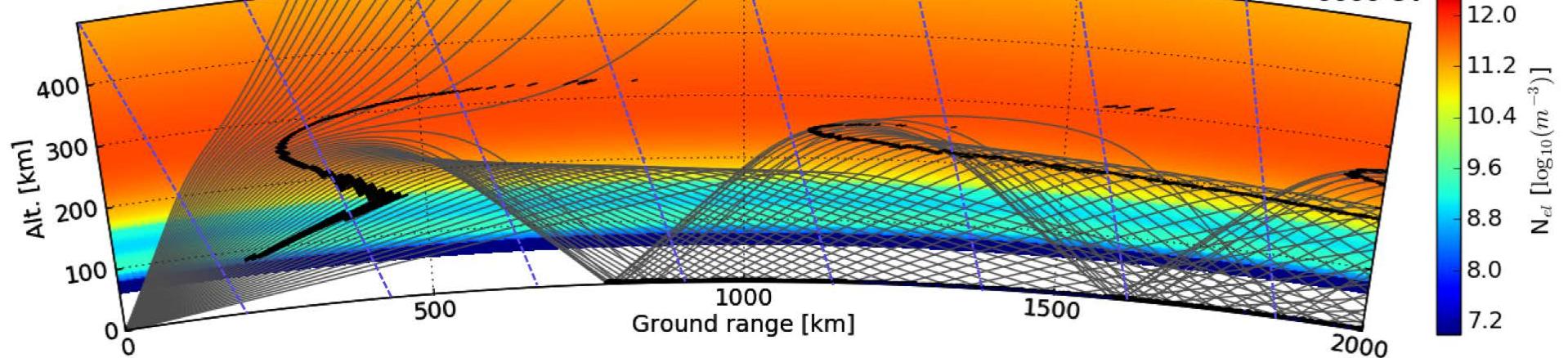
**16 Nov 2015
0000 UT**



10.0 MHz

BKS Beam 15

**16 Nov 2015
0000 UT**



Solar Eclipse QSO Party (SEQP)

- Ham Radio Contest-Like Event
- Generate a quasi-random dataset
- Point-to-point contact (QSO) data from *automatic* [RBN, PSKReporter, WSPRNet] and *manual* sources [Logs]

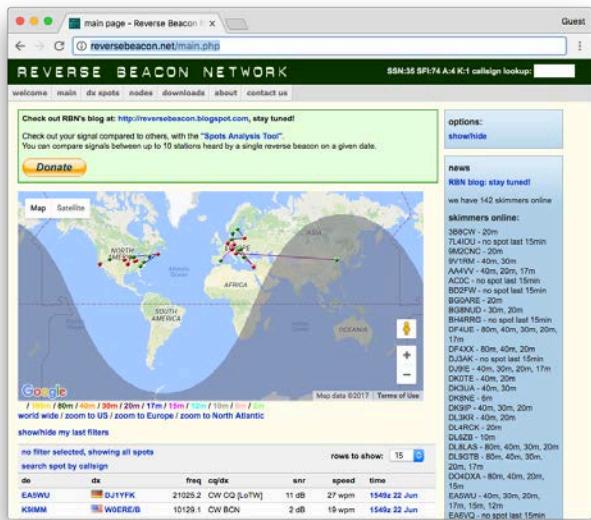


HamSCI
<http://hamsci.org>



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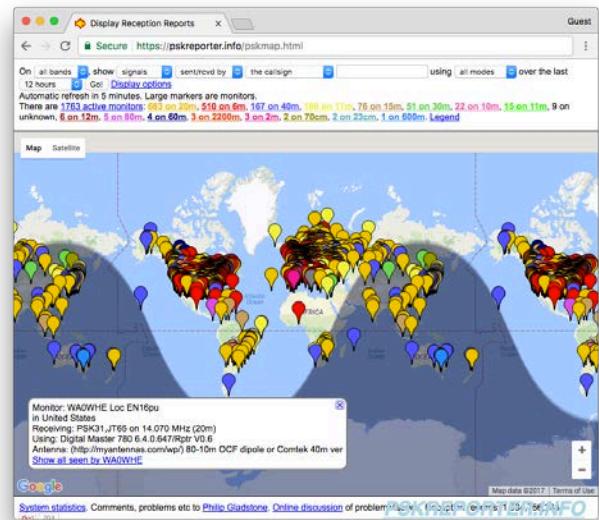
SEQP Observations



RBN
reversebeacon.net



WSPRNet
wsprnet.org



PSKReporter
pskreporter.info

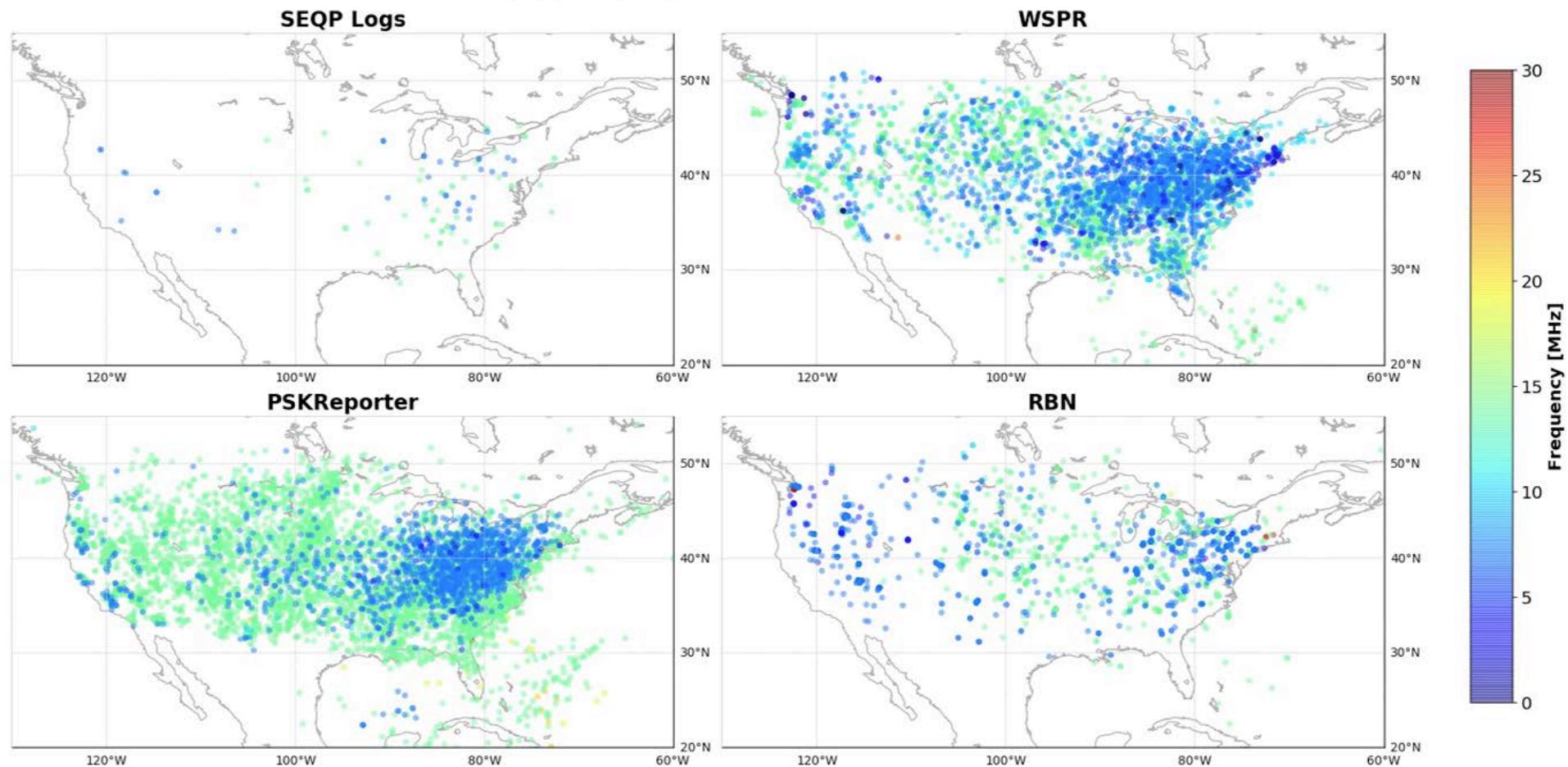
Observations from 21 August 2017 1400 – 2200 UT

Network	# Spots / QSOs
RBN	618,623
WSPRNet	630,132
PSKReporter	1,287,855
Participant Logs	30,768



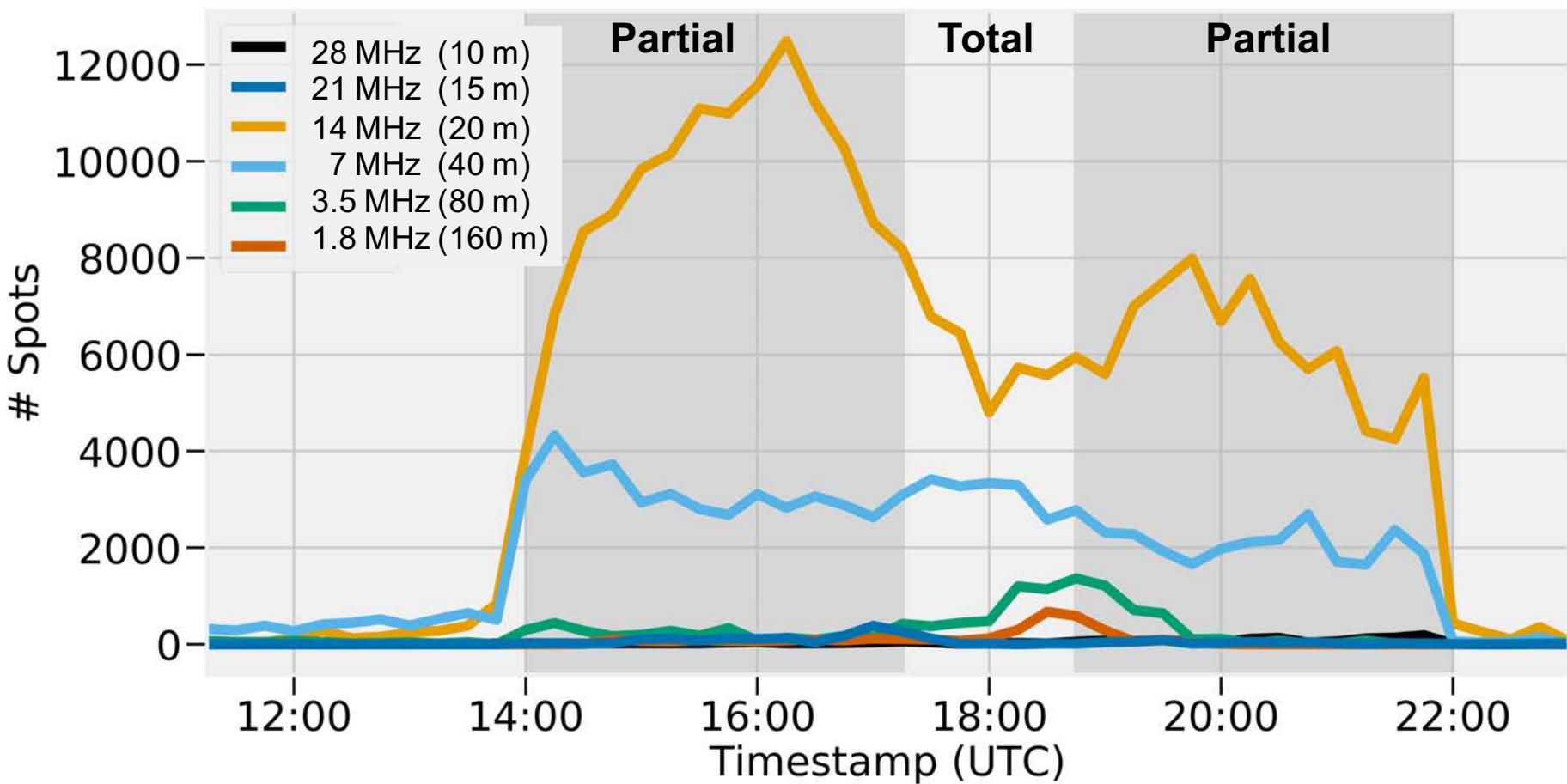
Ham Radio Eclipse Data

21 Aug 2017 1400 UT - 21 Aug 2017 1405 UT
QSO/Spot Midpoints; 300.0 km Obscuration Alt

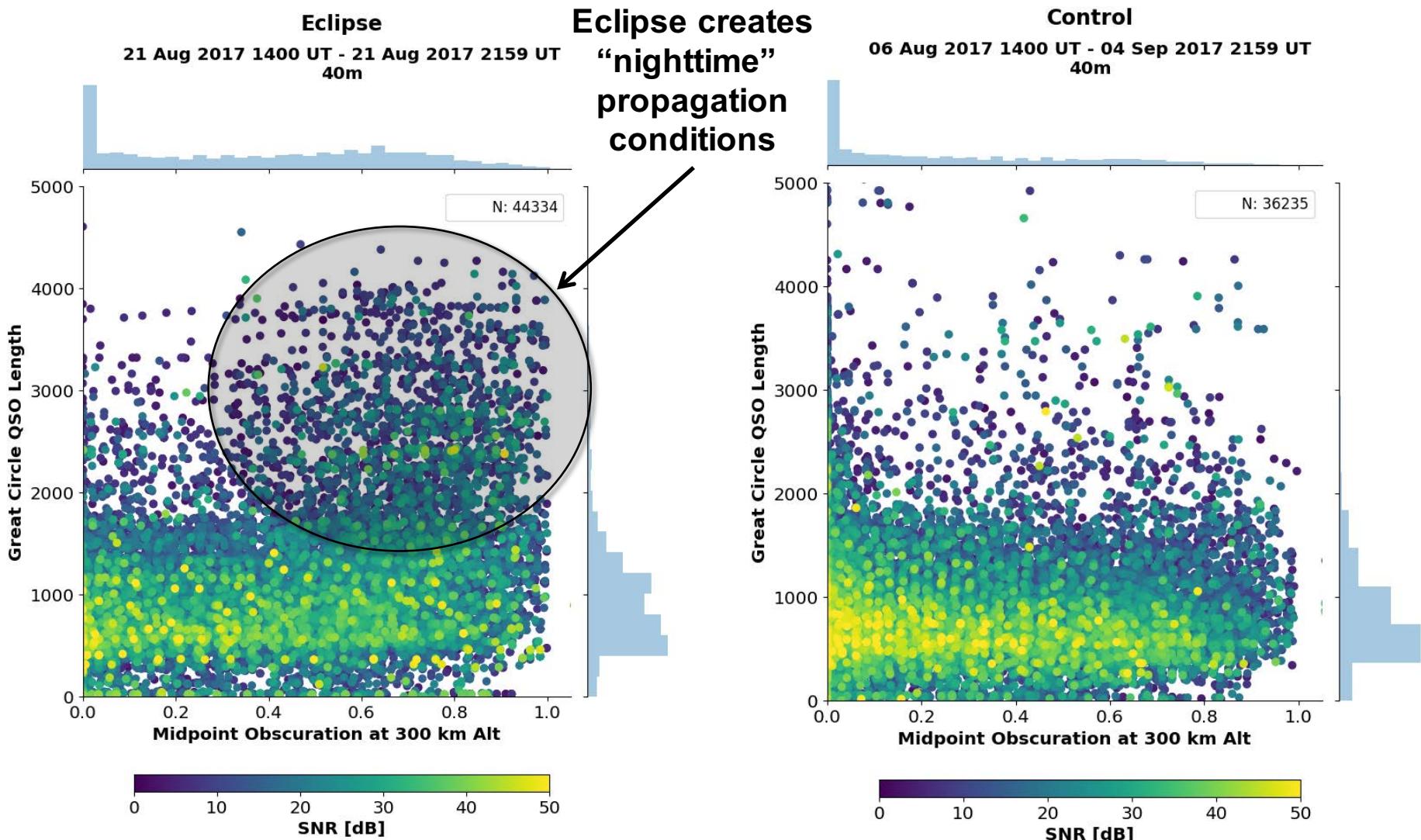


SEQP RBN Spots

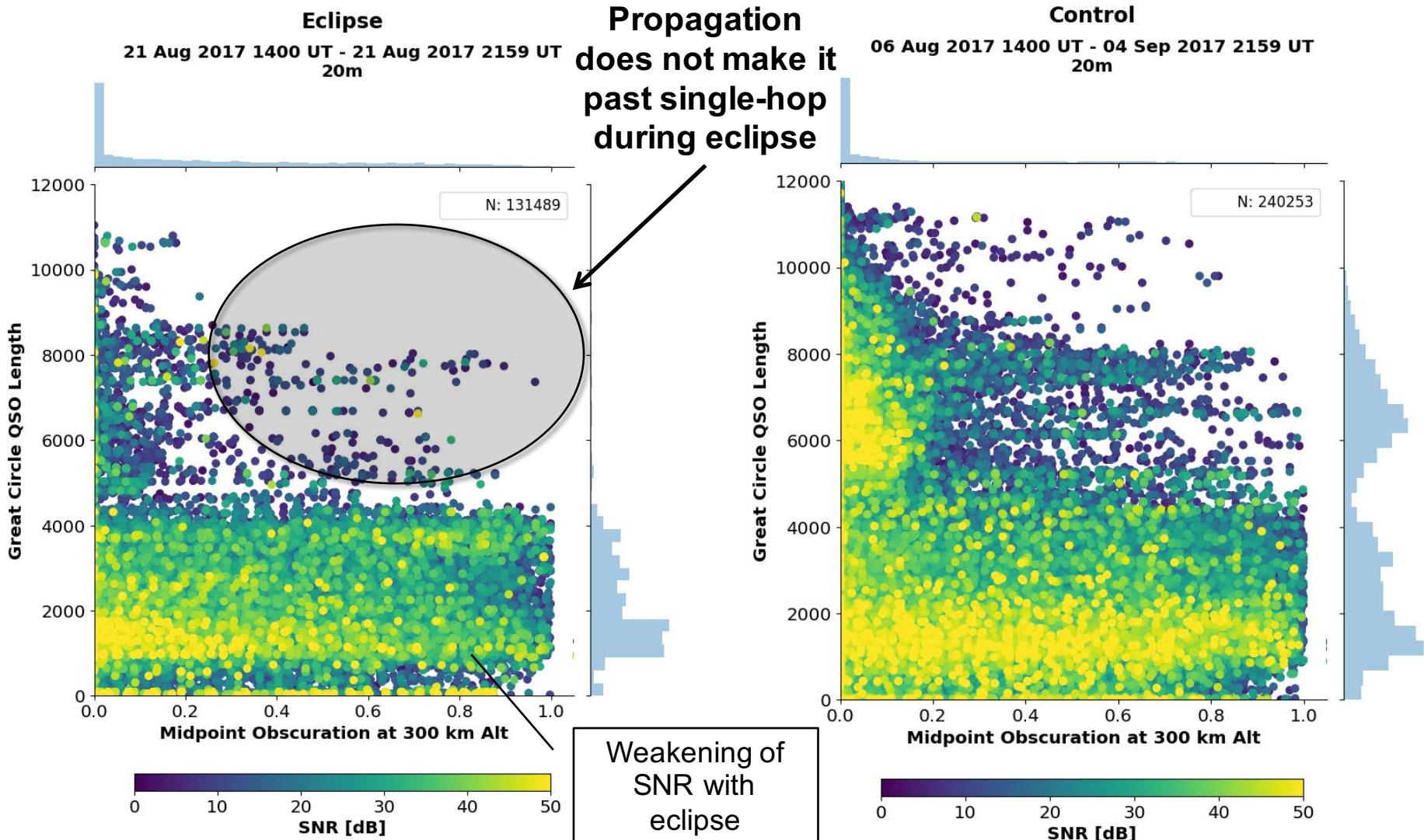
RBN SEQP Spots by Band (Contiguous US TX and RX Only)



7 MHz RBN: Great-Circle Range vs Obscuration

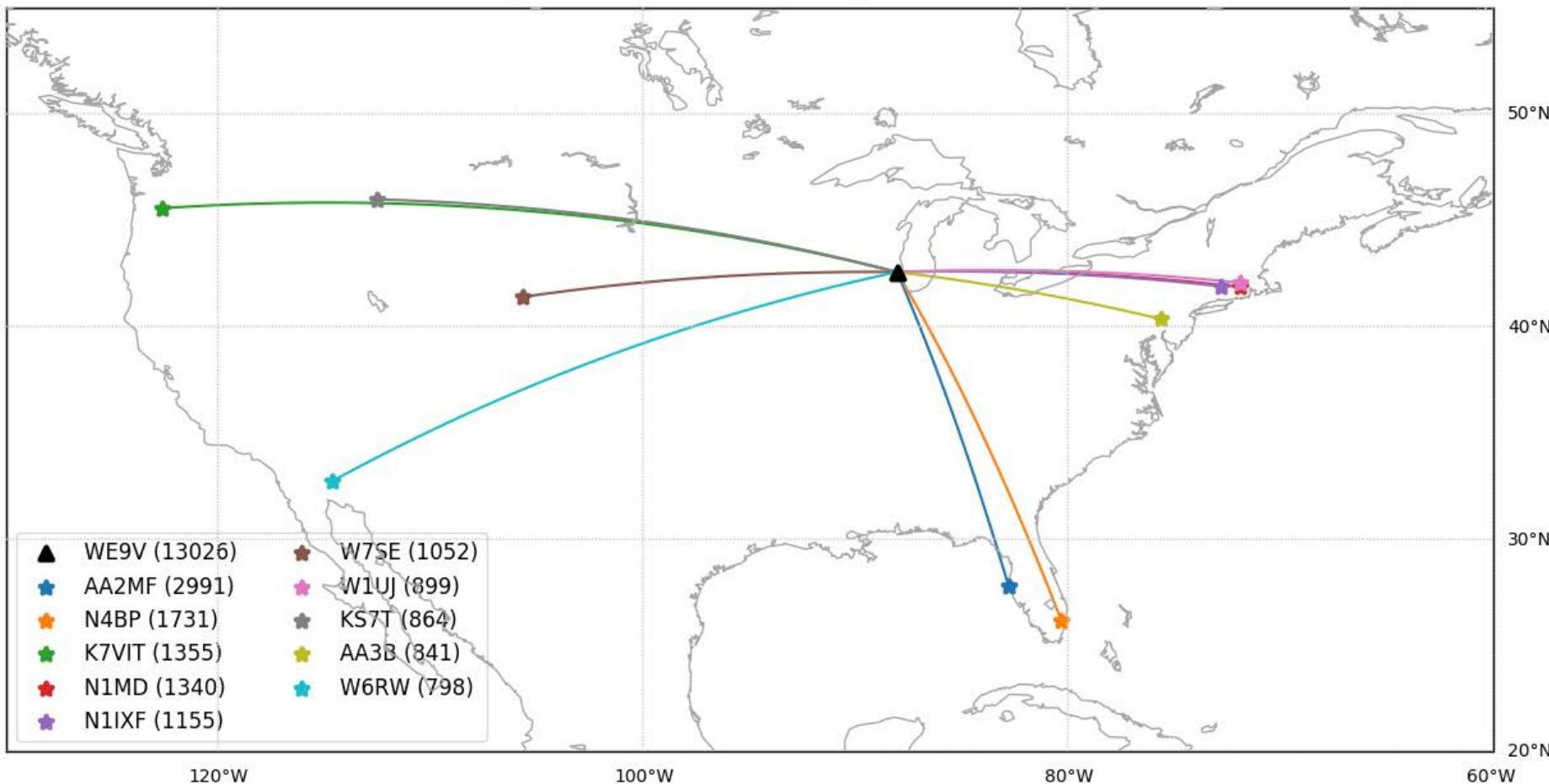


14 MHz RBN: Great-Circle Range vs Obscuration



WE9V 14 MHz RBN Rx, Wisconsin

WE9V RBN Pairs
20 m Eclipse
21 Aug 2017 1400 UT - 21 Aug 2017 2159 UT



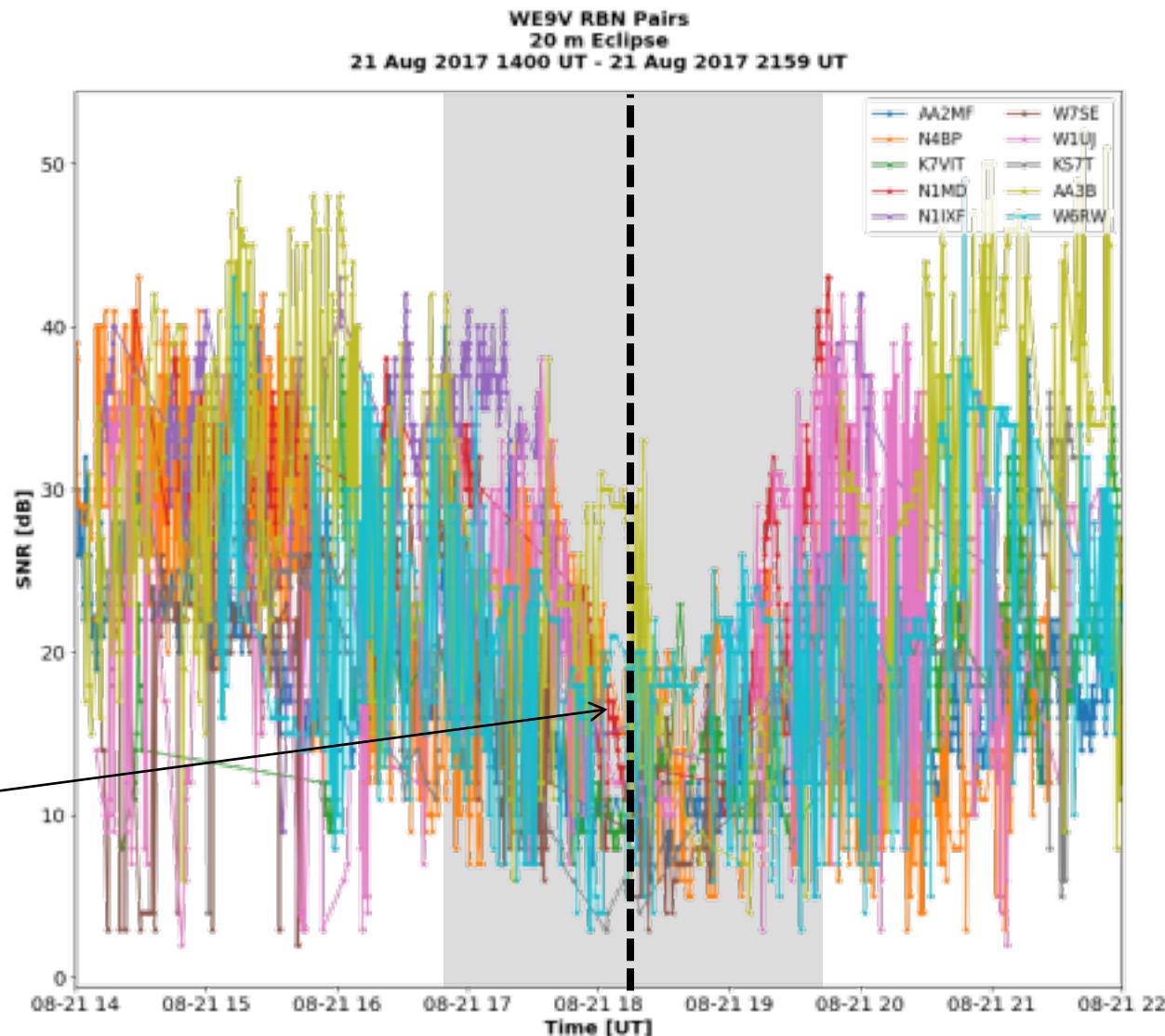
WE9V 14 MHz RBN Rx, Wisconsin

Ground Eclipse Times

Bristol, WI:

- Start partial: 1653 UT
- Max: 1818 UT
- End partial: 1940 UT

Clear drop in 20 meter propagation during temporary ‘nighttime’ conditions



Summary & Conclusions

- **Ham Radio Science Citizen Investigation**

- An organization that allows university researchers to collaborate with the amateur radio community in scientific investigations.

- **2017 Solar Eclipse QSO Party**

- Number of HF Spots During Eclipse
 - Increases on 1.8 to 7 MHz.
 - Decreases on 14 MHz
- With increasing obscuration
 - 7 MHz path length increases
 - 14 MHz SNR decreases; second-hop propagation goes away.
- This shows temporary “night-like” propagation conditions of the ionosphere.



Thank you!

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References

- Afraimovich, E.L., E.A. Kosogorov, O.S. Lesyuta (2002), Effects of the August 11, 1999 total solar eclipse as deduced from total electron content measurements at the GPS network, Journal of Atmospheric and Solar-Terrestrial Physics, Volume 64, Issue 18, Pages 1933-1941, ISSN 1364-6826, [http://dx.doi.org/10.1016/S1364-6826\(02\)00221-3](http://dx.doi.org/10.1016/S1364-6826(02)00221-3).**
- Bamford, R. (2000), Radio and the 1999 UK Total Solar Eclipse, Rutherford Appleton Laboratory, Chilton, Didcot, UK.**

