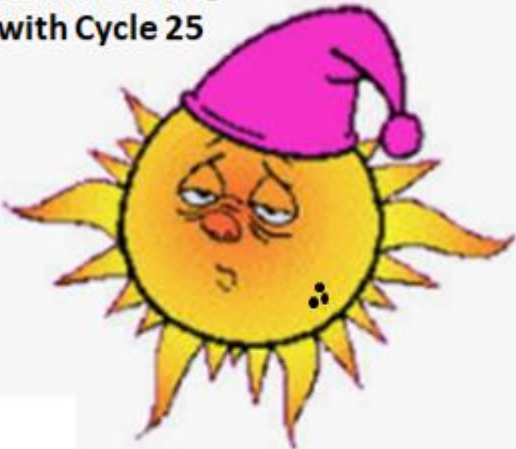


Get Ready for Solar Cycle 25

*This is my presentation (with updates)
from the SLSRC Winterfest 2021*

The sun is waking
up with Cycle 25



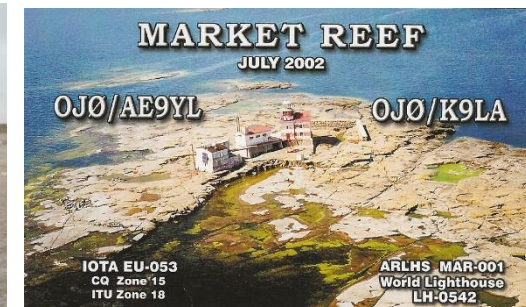
Carl Luetzelschwab K9LA

E-mail: k9la@arri.net

Website: <https://k9la.us>

A Little About K9LA

- Novice license in 1961 (WN9AVT)
- I enjoy
 - Learning about the sun and propagation
 - DXing
 - Contesting – mostly casual these days
 - Playing around with antennas
 - And modeling them, too
 - Fixing and using vintage equipment
 - More in queue than I'd like to admit
- My wife Vicky AE9YL and I live in Fort Wayne, IN
- We enjoy traveling
 - Ham club meetings, conventions, DXpeditions



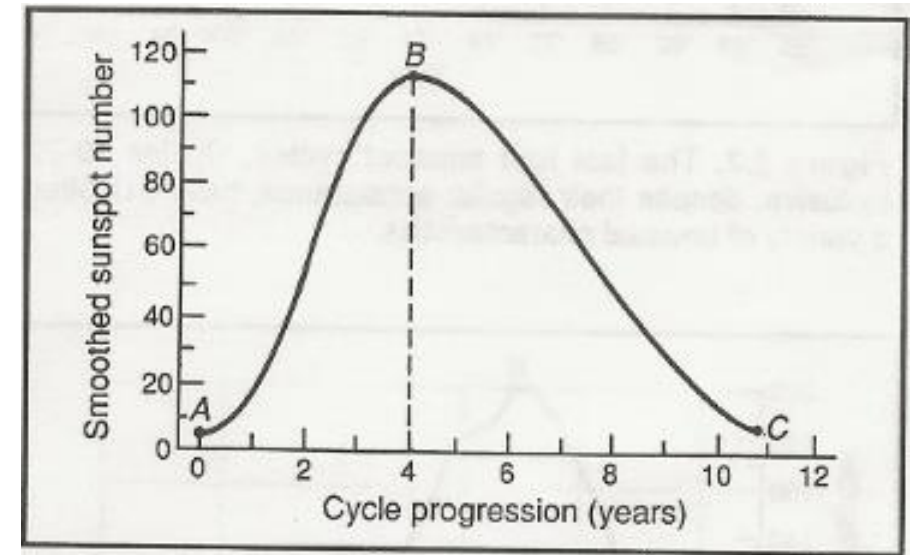
Questions We'll Cover

- What is a solar cycle?
- Why is it important?
- What did the previous solar cycles do?
- What propagation can we expect at solar minimum?
 - Where we still are right now
- What will Cycle 25 do?
- When will the higher bands be back?
- What are some simple antennas for 15m, 12m, 10m and 6m?
- What can we do on the higher HF bands when Cycle 25 is good?

What Is a Solar Cycle and Why Is It Important?

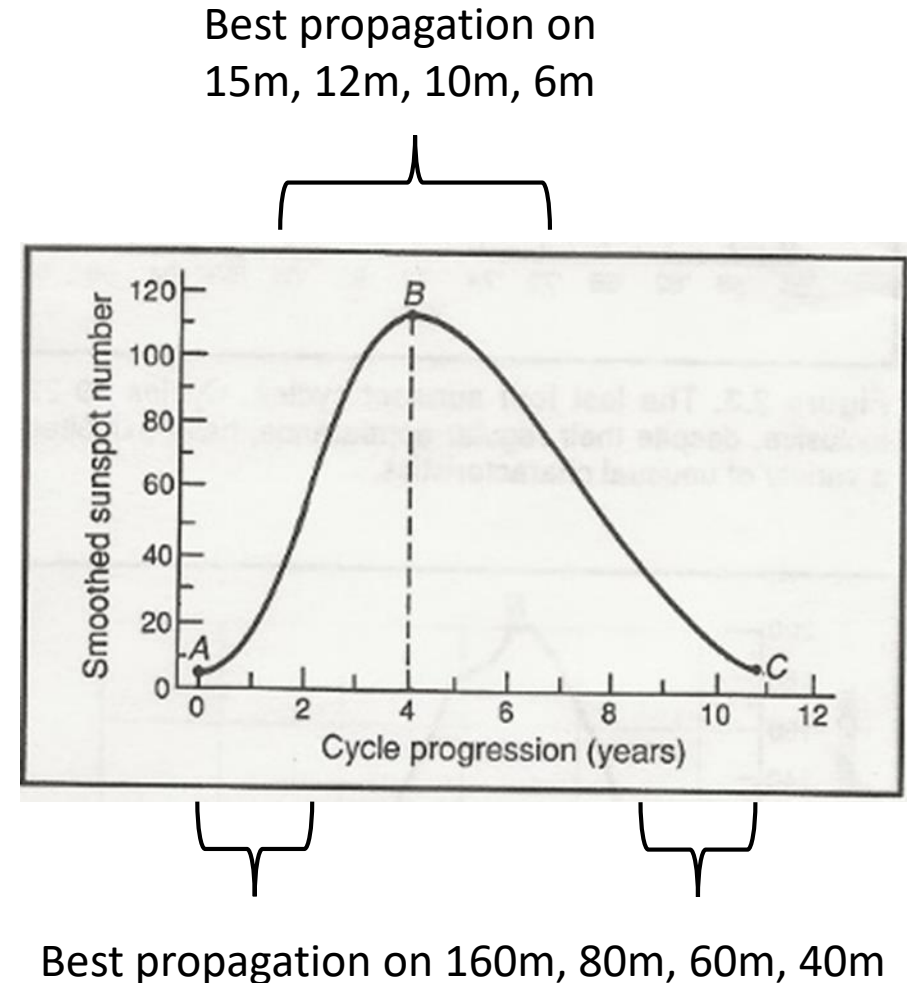
What Is a Solar Cycle?

- Also known as a sunspot cycle
- It's the time period from a very low number of sunspots on the sun (solar minimum) through a maximum number of sunspots (solar maximum) and then back down to a very low number of sunspots
 - A to B to C in the plot on the right
- It's an approximate 11 year cycle
- On average
 - Rise time = 4 years
 - Descent time = 7 years



Why Are Solar Cycles Important?

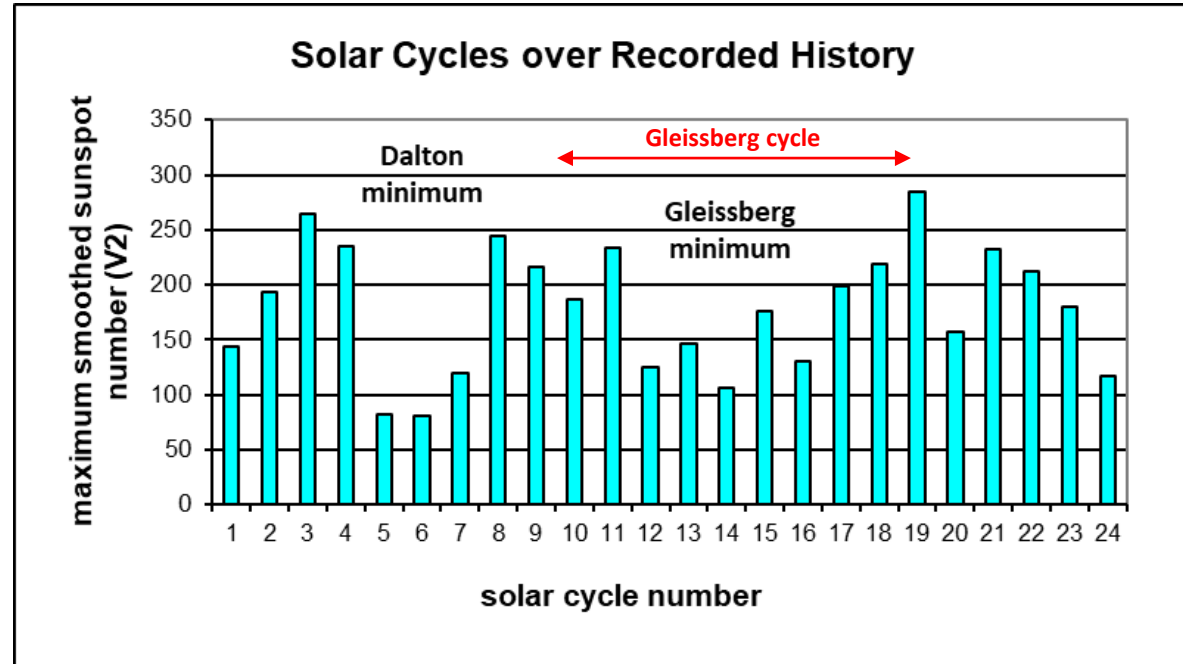
- They are important for the higher HF bands
 - 15m, 12m, 10m (and 6m)
 - The area around sunspots emits EUV (extreme ultraviolet) radiation to ionize the F2 region
 - The F2 region is responsible for most of our long-distance (DX) contacts on HF
 - More sunspots = more EUV = best propagation on the higher HF bands
- They are important for the low bands
 - 160m, 80m, 60m, 40m
 - Less sunspots = less ionospheric absorption and less disturbances = best propagation on the low bands
- 30m, 20m, 17m are generally good throughout a solar cycle



What Did the Previous Solar Cycles Do?

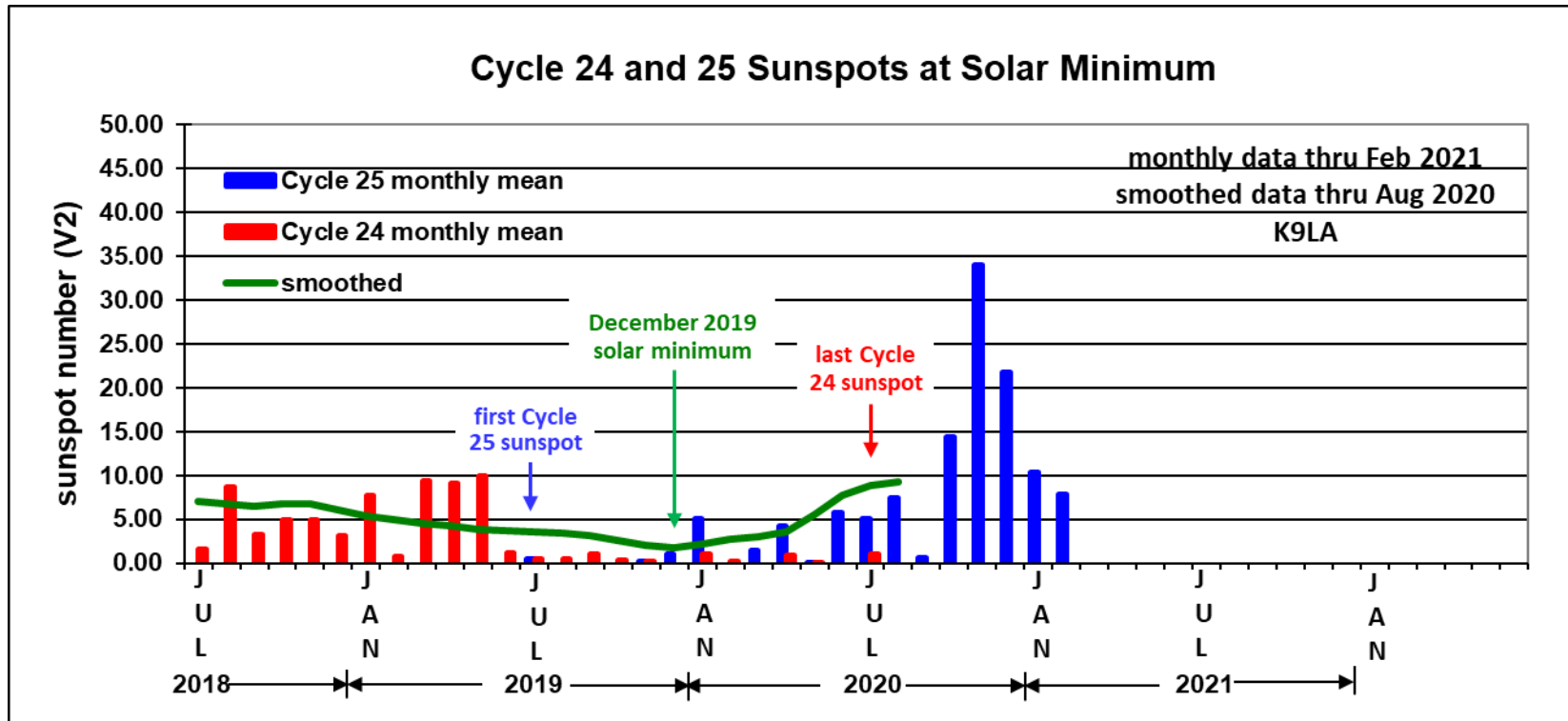
Recorded History

- Cycle 1 began in 1755
 - Maunder Minimum occurred from 1645-1715 with few sunspots
- We've gone through 3 periods of big cycles and 2 periods of small cycles
 - We appear to be in a third period of small cycles



- Cycle 24 just “ended” in December 2019 (when the smoothed sunspot number numerically minimized)
 - But in reality solar cycles overlap

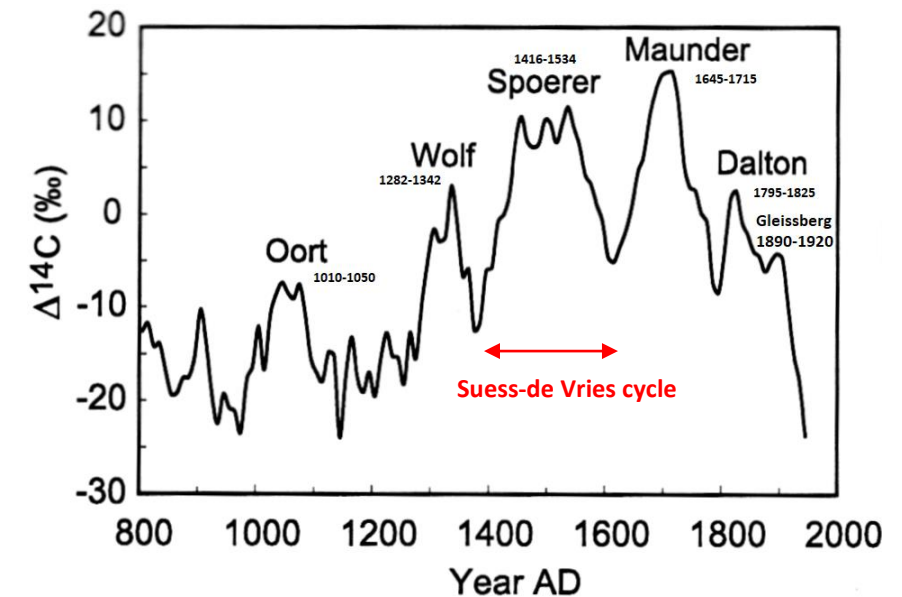
Cycle 24 Transition to Cycle 25



- First Cycle 25 sunspot in July 2019, last Cycle 24 sunspot in July 2020
- We can tell which cycle a sunspot is from by where it emerges on the solar disk and by the polarity of its magnetic field

Cycles of the Solar Cycle

- The 11-year cycle is the Schwabe cycle
- The 22-year cycle is the Hale cycle
 - The sun's north-south magnetic field flips at solar maximum
- The 80 to 100-year cycle is the Gleissberg cycle
 - You can see it on slide 8
- Even longer cycles
 - Suess-de Vries cycle ~ 200 years
 - Hallstadt cycle ~ 2100-2500 years
 - And more – from beryllium-10 cosmogenic isotope data in ice cores



What Propagation Can We Expect at Solar Minimum?

The Higher Bands Right Now

- Although Cycle 24 is considered to have ended in December 2019, we're still at solar minimum
 - Remember it takes a solar cycle about 4 years to rise
 - So we have about 3 more years to solar maximum
- Right now
 - 15m offers decent worldwide propagation on a few days of the month
 - 12m is kind of quiet
 - Occasional openings to the south and to VK/ZL
 - 10m is mostly noise
 - Very occasional openings to the south and to VK/ZL
 - Digital modes offer more opportunities due to their signal-to-noise ratio advantage
 - FT8/FT4 offers more opportunities than CW, CW offers more than SSB

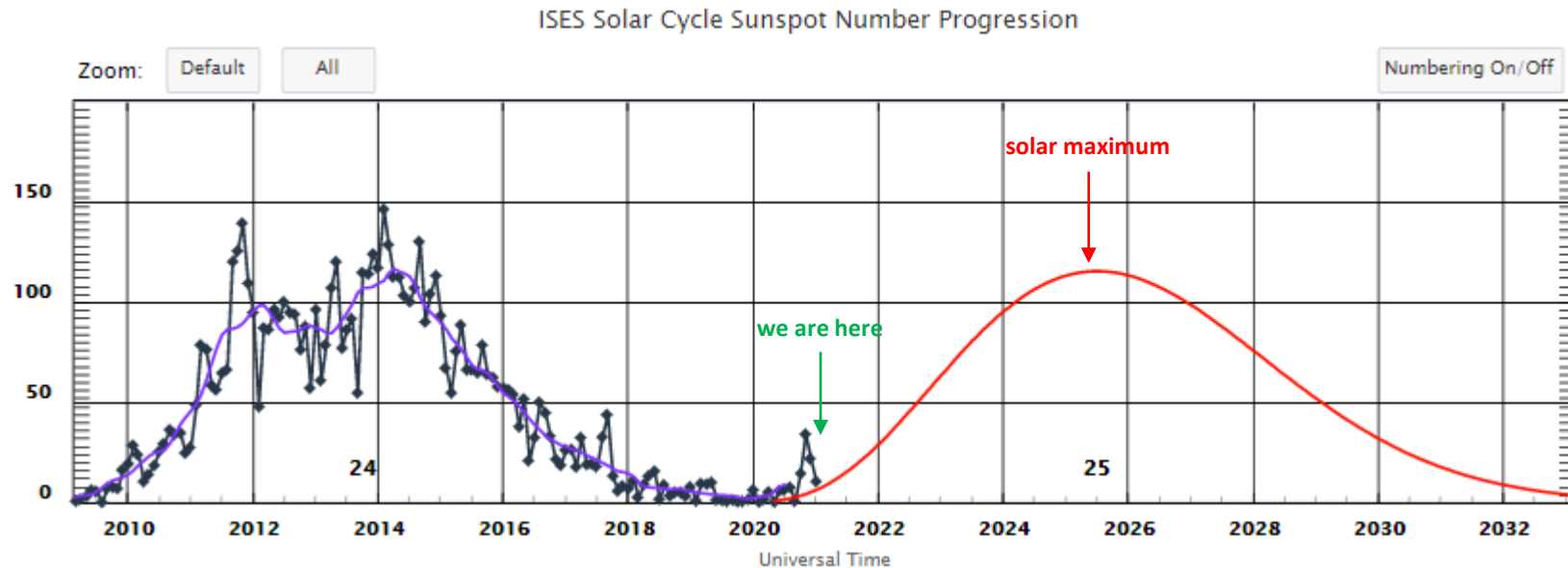
Fun with 100 Watts and Wires

- Don't forget the low bands at solar minimum
- Antennas are getting bigger as you go lower in frequency, but you may be able to put up a 40m dipole or inverted-vee
 - About 33 ½ feet on each side of center
- I have a 40m inverted-vee with its apex at 40 feet
- I participated in the ARRL International DX CW contest last month
 - I worked 48 countries on 40m using my Ten-Tec OMNI VII at 90 Watts
 - I also worked more 4 countries on 15m (more on this later)
- Don't shy away from 100 W and wire antennas on the low bands

What Will Cycle 25 Do?

What Will Cycle 25 Do?

- Here's the forecast from the Solar Cycle 25 Prediction Panel



- One of many predictions that forecasts a Cycle 25 similar to or smaller than Cycle 24
- There are a few for a really big Cycle 25 – we'll just have to wait and see

When Will the Higher Bands Be Back?

Tech and General Privileges on the Higher Bands

- Technician (and Novice)

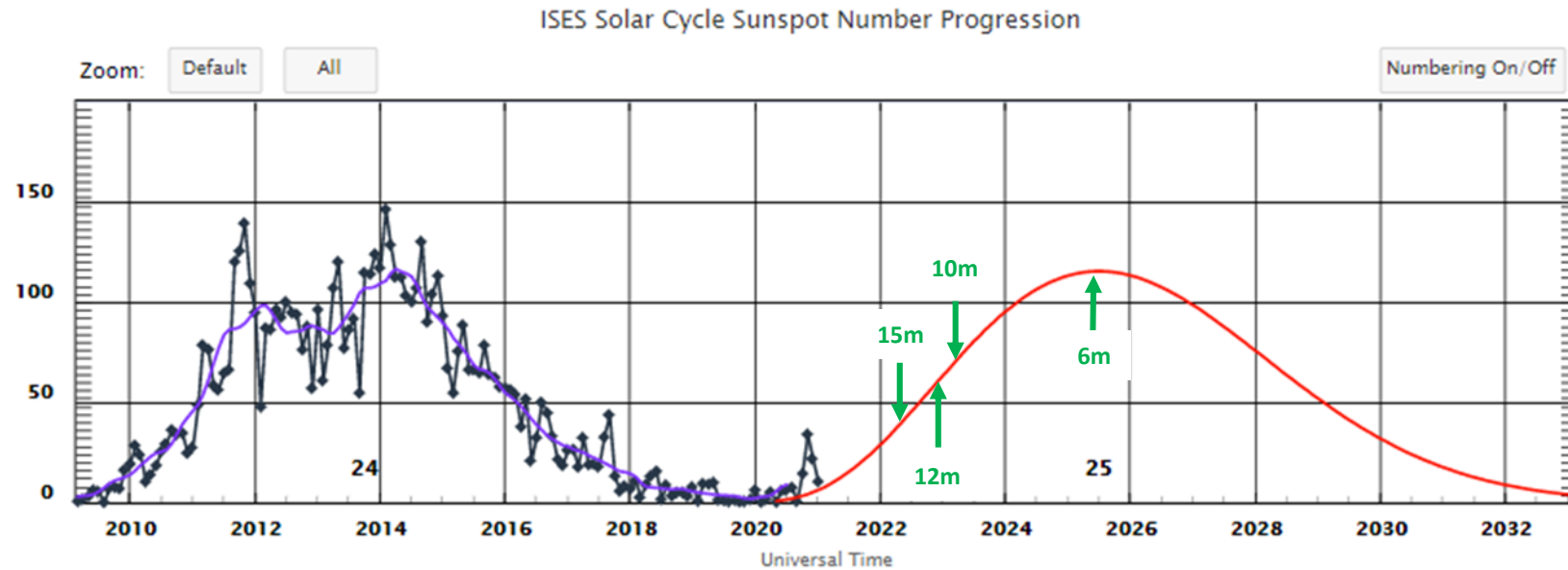
- 15m
 - 21.025-21.200, CW only, 200 W
- 12m
 - No privileges
- 10m
 - 28.000-28.300, RTTY and data, 200 W
 - 28.300-28.500, SSB phone, 200 W

- General

- 15m
 - 21.025-21.200, RTTY and data
 - 21.275-21.450, phone and image
- 12m
 - 24.890-24.930, RTTY and data
 - 24.930-24.990, phone and image
- 10m
 - 28.000-28.300, RTTY and data
 - 28.300-29.700, phone and image

If you're a Tech, go after your General

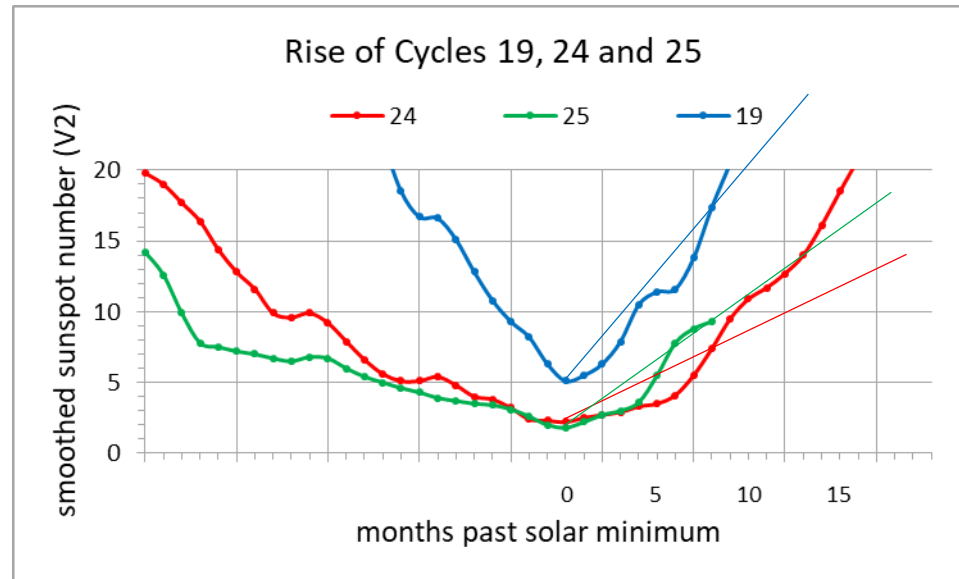
When Will the Higher Bands Be Back?



- If Cycle 25 is similar to Cycle 24 . . .
 - 15m should be back around the spring of 2022
 - 12m should be back around the winter of 2022/2023
 - 10m should be back around the spring of 2023
 - 6m should offer F2 propagation around solar maximum
 - Don't forget E_s in the summer – not tied to the solar cycle

Always watch for a spike in sunspots/10.7 cm solar flux – then check out the higher bands

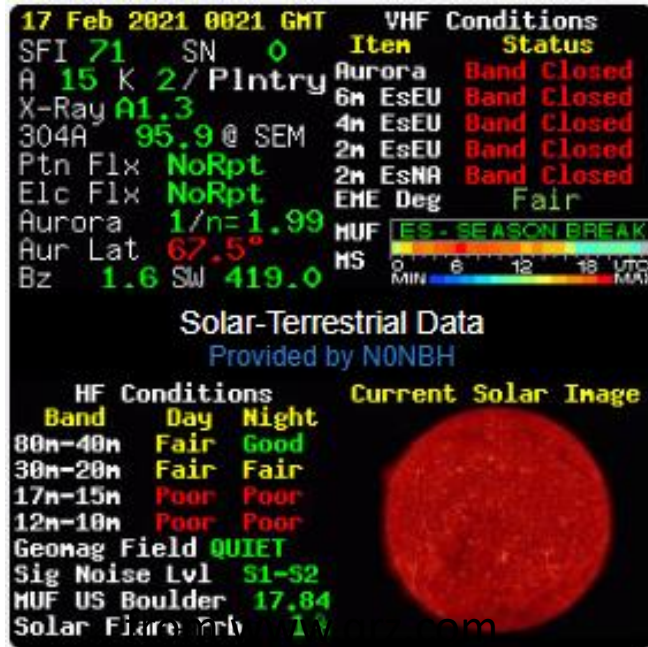
How Is Cycle 25 Doing?



after 8 months of data

- The faster a cycle rises, in general the bigger it is
- Cycle 25 is off to a decent start - it's rising faster than Cycle 24
- But it's still too early to tell what Cycle 25 will do

Space Weather and Propagation



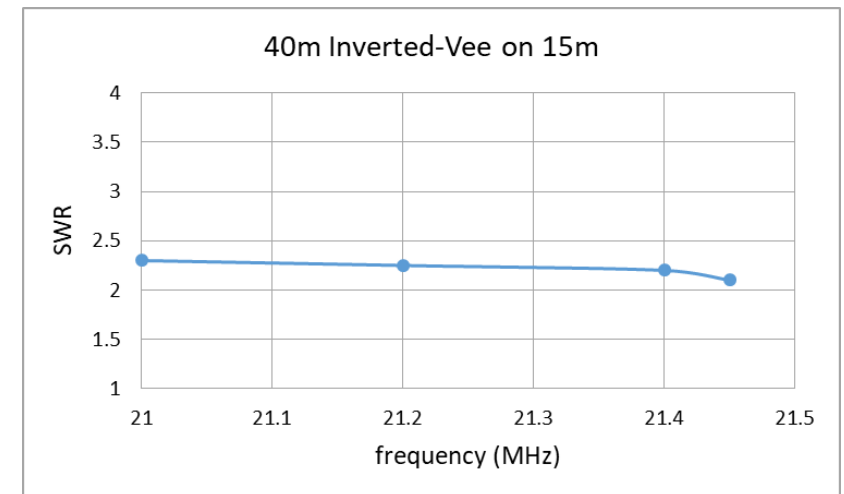
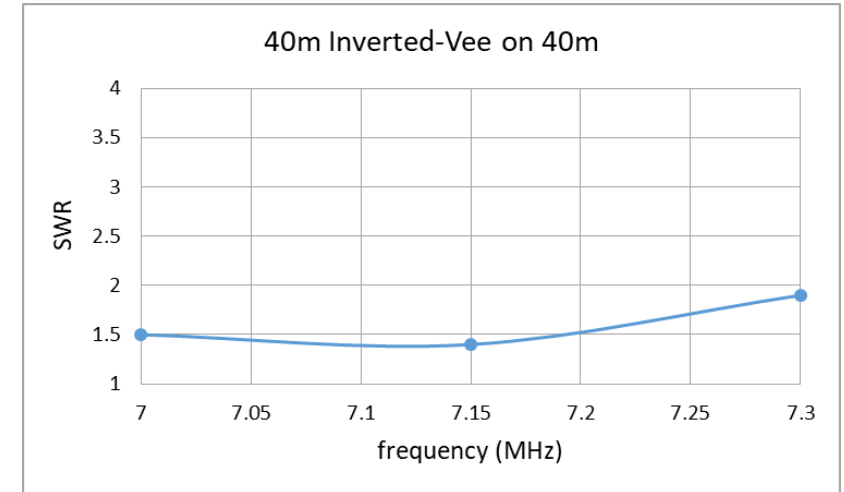
- Lots of data – what's important?
- SFI (10.7 cm solar flux index) and SN (sunspot number) indicate the status of the higher HF bands (15m, 12m, and 10m)
 - For 15m: $SFI \geq 90$, $SN \geq 50$ for a long period
 - For 12m: $SFI \geq 95$, $SN \geq 60$ for a long period
 - For 10m: $SFI \geq 105$, $SN \geq 70$ for a long period
- K and A indicate activity of the Earth's magnetic field
 - $K \leq 2$ for an undisturbed ionosphere
 - $A \leq 7$ for an undisturbed ionosphere
- When Bz is negative and large, and SW is $\gg 400$, geomagnetic storm (elevated K and A indices) possible

Antennas for the Higher HF Bands

for when we have consistent worldwide openings

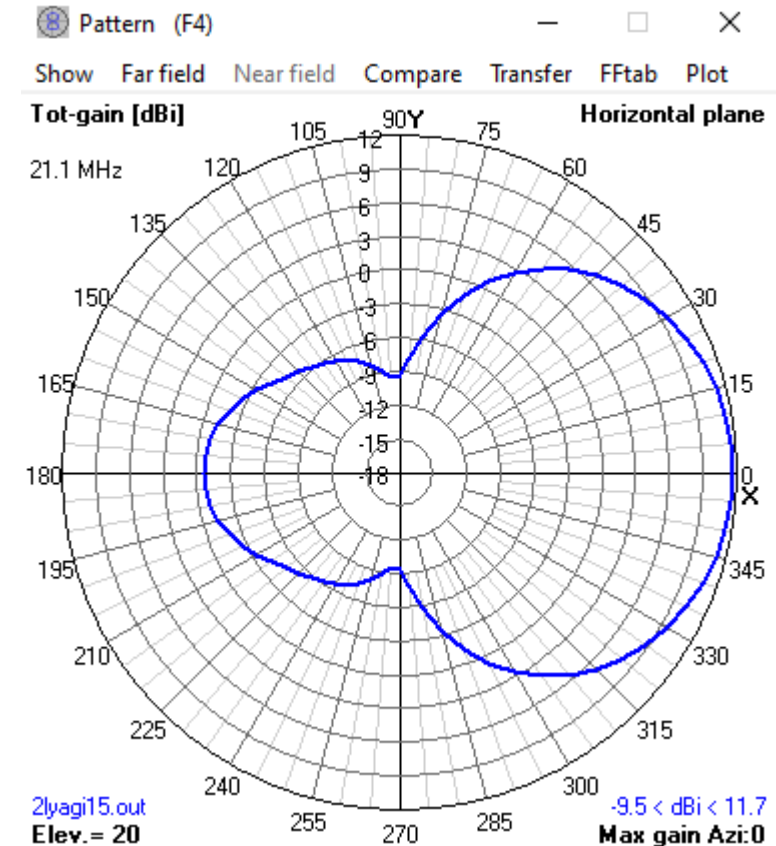
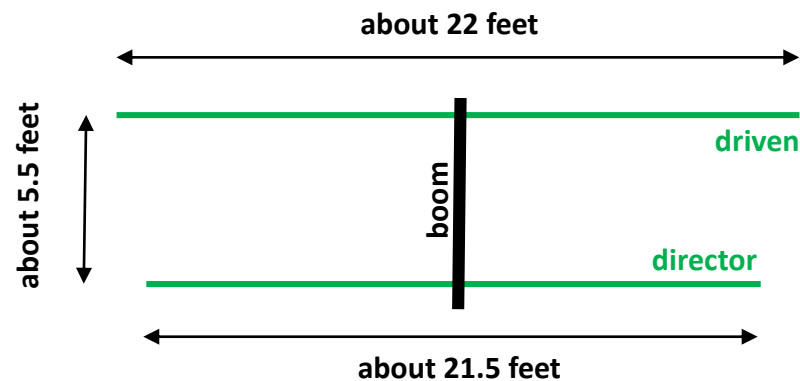
Antennas for 15m

- Use your 40m dipole/inverted-vee (slide 13)
 - Works as a 3/2-wavelength antenna
 - A bit of gain in some directions
 - Lowest SWR on 15m may be above 21.450 MHz
 - May need to use a tuner – either your rig's internal tuner or an external tuner
- Vertical with four elevated radials
 - I have a Hustler 4BTV – gives decent results
- 15m dipole/inverted-vee
 - Overall length about 22 feet



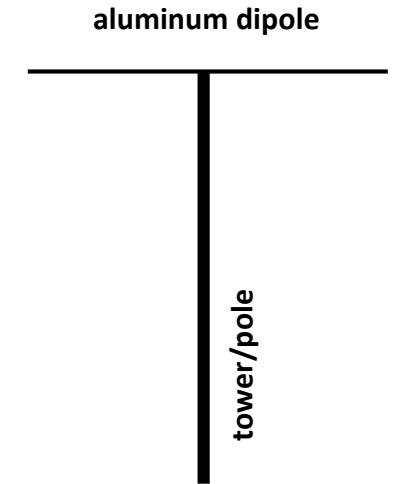
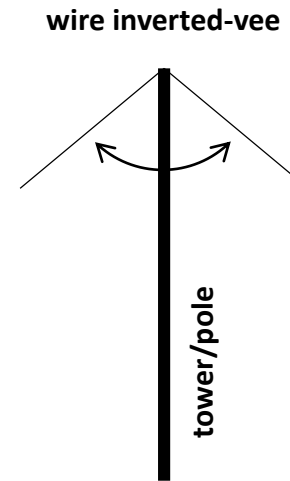
Another Antenna for 15m

- 2-element Yagi
 - Driven element and director
 - Aluminum tubing
 - About 5dB gain over a dipole
 - A rotator is required due to F/B and F/S ratios
- A height of 30 feet would work very well



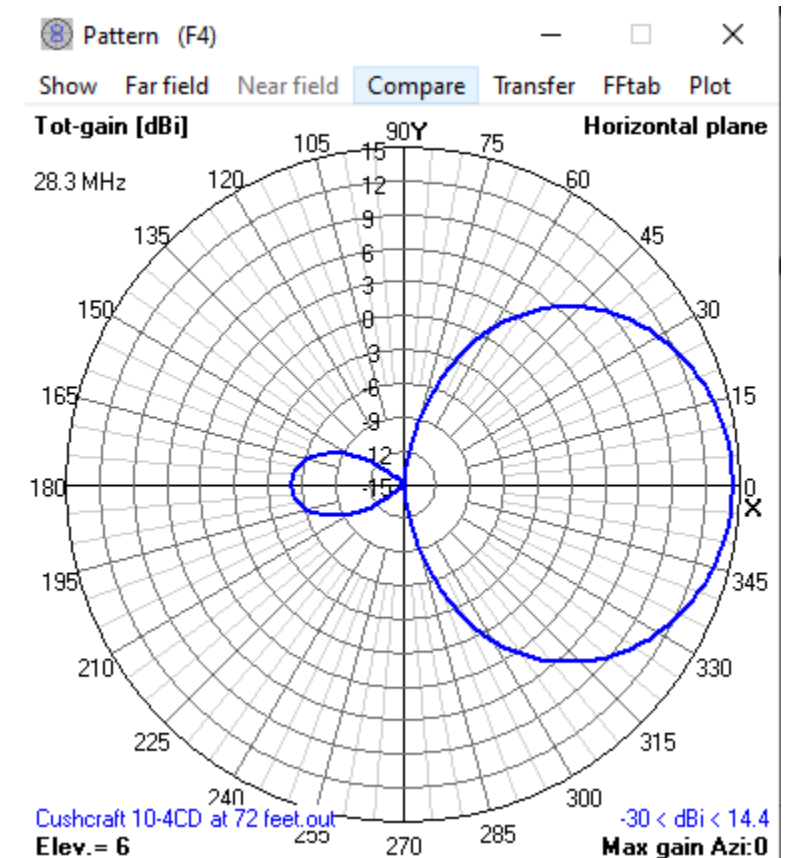
Antennas for 12m

- Inverted-vee
 - Each side about 9.25 feet
 - Keep angle > 90 degrees
- Dipole made with aluminum tubing
 - About 18.5 feet from tip-to-tip
- 2-element Yagi
 - A bit smaller than the 15m Yagi
 - Scale it from the approximate dimensions on slide 23
- 3-element Yagi



Antennas for 10m

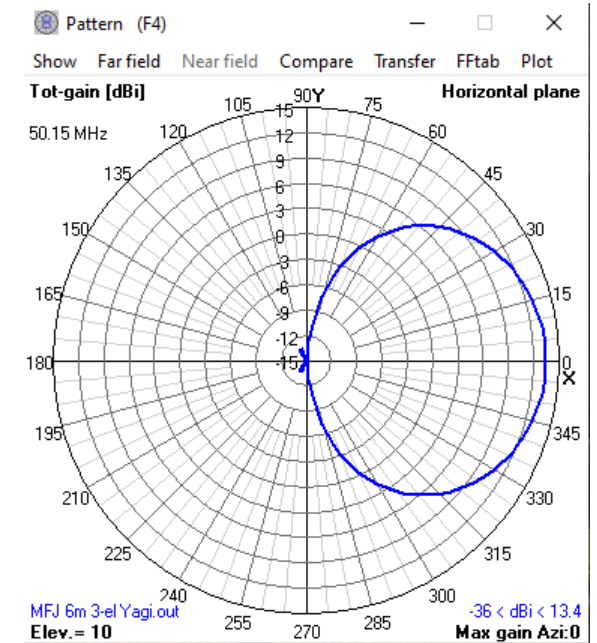
- Dipole (made of aluminum) is relatively small
 - About 16.5 feet tip-to-tip
 - It will give great results at 15-20 feet high
- Multi-element Yagis are quite reasonable
- I have an old 4-element Cushcraft 10m Yagi
 - Model 10-4CD
 - 16 foot boom, elements about 17 feet tip-to-tip
 - Bought it in Texas in 1980 (when we lived there)
 - It worked great for me in Texas and it works great for me in Ft Wayne
 - Used it to work many stations with my homebrew QRP (250 milliwatts) 10m transceiver



Antennas for 6m

- A multi-element Yagi is very doable – even for small property lots
 - Small and lightweight
- I have an MFJ-1762 3-element 6m Yagi
 - 9 foot elements, 6 foot boom, about 3 pounds
 - Great F/B – but what do you do when E_s is open in more than one direction?
- When a good E_s opening is available, just about any antenna will work that has a reasonable SWR on 6m
 - Very strong signals
 - I've used my 40m inverted-vee

MFJ-1762



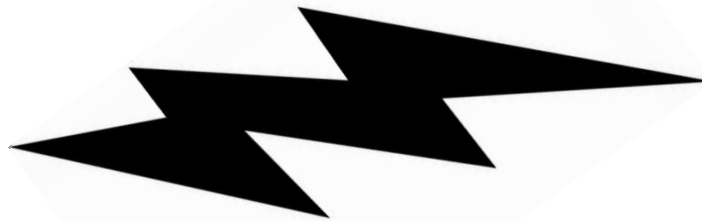
*When Are the Higher HF Bands Open During the Day?
and
What Can We Do On These Bands?*

When Are the Bands Open During the Day?

- Propagation on the higher bands basically “follows the sun”
- Look to the northeast through southeast in the mornings
 - Europe, Africa, Caribbean, South America, Central America
- Look to the southeast through southwest around local noon
 - Africa, Caribbean, South America, Central America
- Look to the southwest through northwest in the afternoon and evening
 - Caribbean, South America, Central America, VK, ZL, Pacific, Japan and Southeast Asia

What Can You Do on the Higher Bands?

- Part 97.1 (e) of the Amateur Radio rules
 - “*Continuation and extension of the amateur's unique ability to enhance international goodwill*”
- Rag chew with other hams around the world



More Things To Do In Cycle 25

- Part 97.1 (d) of the Amateur Radio rules
 - *“Expansion of the existing reservoir within the amateur radio service of trained operators, technicians, and electronics experts”*
- Go after awards
 - WAS (Worked All States)
 - DXCC (DX Century Club) – work 100 countries
 - 5BDXCC (80m, 40m, 20m, 15m, 10m)
 - WAZ (Worked All Zones) – work all 40 CQ Zones
 - 5BWAZ (80m, 40m, 20m, 15m, 10m)
- Focus on 15m and 10m for the 5-Band awards



Even More Things To Do in Cycle 25

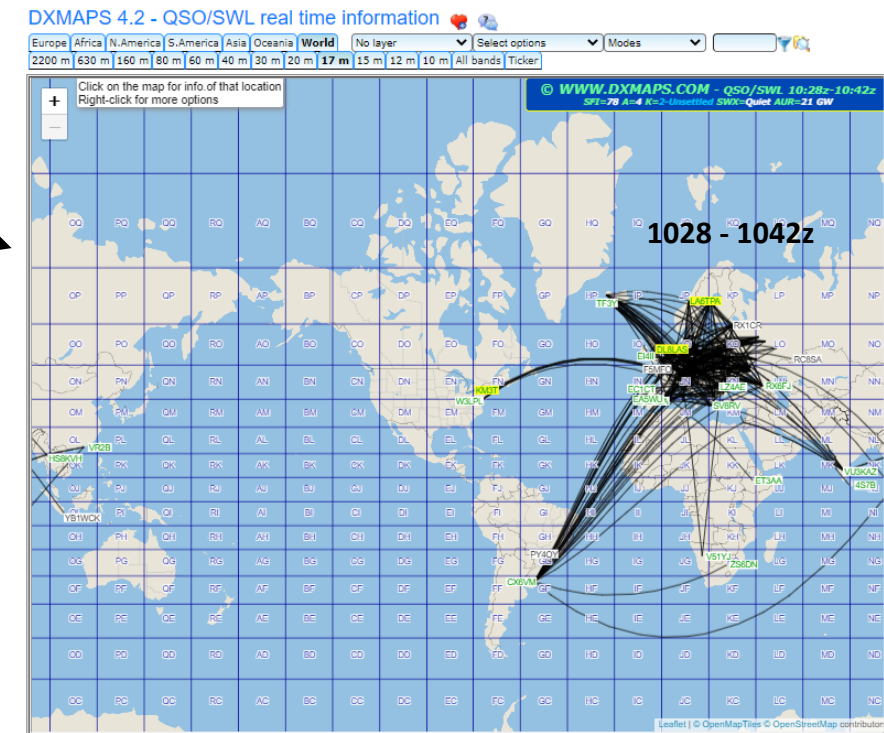
- Part 97.1 (a) of the Amateur Radio rules
 - *“Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications”*
- Participate in contests
 - State QSO parties
 - Maryland-DC – August 14 and 15, 2021 (google ‘Maryland-DC QSO Party’)
 - CQ WW DX (PH and CW) – end of October and end of November
 - ARRL DX (CW and PH) – towards the end of February and the beginning of March
 - Many other contests throughout the year

Some References to Start With

- Propagation
 - Propagation chapters of the ARRL Antenna Book and the ARRL Handbook
 - “The Little Pistol’s Guide to HF Propagation” by Bob Brown NM7M (SK)
 - Available for free on my website at <https://k9la.us> - 15Mb file
 - For the more technically minded – Ionospheric Radio, Kenneth Davies, 1990
- Antennas
 - ARRL Antenna Book
- Solar info
 - Lots of data on the internet – pay attention to SFI, SN and the K index
 - <https://spaceweather.com/>, <https://www.swpc.noaa.gov/>,
<https://www.solarham.net/>, NØNBH banner at <https://www.qrz.com/>,
<https://www.spaceweatherwoman.com/>

More References

- Real-time QSOs (who is working who right now)
 - <https://www.dxmaps.com/spots/mapg.php?Lan=E>
 - <https://pskreporter.info/pskmap.html>
 - <http://www.wsprnet.org/drupal/>
 - <http://www.reversebeacon.net/main.php>
- Real-time ionosphere (what the ionosphere is doing right now)
 - <http://prop.kc2g.com/> - shows worldwide MUFs (maximum usable frequencies) for a 3000 km path



Summary

- Cycle 24 is over, Cycle 25 is beginning its ascent
- Most forecast a below average Cycle 25, a few forecast a big Cycle 25
 - All we can do is wait and see what happens
- Solar min is best for the low bands (160m, 80m, 60m, 40m)
- 30m, 20m, 17m are good throughout a solar cycle
- Solar max is best for the higher bands (15m, 12m, 10m)
 - Lots of things to do with modest power and modest antennas
- Antennas are reasonable on 15m, 12m, 10m, 6m

Get radio-active on HF!