HamSCI Personal Space Weather Station: A New Tool for Citizen Science Geospace Research

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What is Space Weather?

- Space weather is *broad* field, covering solar, heliospheric, magnetospheric, ionospheric physics, meteorology, aerospace engineering, etc...
- Definition: “Space weather refers to conditions on the Sun and in the space environment that can influence the performance and reliability of space-borne and ground- based technological systems, and can endanger human life or health.”

[National Space Weather Program]

Personal Terrestrial WX Station

- Multi-instrument
- Internet Connected
- Easy Set-Up
- Reasonable Cost

Ambient Weather WS-2902

Instrument Possibilities

- Ground Magnetometer?
- GPS-TEC Receiver (Total Electron Content)?
- Ionosonde (Vertical Incident HF Radar)?
- Riometer (Relative Ionospheric Opacity Meter)?
- **WWV/CHU Standards Monitor?**
- **RBN/PSKReporter/WSPR Receiver?**
- Others?

What makes sense for a personal, ground-based local station?

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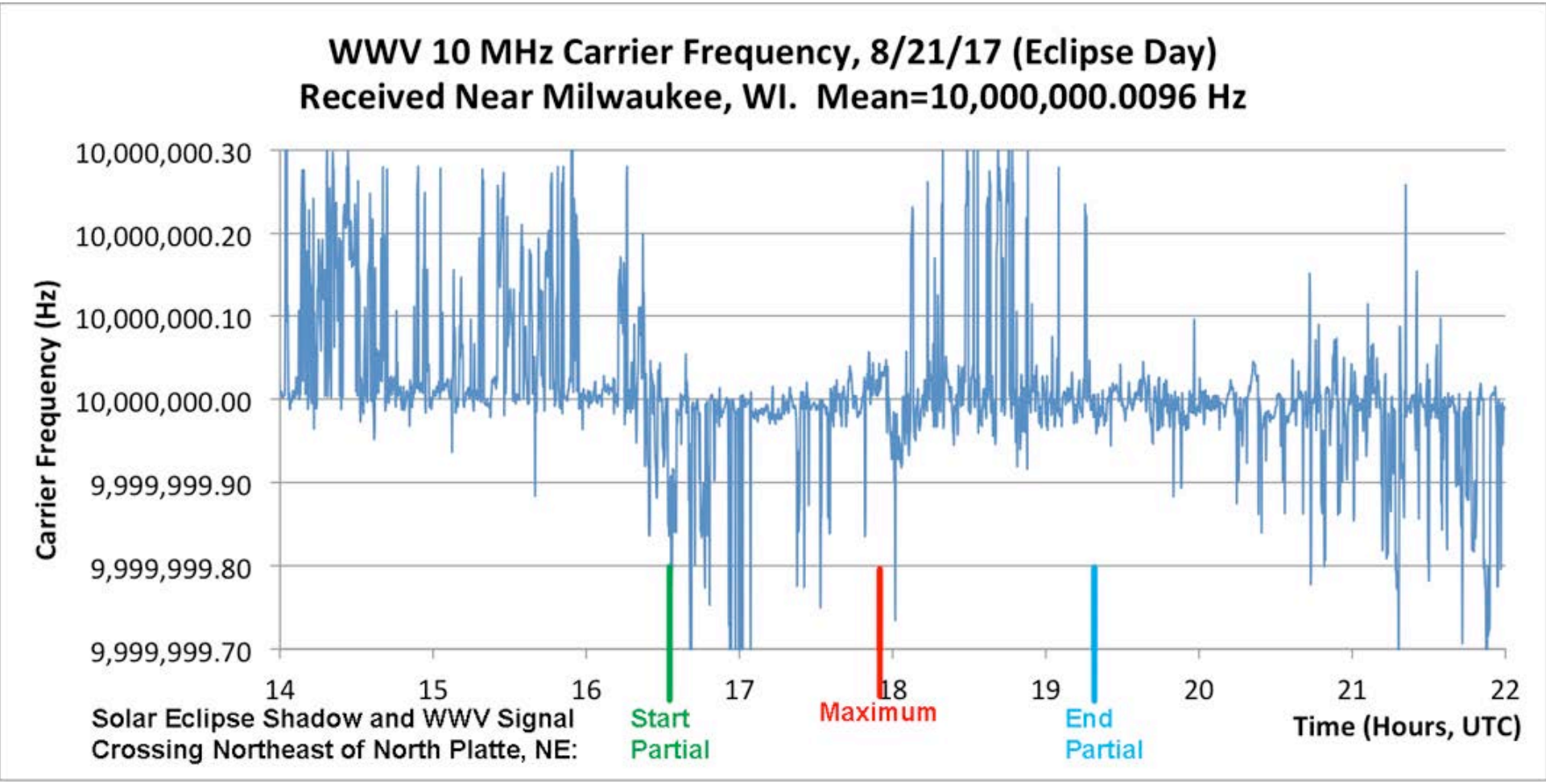
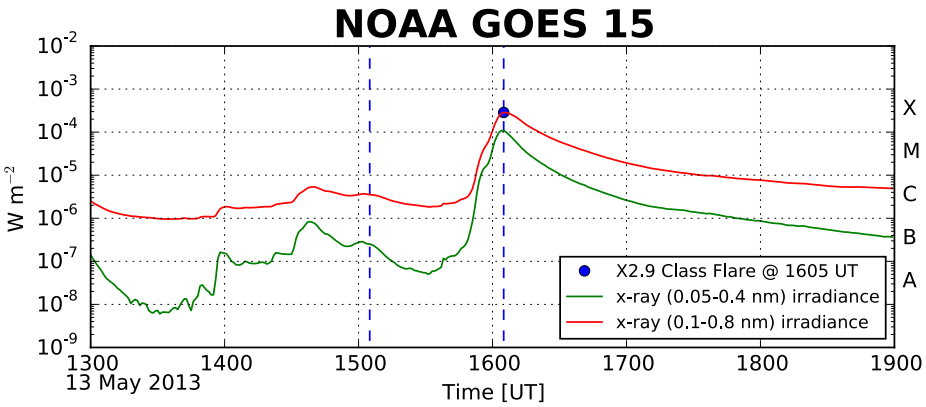
WWV/CHU Standards Monitor

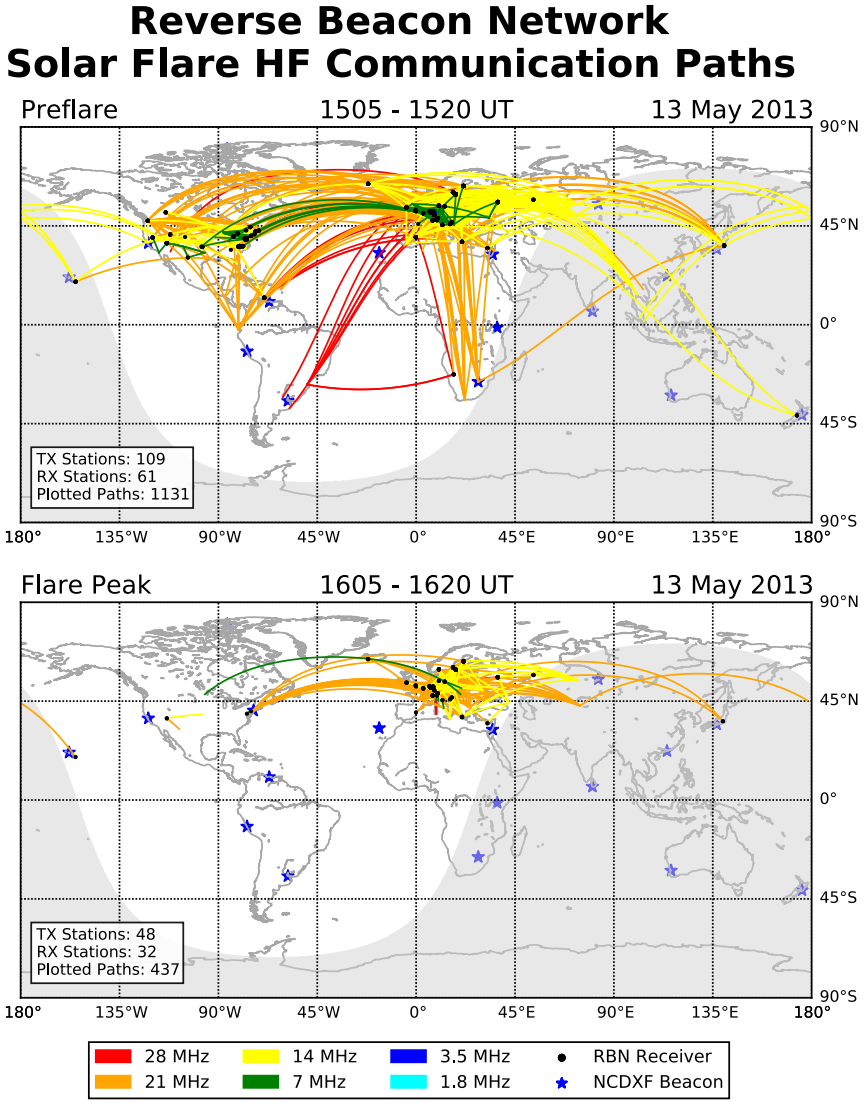


Steve Reyer, WA9VNJ

RBN/PSKReporter/WSPR Receiver



[*Frissell et al.*, 2014, *Space Weather*]



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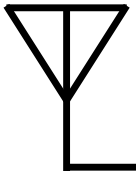
Personal Space Weather Station

Antenna



GPS Disciplined Oscillator

Magnetometer

Software Defined Radio

- Radio Beacon Monitor
  - RBN, PSKReporter, WSPR, Beacons
- HF Noise Characterizer
- GPS TEC Receiver
- Lightning Detector
- Traveling Ionospheric Disturbance Detector

Computer
(e.g. Single Board Computer)

- Local User Display
- Local Data Reduction
- Sends Data to Server

HamSCI Public Database

Internet

Some possible hardware…

Antenna
DXE ARAV3

?

GPSDO
Leo Bodnar

?

Magnetometer
British Geological Survey

?

Software Defined Radio
e.g. Red Pitaya

?

Computer
e.g. Raspberry Pi

?

HamSCI Public Database

Internet

Target Specifications

- Useful to ham radio, space science, and space weather communities.
- $100 to $500 (??) price range (accessible)
- Modular Instrument Design
  - Easy ability to add or remove instruments, especially in software architecture
- Small footprint
- Nice User Interface/Local Display
- Standard format to send data back to a central repository
- Open community-driven design

Timeline

Yr	Meeting	Hardware	Software	Backend
1	HamSCI 2019	Specifications & Initial Design		
	TAPR 2019	Prototype	Interface and Data Specification	Interface and Database Specification
2	HamSCI 2020		Data Structure Implementation	Database Implementation
	TAPR 2020	Beta Version	Prototype Science/Eng. Products	Aggregate Data Test Science Products
3	HamSCI 2021		Refine Science/Eng. Products	Refine Science Products
	TAPR 2021	Field Tests	Field Tests	Field Tests
4	HamSCI 2022	Review & Refine	Review & Refine	Review & Refine
	TAPR 2022	Manufacture		
5	HamSCI 2023	Distribute and Deploy		
	TAPR 2023	**Annular Eclipse (October 14, 2023)**		
6	HamSCI 2024	**Total Eclipse (April 8, 2024)**		
	TAPR 2024			Analyze Data

Thank you!

For more information, please visit the HamSCI project page:

http://hamsci.org/swstation

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