



Solar Eclipse 2018
Ionospheric Changes Detected with
an INSPIRE receiver

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First Let's Talk About Radio Waves: Natural and Manmade

Where they go depends on our ionosphere



- The ionosphere is at the top of our atmosphere
- ~90 km to 1000 km in altitude
- Made of atmospheric gas ionized by solar UV

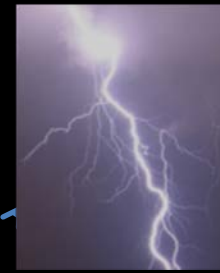
Manmade



Natural



Radio Noise from Lightning



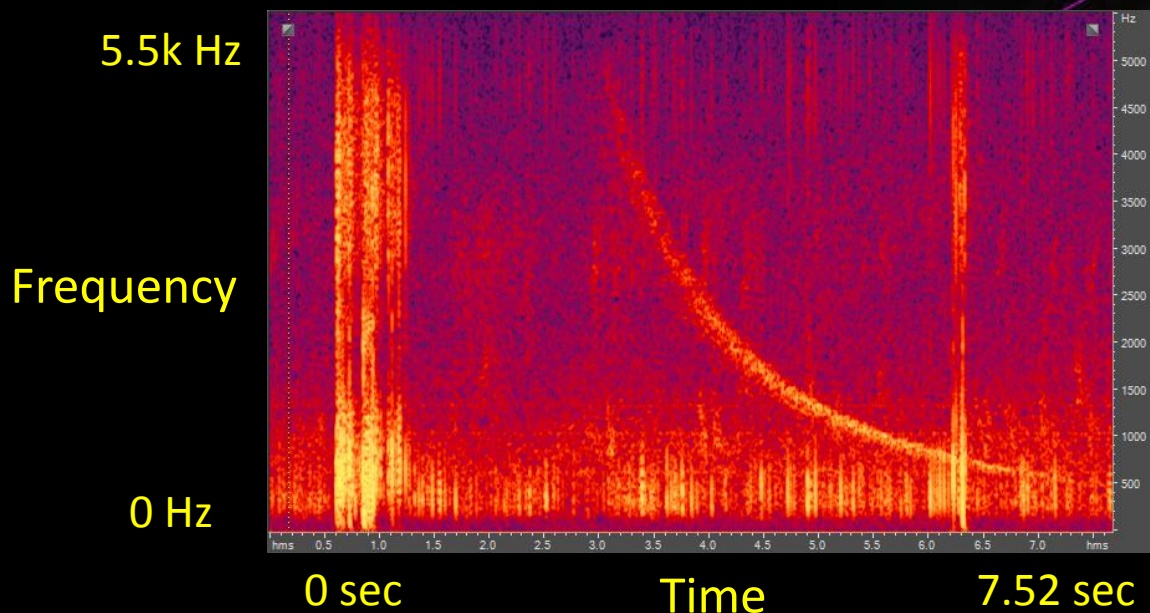
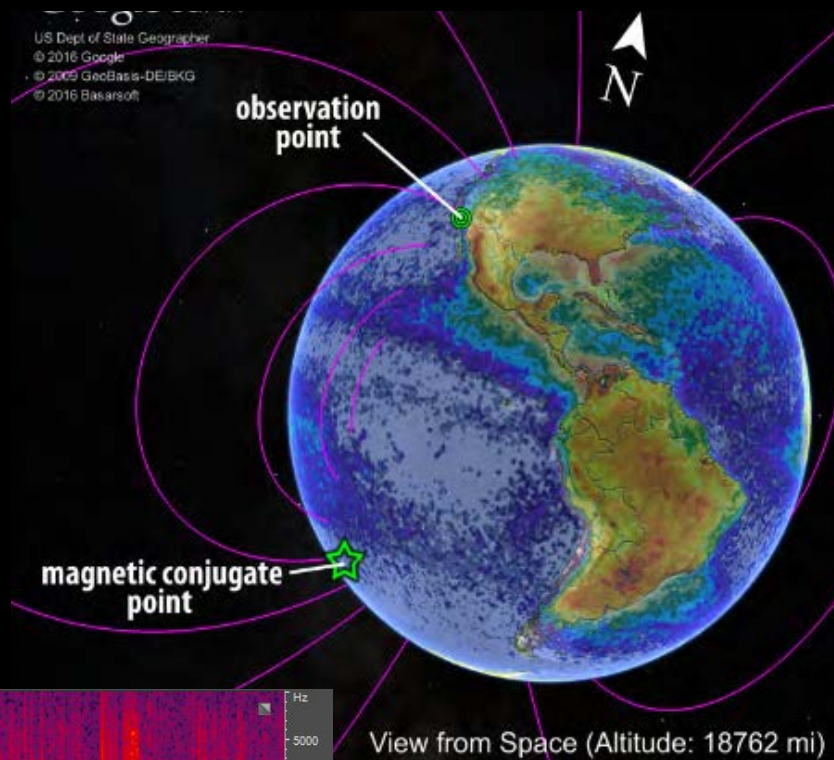
Lightning produces a broad spectrum of radio waves. Most of the wave energy is usually confined between Earth's surface and the ionosphere.

- Spherics is the crashing sound you may have heard while listening to AM radio.
- Tweaks sounds a little like a plucked string and can come from anywhere in the world, traveling between the ground and ionosphere.
- Whistlers have been in space, nearly following magnetic field lines in the ionized gas of Earth's magnetic environment.



Radio Noise from Lightning

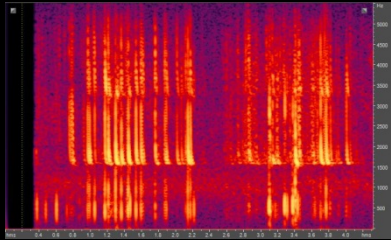
- Sometimes lightning wave energy goes through the ionosphere.
- The low frequency part is guided by the magnetic field.
- Where somewhat higher frequencies move faster than lower frequencies.



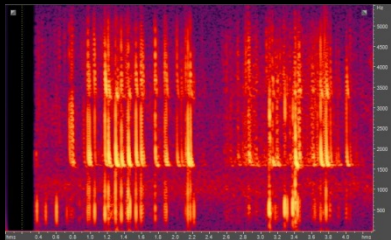
So What is to Be Done with VLF Waves?

Answer the question: “Does the eclipse shadow change the ionosphere enough to cause VLF waves to behave like they do at dawn/dusk on normal days or will VLF radio noise be like it is at mid-day without an eclipse?”

Dawn/Dusk



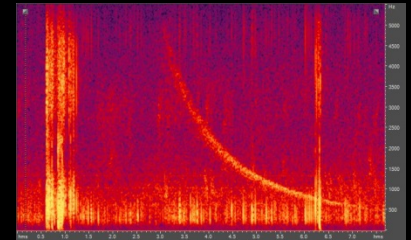
Mid-Day



What are VLF waves like at these times without an eclipse?

What are VLF waves like during this eclipse?

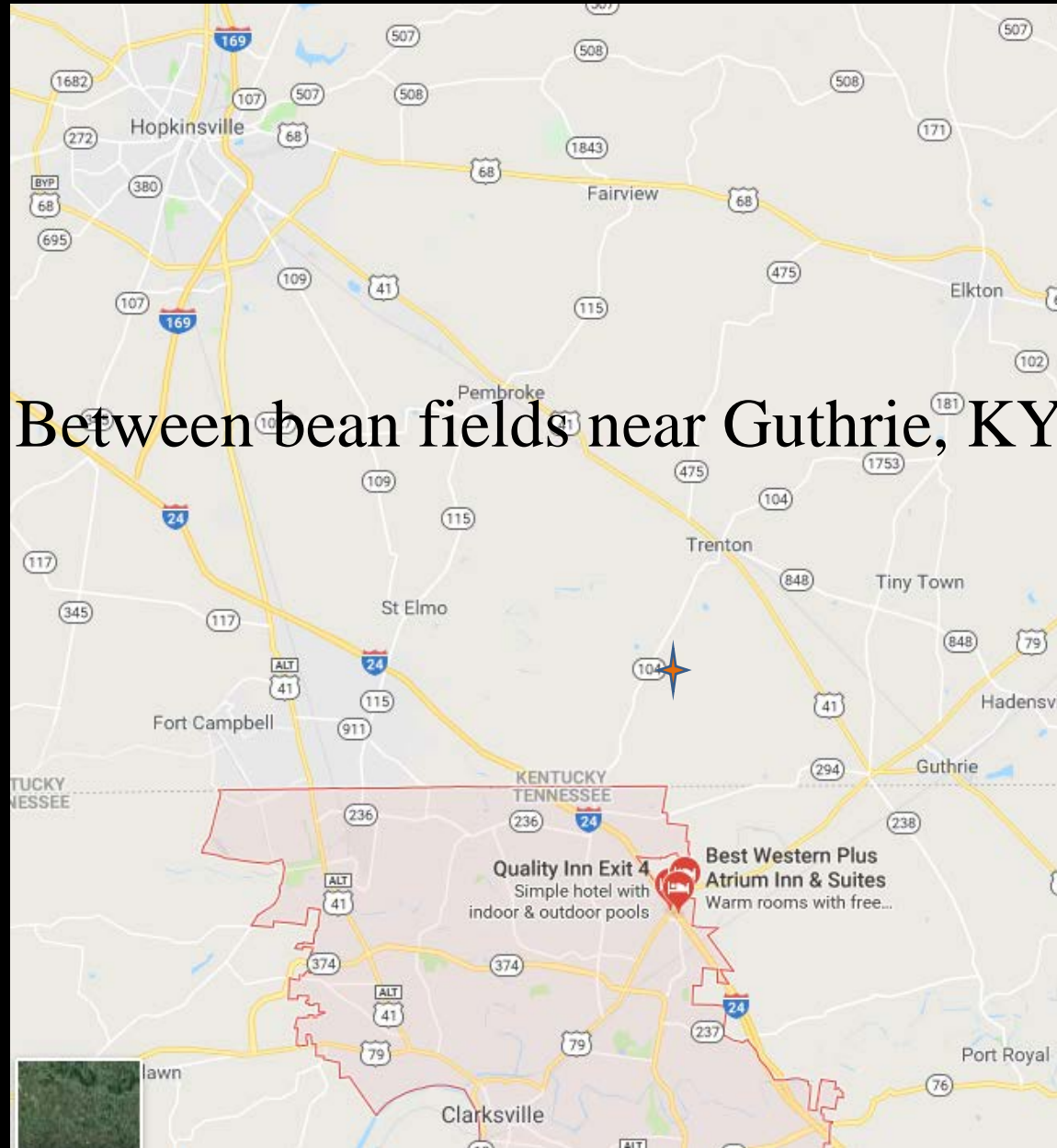
Mid-Day Eclipse



Do what with the answer? Publish in the INSPIRE Journal!

Other VLF enthusiasts may also submit their observations from elsewhere along the path of totality that can be used to answer the question.

2017 Solar Eclipse VLF Site



2017 Solar Eclipse VLF Site



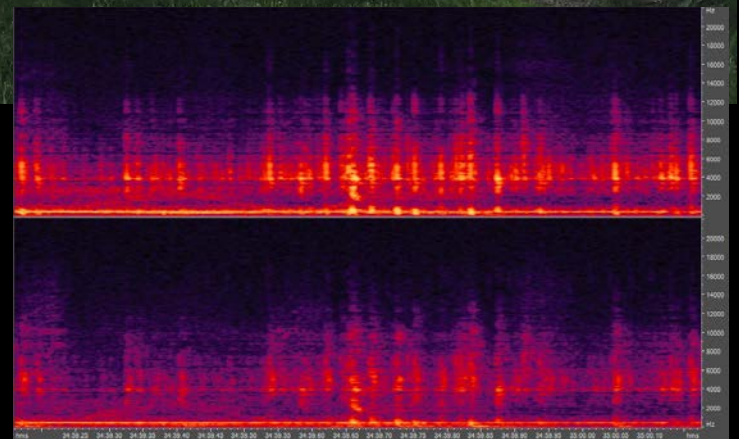
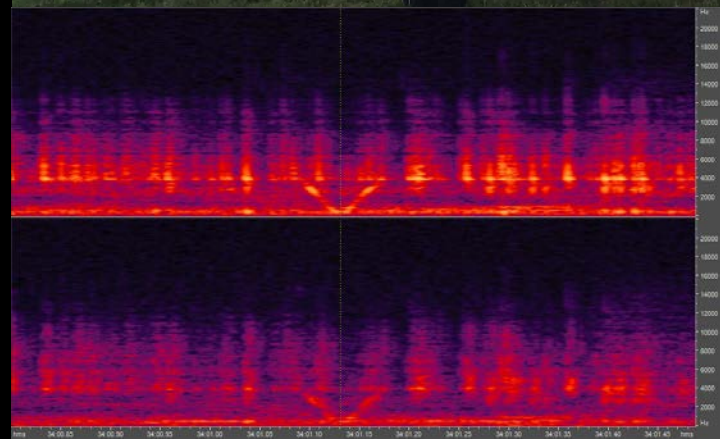
Between bean fields near Guthrie, KY

Photograph courtesy of Jesse-Lee Dimech

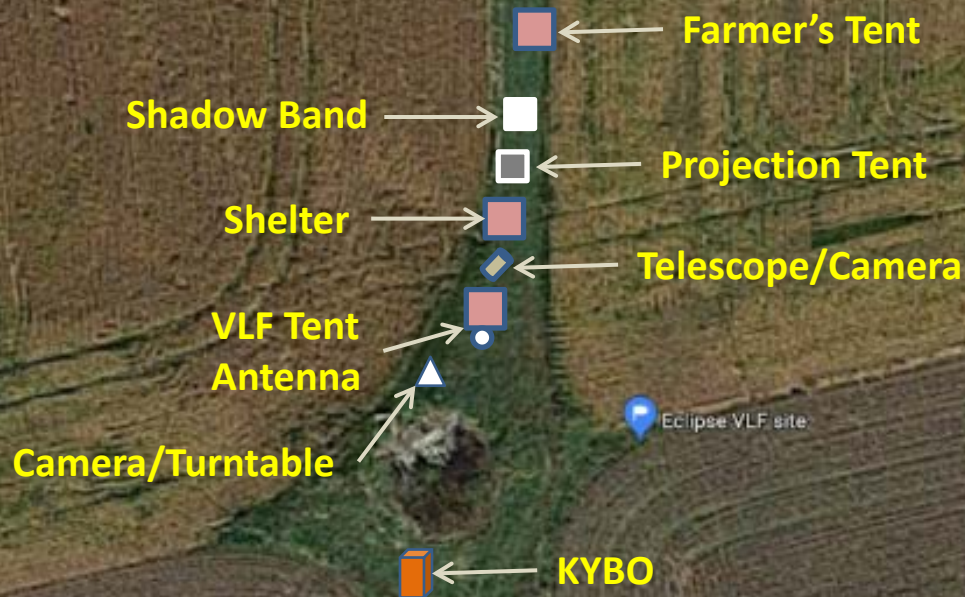
Experiment Outline

- Record VLF noise at VLF eclipse site:
 - Around dawn before the eclipse
 - Around dusk before the eclipse
 - Near the eclipse time of day, but on days before the eclipse
 - Just before, during, and just after the eclipse on that day
- Examine pre-eclipse recordings to see what differences there are in VLF noise at the different times of the day
- Examine the VLF noise recorded on eclipse day
- Compare eclipse day VLF noise (before, during, and after) to VLF noise recorded prior to the eclipse
- Decide whether VLF noise at these different times (all in the same place) are different, the same, or similar.
- Decide if you can conclude whether changes in the ionosphere as a result of the eclipse lead to conditions similar to other times when the eclipse is not taking place.

August 19, 2018: Pre-Eclipse VLF



VLF Field Site Setup



Google



Eclipse Day



Telescope/Camera Setup



Eclipse Projection Tent



Eclipse Chill'n

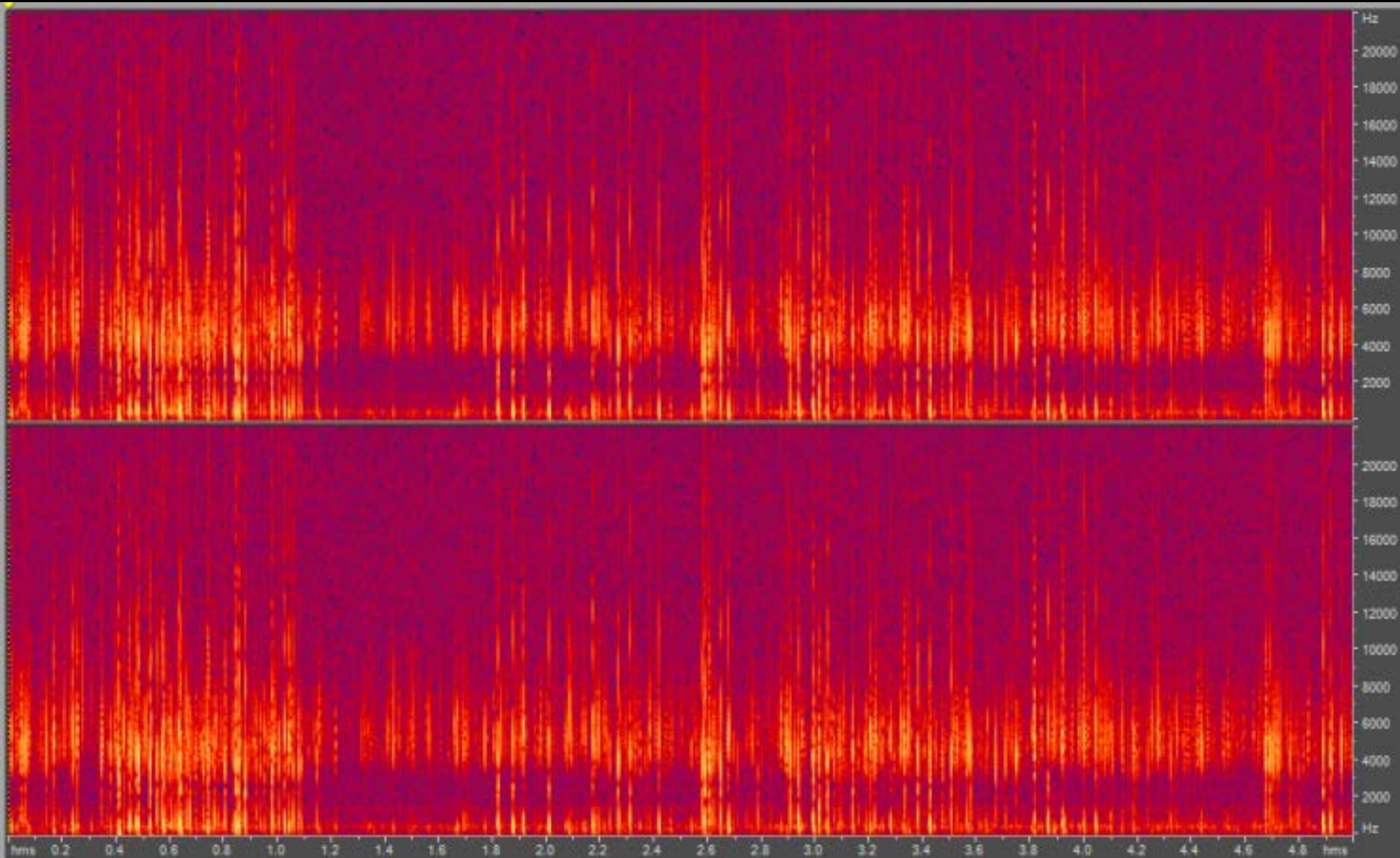


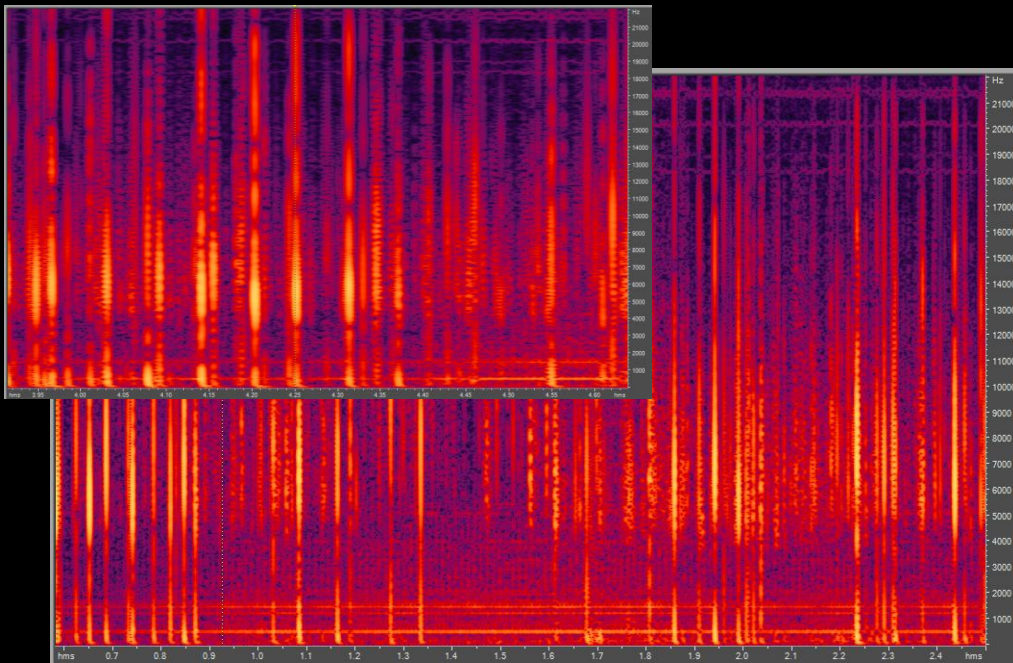
Eclipse Event Panorama



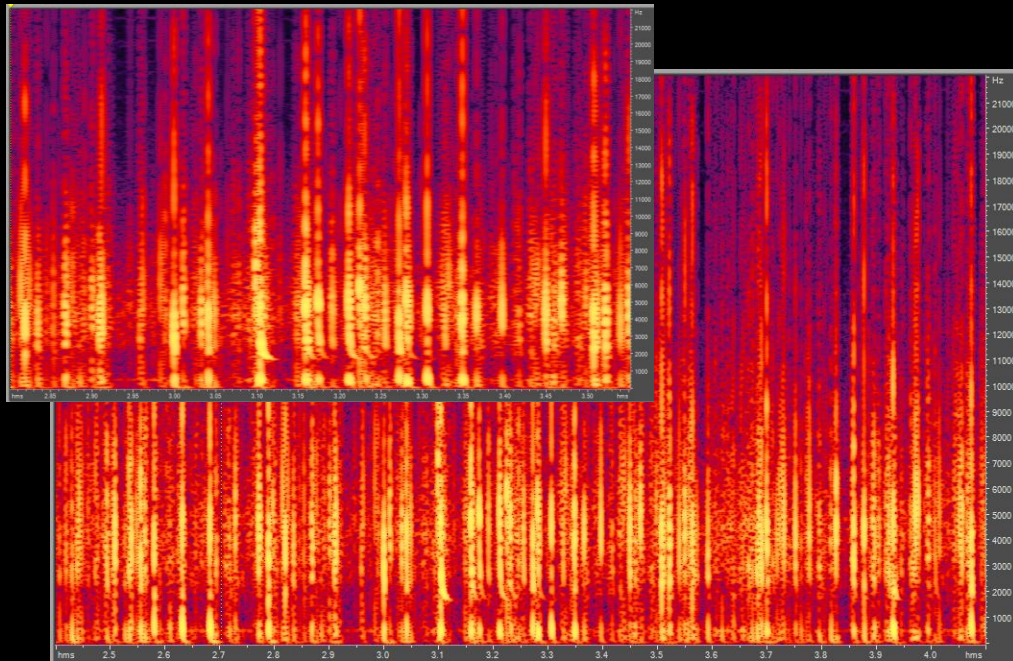


Eclipse Day 2018 VLF

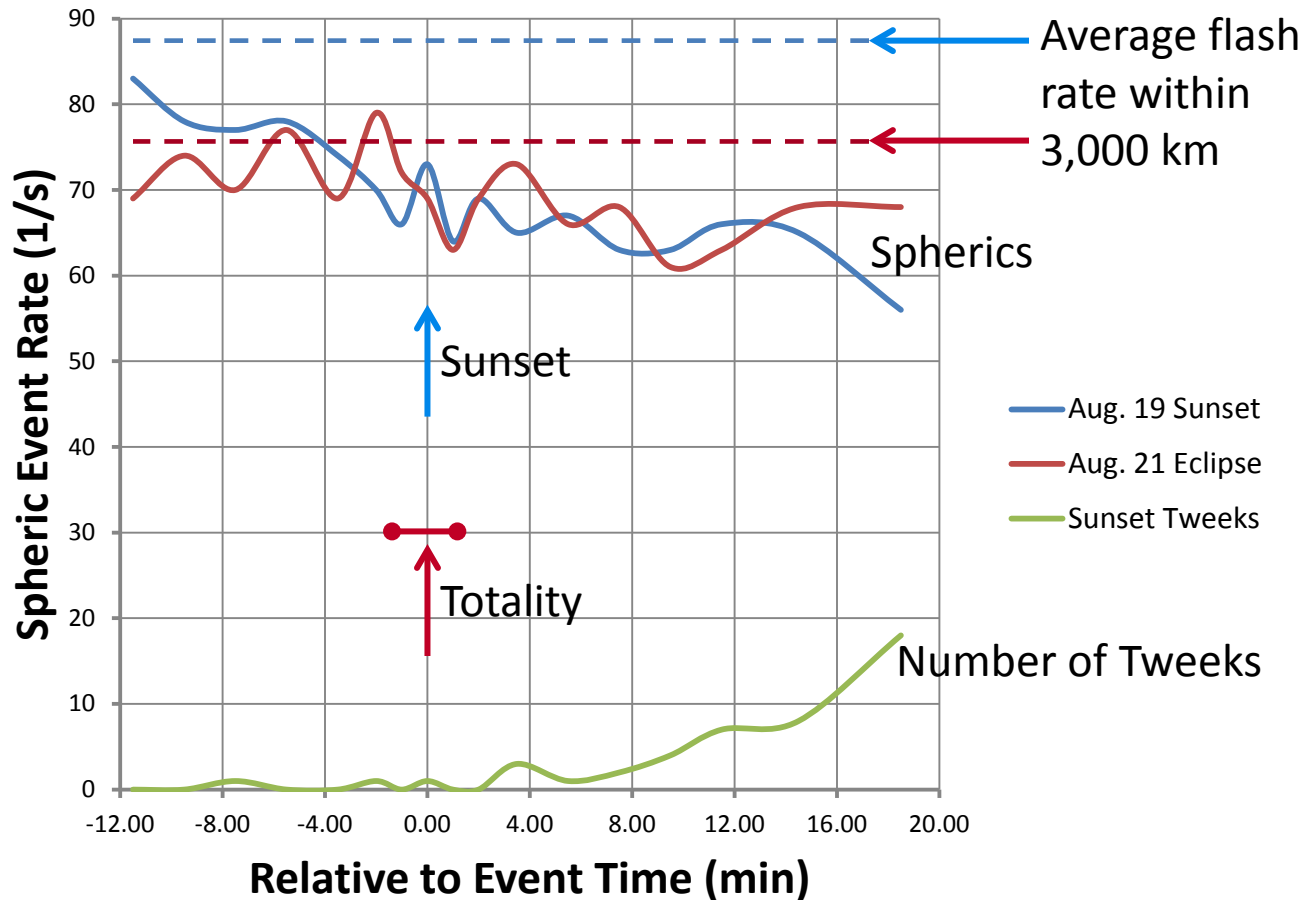




August 24, 2017 1:12 PM
Around time of eclipse,
but two days later.



August 24, 2017 7:53 PM
After sunset same day.



Spherics appear little influenced by day versus night. Tweaks, which result from longer propagation paths, become common more than 3 minutes after sunset. That delay is consistent with the lack of tweak observations during totality in the 2017 eclipse. The importance of broad ionospheric modification due to darkness for tweak observation might be tested by VLF observations during the longest eclipse events.

INSPIRE VLF Receiver

