

Hello Solar Cycle 25

*This is the Montgomery County ARC presentation
from March 2021 with appropriate updates*

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A Little About K9LA

- Novice license in 1961 (WN9AVT)
- I enjoy
 - Learning about the sun and propagation
 - DXing – top of the Honor Roll
 - 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 and conventions



Ranger II and Drake 2-B

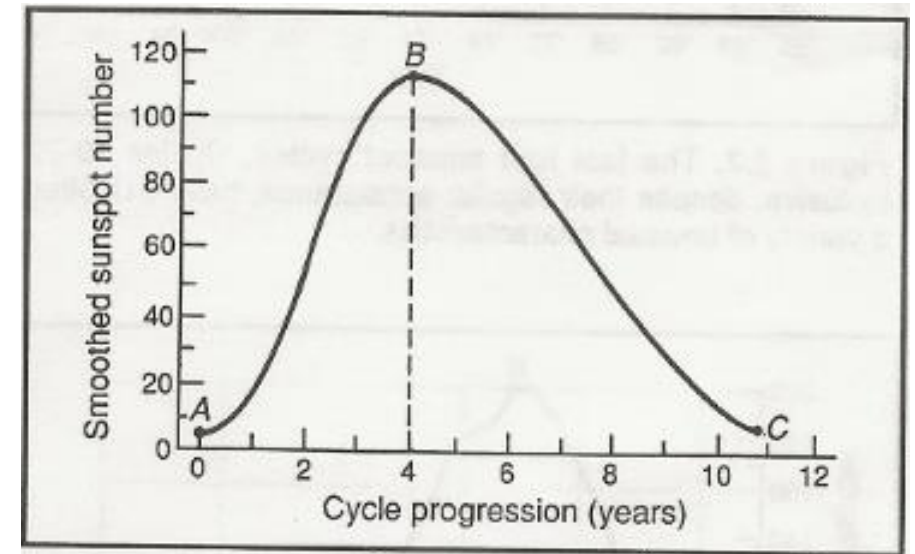
Questions We'll Cover

- What is a solar cycle?
- Why is it important?
- What did the previous solar cycles do?
- What propagation can we expect at solar minimum?
 - Kind of 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?
- Can we predict sporadic-E?

What Is a Solar Cycle and Why Is It Important?

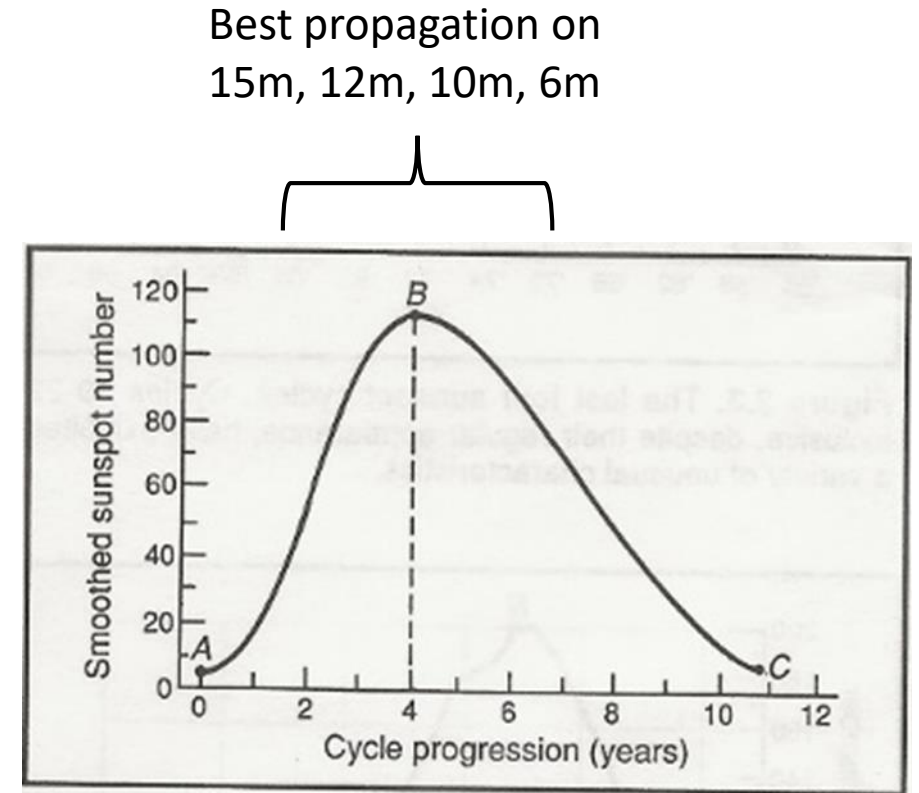
What Is a Solar Cycle?

- 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



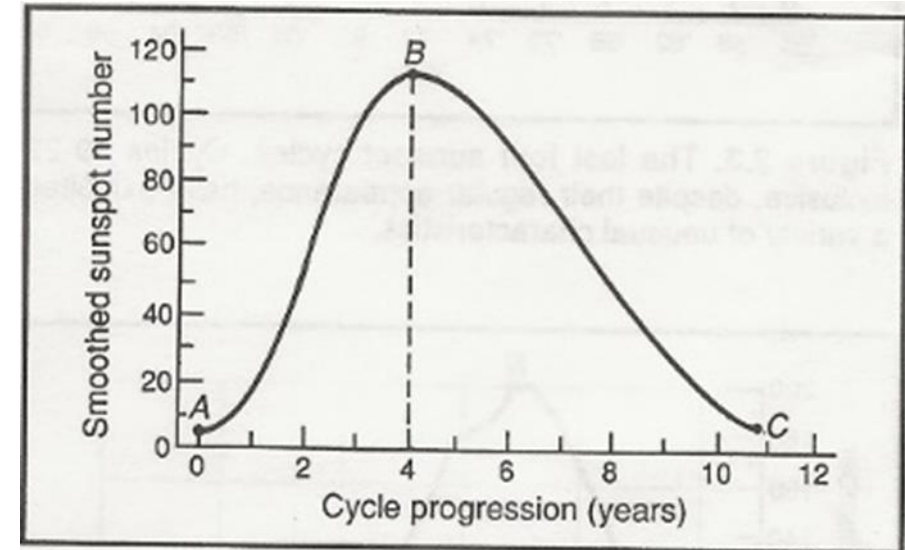
Why Are Solar Cycles Important?

- 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 medium- and long-distance (DX) contacts on HF
 - More sunspots = more EUV = more ionization = best propagation on the higher HF bands



Why Are Solar Cycles Important?

- They are important for the lower HF bands
 - 160m, 80m, 60m, 40m
 - Clarification: 160m is MF, not HF
 - Less sunspots = less ionospheric absorption
 - Less sunspots = less disturbances
 - This results in the best propagation on the low bands
- 30m, 20m, 17m are generally good throughout a solar cycle

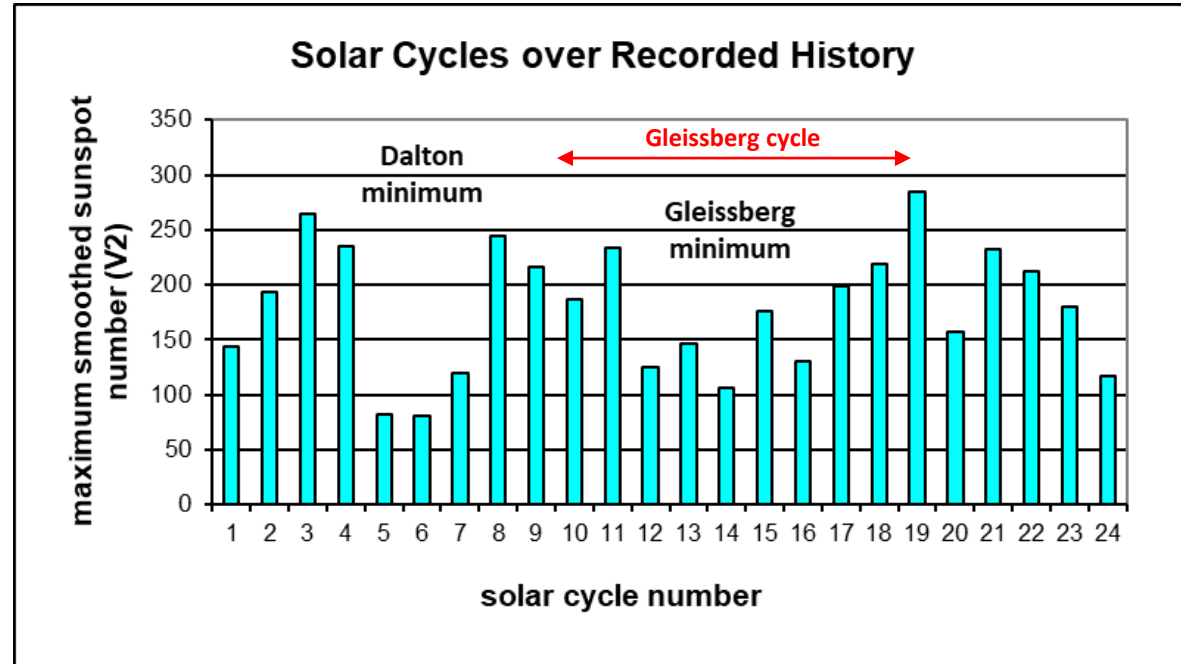


Best propagation on 160m, 80m, 60m, 40m

What Did the Previous Solar Cycles Do?

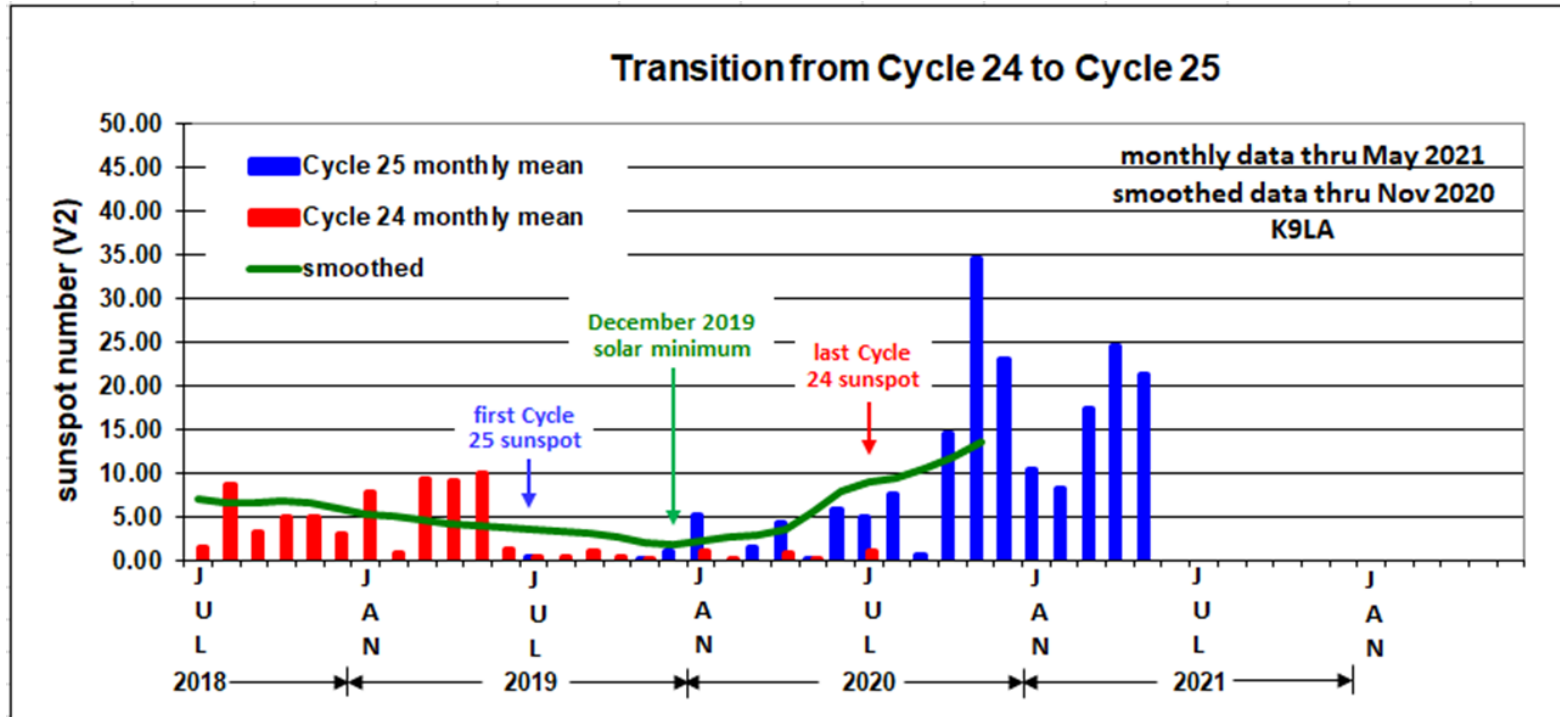
Recorded History

- 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
- Big question – will Cycle 25 get us out of this third period of small cycles?



- Carrington event (1859) was Cycle 10
- Cycle 24 “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 (its latitude) and by the polarity of its magnetic field

What Propagation Can We Expect at Solar Minimum?

The Higher Bands Right Now

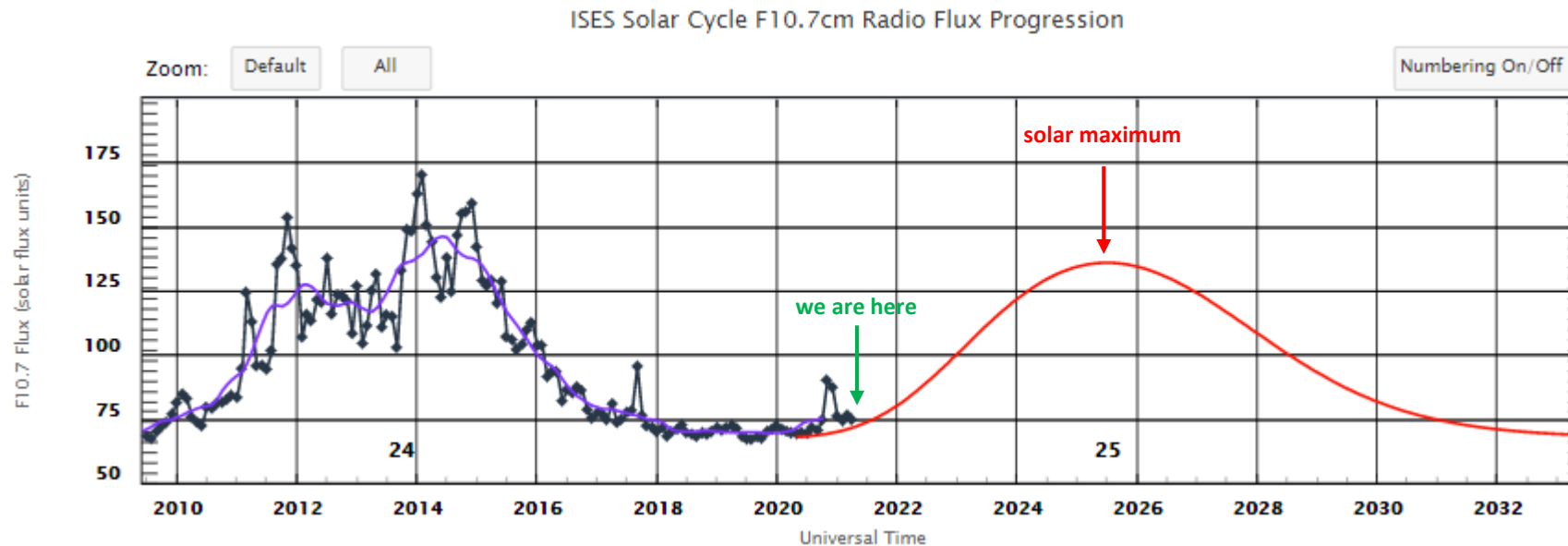
- 15m offers decent worldwide propagation on a few days of the month
- 12m is kind of quiet
 - Occasional openings to the south and to VK/ZL
- 10m is mostly noise
 - Very occasional openings to the south and to VK/ZL
- Digital modes offer more opportunities due to their signal-to-noise ratio advantage
 - FT8 offers more opportunities than CW, CW offers more than SSB
- Things are starting to improve on these bands as Cycle 25 ascends

The Lower Bands Right Now

- Antennas are getting bigger as you go lower in frequency, but you may be able to put up a 40m dipole or a 40m 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 in February
 - I worked 48 countries on 40m using my Ten-Tec OMNI VII at 90 Watts
 - I also worked 4 more countries on 15m using the 40m inverted-vee (more on this later)
- Don't shy away from 100 W and wire antennas on the lower bands

What Will Cycle 25 Do?

What Will Cycle 25 Do?



- I'm aware of 56 predictions for Cycle 25 (50 of the 56 are for a small cycle)
- The above image is the prediction from the Solar Cycle 25 Prediction Panel
- There are 3 predictions for a really big Cycle 25
- We'll just have to wait and see what happens

When Will the Higher Bands Be Back?

Tech and General Privileges on the Higher Bands

- Technician (and Novice)

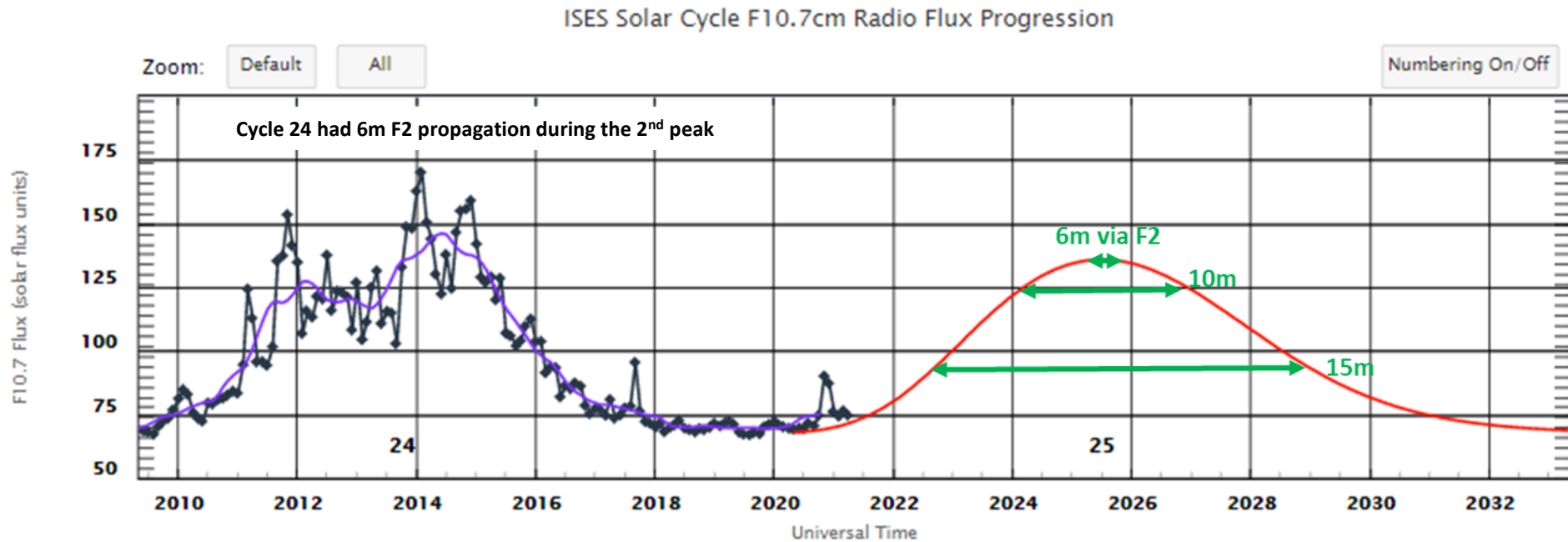
- 15m
 - 21.025-21.200, CW only, 200 W
- 12m
 - No privileges
- 10m
 - 28.000-28.300, RTTY and data, 200 W
 - 28.300-28.500, SSB phone, 200 W

- 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

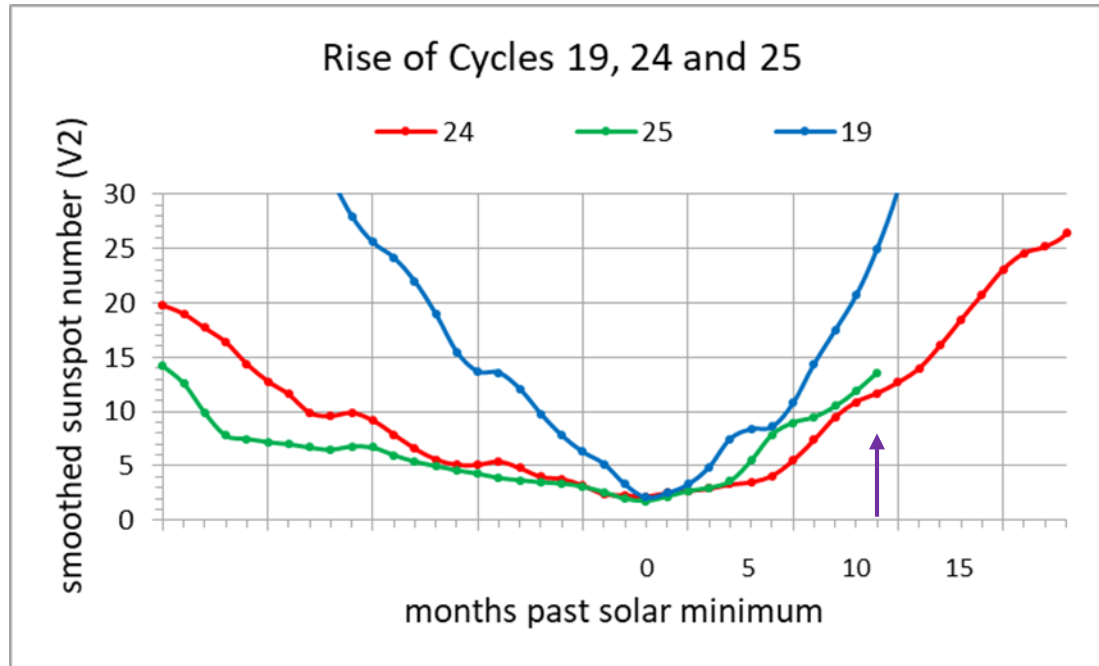
If you're a Tech, go after your General

When Will the Higher Bands Be Back?



- Green horizontal lines are the long-term 10.7 cm solar flux values that give openings on many days of the month
 - Kind of bleak – but watch for short-term spikes in 10.7 cm solar flux
- If Cycle 25 is bigger than Cycle 24, the higher bands will be open earlier than and later than the dates suggested above

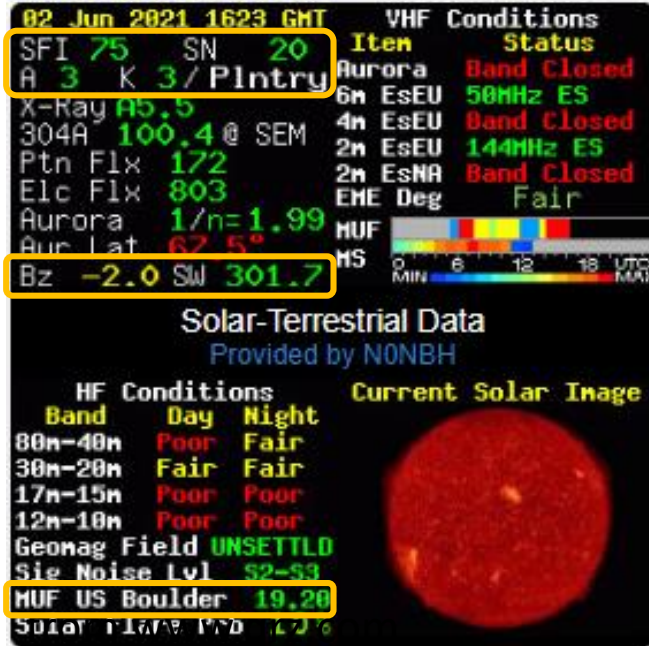
How Is Cycle 25 Doing?



after 11 months of data

- Historical data says the faster a cycle rises, the bigger it is
- Cycle 25 is rising a bit faster than Cycle 24
- But it's still too early to tell what Cycle 25 will do
 - Another 6-12 months of data may make the picture clearer

Space Weather and Propagation – What We Want



NØNBH banner –
one of many sources
of space weather

- SFI (10.7 cm solar flux index), SN (sunspot number) and 304A (EUV at 30.4 nm) indicate status of the higher HF bands

	SFI value for many weeks	SN (V2) value for many weeks	EUV value for many weeks
17m	80	30	105
15m	90	50	140
12m	105	75	195
10m	125	100	250
6m	190	215	400

- K (3-hr index) and A (daily index) indicate activity of the Earth's magnetic field
 - $K \leq 3$, $A \leq 15$ for an undisturbed F2 region of the ionosphere
- Bz (N-S component of the Interplanetary Magnetic Field) and SW (solar wind speed)
 - Bz positive or slightly negative, SW not too much > 400

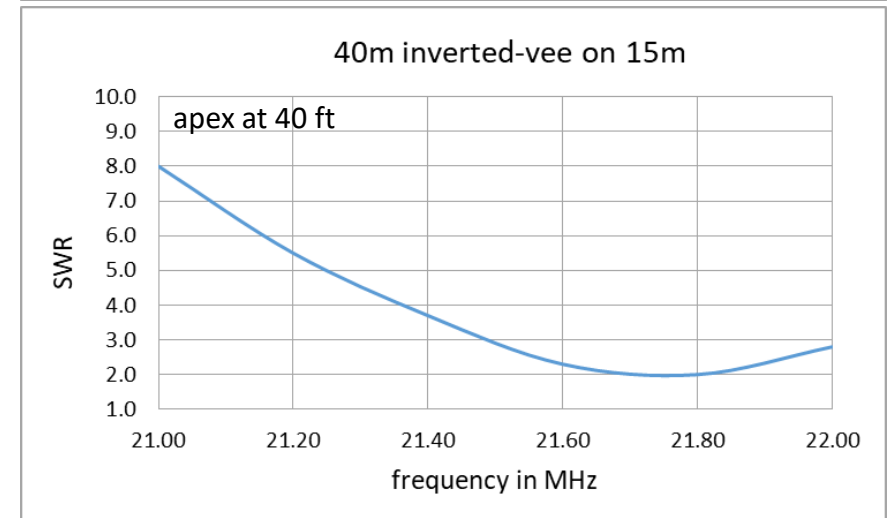
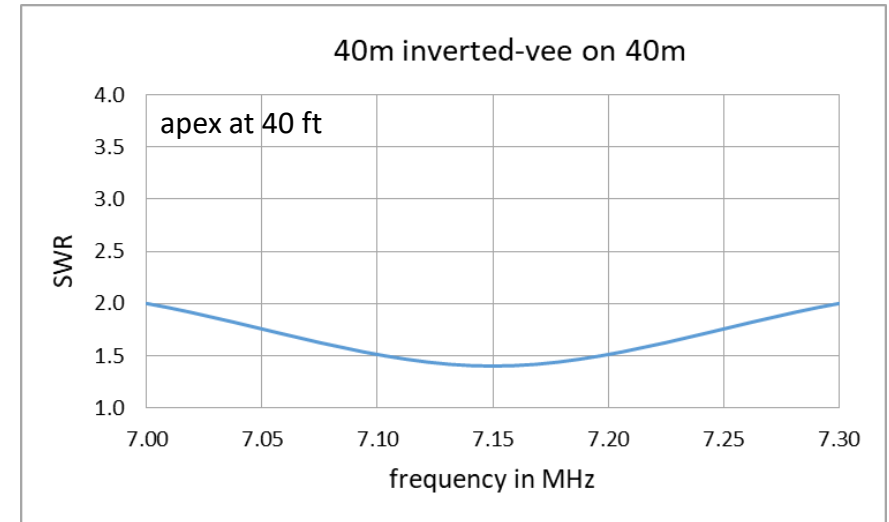
for more details: https://k9la.us/Jun21_Space_Weather_Parameters_and_Propagation_-_revised_1Jun2021.pdf

Antennas for the Higher HF Bands

for when we have consistent worldwide openings

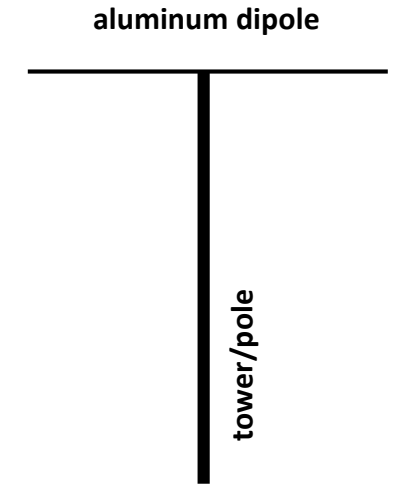
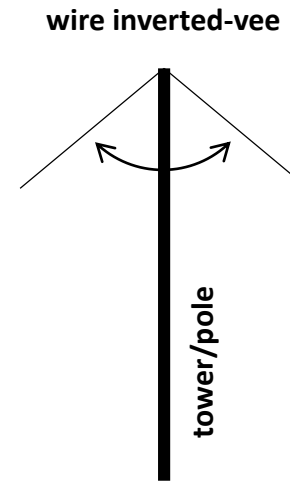
Antennas for 15m

- Use your 40m dipole/inverted-vee
 - Works as a 3/2-wavelength antenna
 - A bit of gain in some directions
 - Lowest SWR on 15m 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
- 2-element Yagi at 20-30 feet high
 - 6 ft boom, 22 ft elements
 - About 5 dB gain over dipole



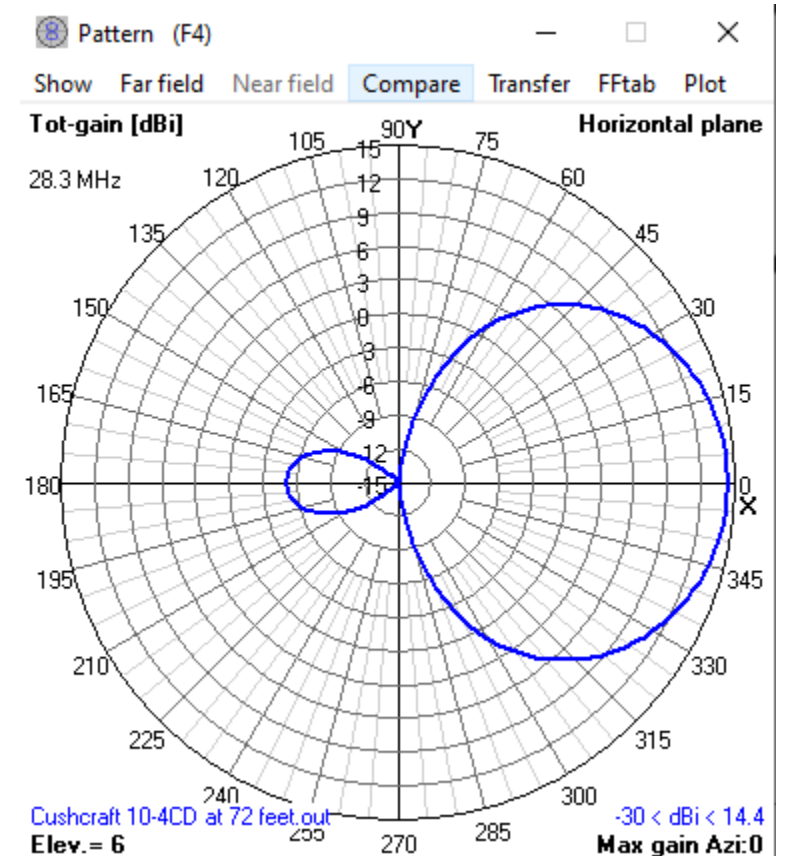
Antennas for 12m

- 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
 - 5 ft boom, 18.5 ft elements
- 3-element Yagi
 - A bit longer boom



Antennas for 10m

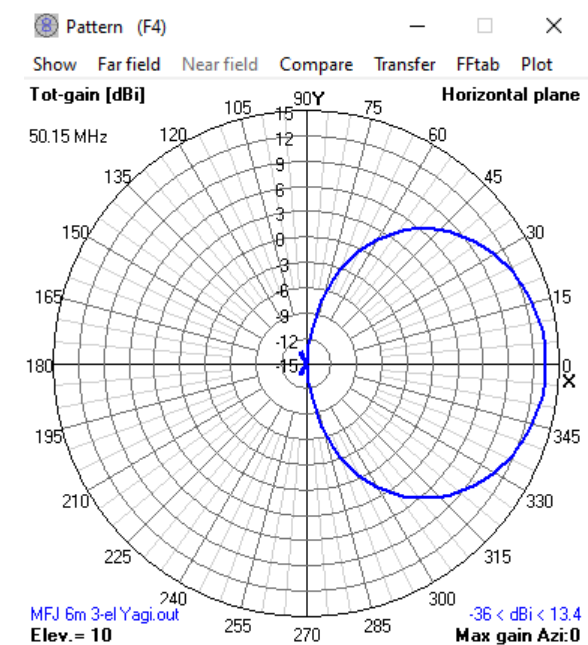
- Dipole (made of aluminum) is relatively small
 - About 16.5 feet tip-to-tip
 - It will give great results at 15-20 feet high
- Multi-element Yagis are quite reasonable
- I have an old 4-element Cushcraft 10m Yagi
 - Model 10-4CD
 - 16 foot boom, elements about 17 feet tip-to-tip
 - Bought it in Texas 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
- When a good E_s opening occurs in several directions, you may miss some QSOs due to the F/B and F/S ratios
 - I've used my 40m inverted-vee to supplement the 6m Yagi (may need to use an antenna tuner)

MFJ-1762



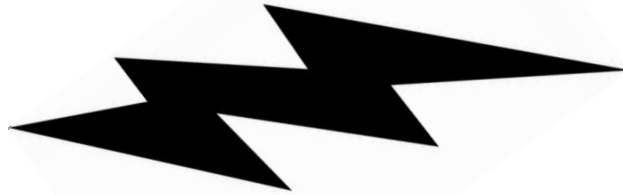
*When Are the Higher HF Bands Open During the Day?
and
What Can We Do On These Bands?*

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 in the early afternoon
 - Southern 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 when Cycle 25 really gets going in earnest



Even More Things To Do in Cycle 25

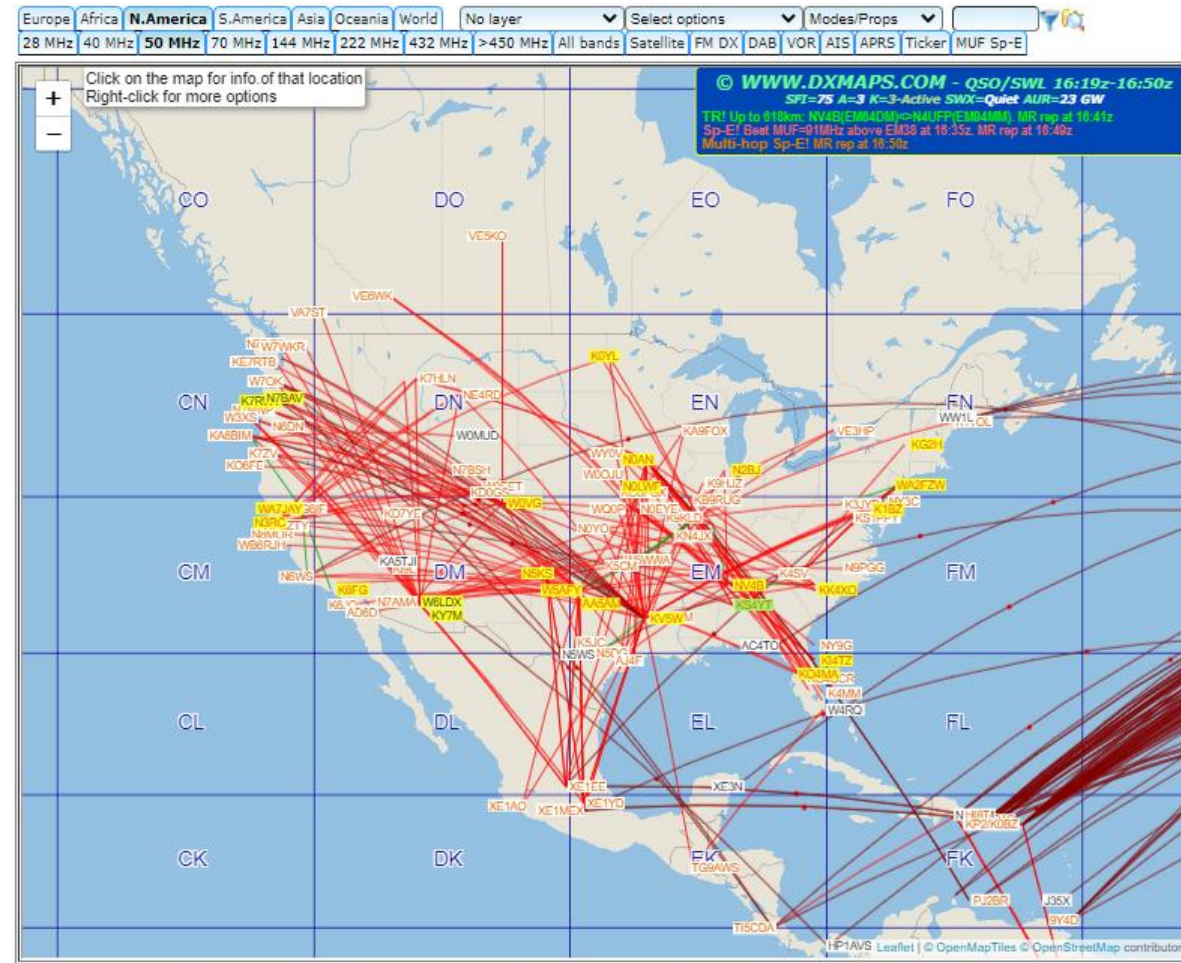
- Part 97.1 (a) of the Amateur Radio rules
 - *“Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications”*
- Participate in contests
 - State QSO parties
 - Virginia QSO Party – this year’s event was in March, next event is March 2022
 - CQ WW DX (PH and CW) – end of October and end of November
 - ARRL DX (CW and PH) – towards the end of February and at 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, 304A, K, A, Bz, SW
 - <https://spaceweather.com/>, <https://www.swpc.noaa.gov/>,
<https://www.solarham.net/>, NØNBH banner at <https://www.qrz.com/>,
<https://www.spaceweatherwoman.com/>

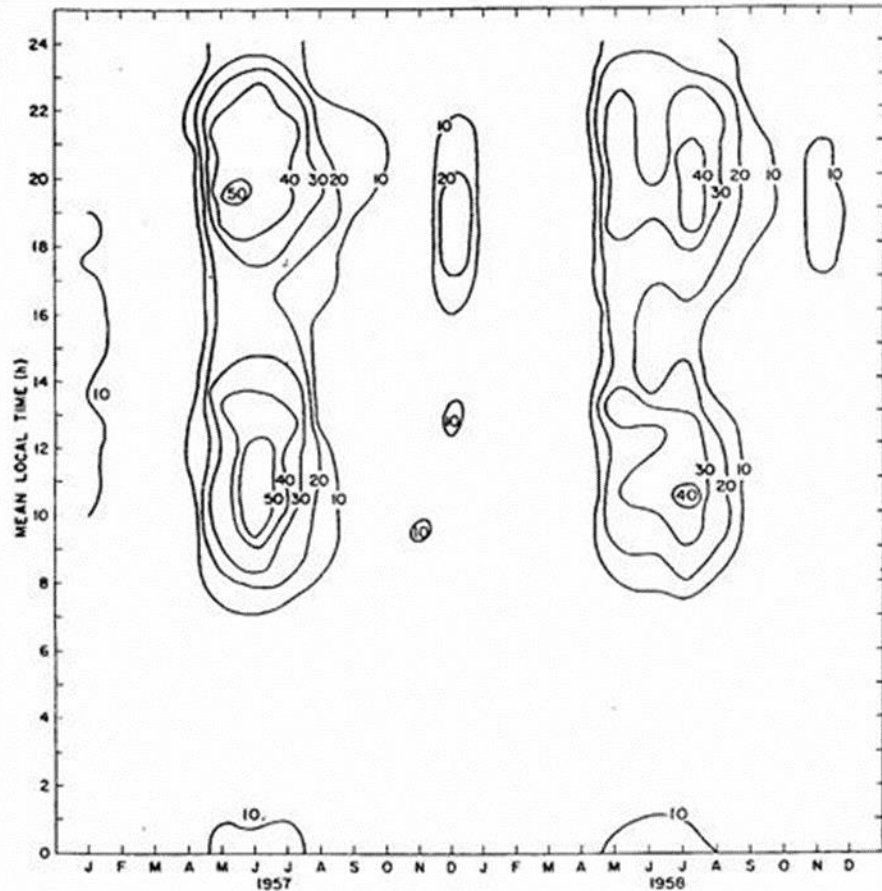
More References

- Real-time QSOs (who is working who right now)
 - <https://www.dxmaps.com>
 - <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 3000 km paths
 - <https://www.ncdxf.org/beacon/> - 18 worldwide beacons on 20m, 17m, 15m, 12m and 10m – in a 3 minute period, you can assess worldwide propagation on a band



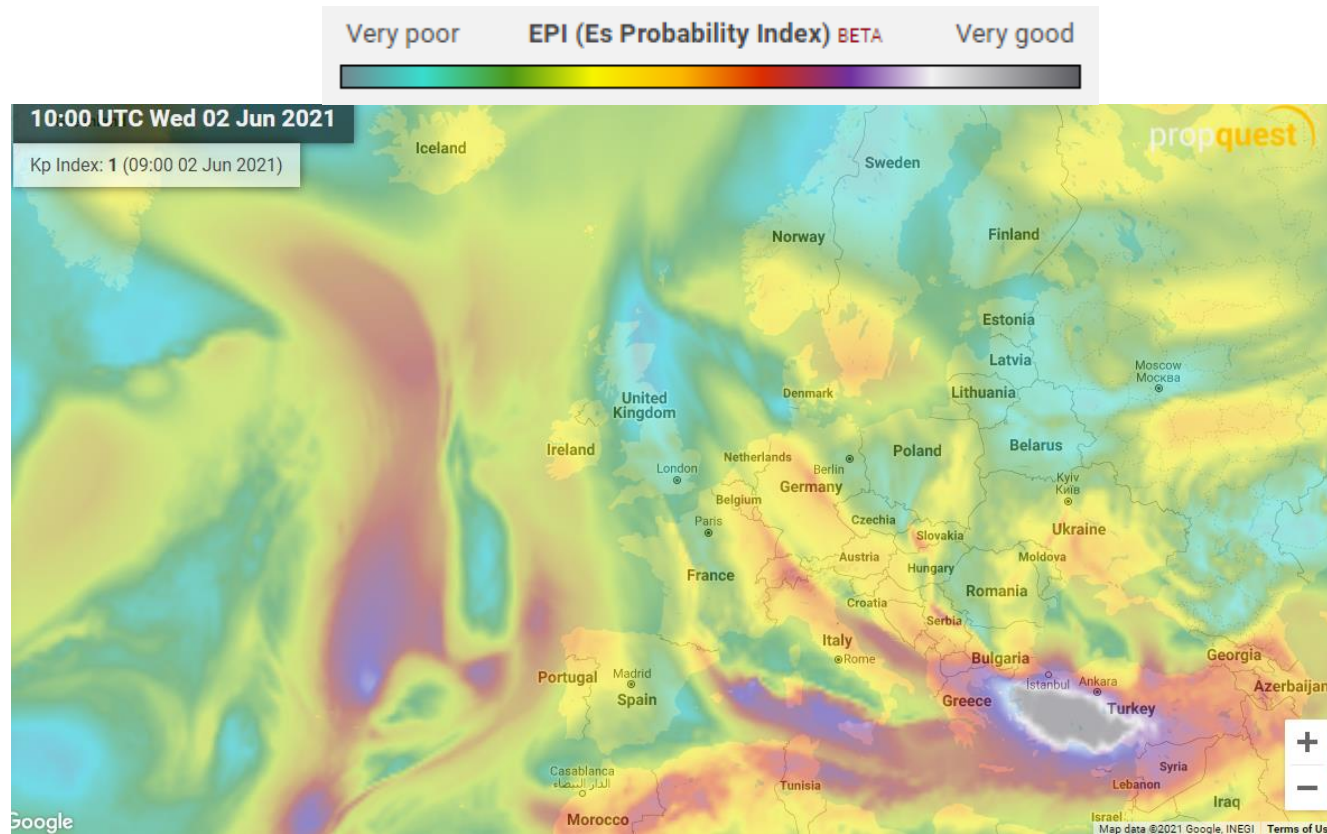
June 2, 1619-1650 UTC, 6m

Sporadic-E Predictions

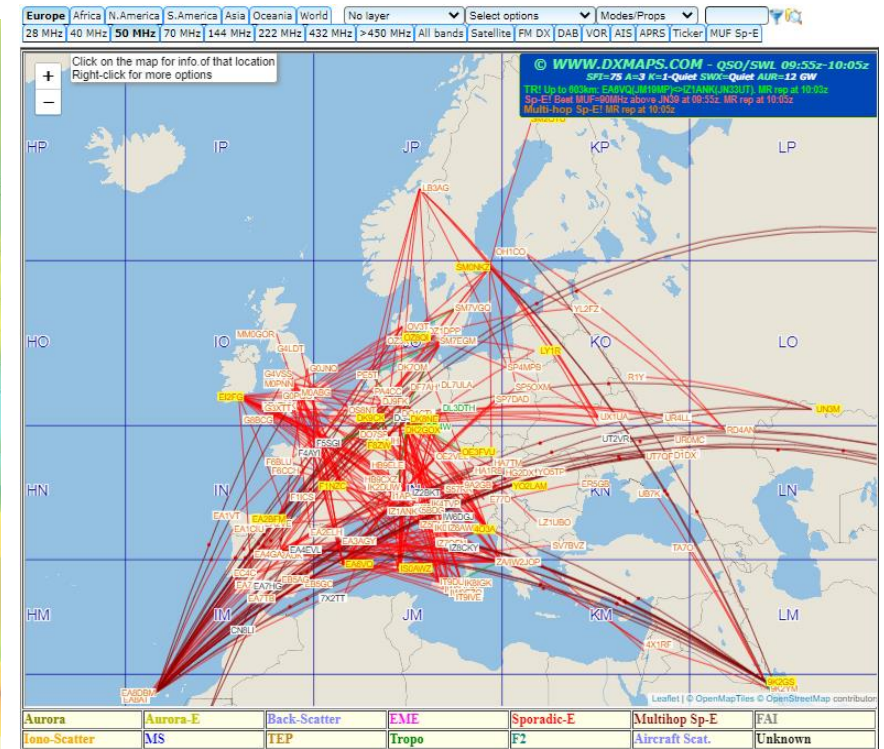


- Data on left shows probabilities of Es throughout a year and by local time
 - Summer months best – late morning, early evening
 - Around December – early evening
- Daily Es predictions from Jim Bacon G3YLA (retired BBC meteorologist) based on terrestrial tropospheric weather
 - He calls it the Es Prediction Index (EPI)
 - <http://propquest.co.uk/map.php>
- Joe Dzekevich K1YOW also looking at tie between Es and tropospheric weather
 - https://hamsci.org/sites/default/files/publications/202011_CQ_Dzekevich_K1YOW_SporadicE.pdf

EPI vs dxmaps.com



EPI, June 2, 1000 UTC



dxmaps.com, June 2, 0955-1005 UTC

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 of reasonable size on 15m, 12m, 10m, 6m

Get radio-active on HF!