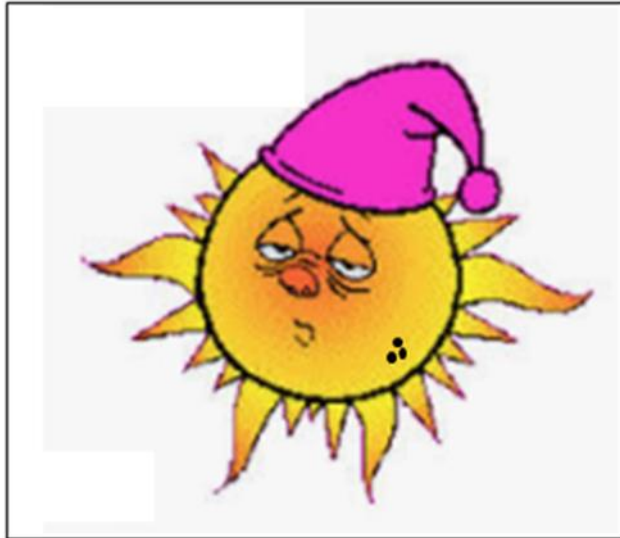


# *Cycle 25 and Propagation*



Cycle 25 is waking up

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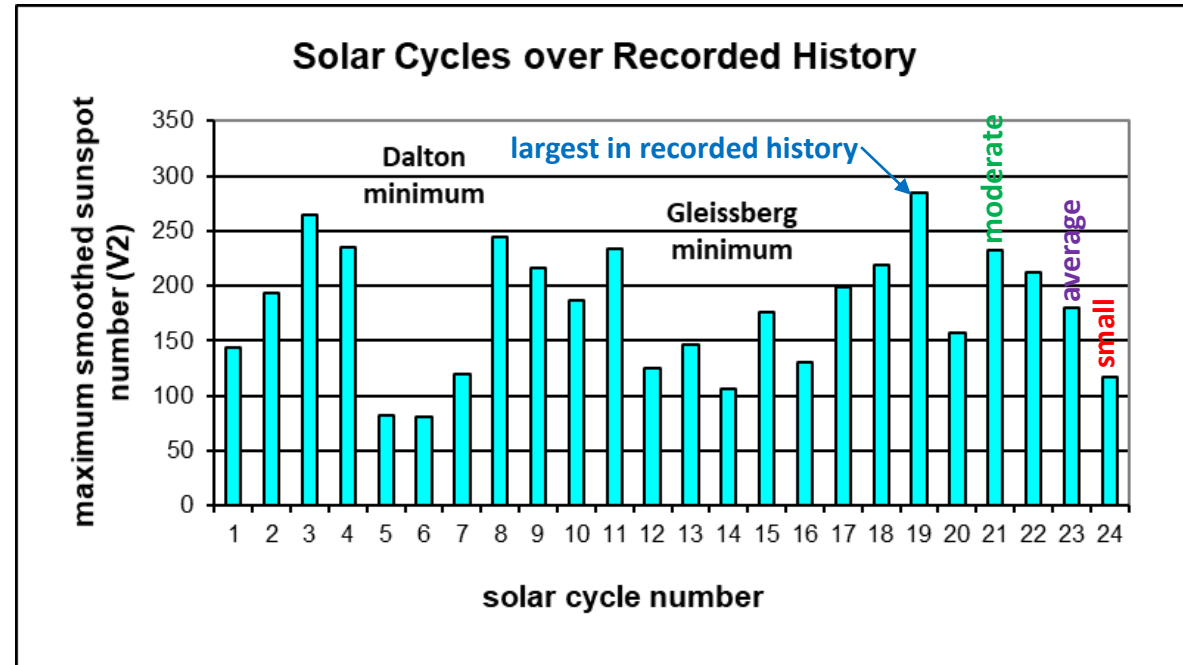
website: <https://k9la.us>

# Agenda

- Previous solar cycles
- Cycle 25 predictions
- Propagation predictions
- Short-term opportunities
- Space weather
- Real-time assessment of the bands
- Simple antennas for 15m, 12m, 10m, 6m

# A Look at Previous Solar Cycles

- Cycle 1 began in 1755
  - Maunder Minimum occurred from 1645-1715 with few sunspots
- We've gone through 3 periods of 'big' solar cycles
  - Cycles 1-4, 8-11, 17-23
- We've gone through 2 periods of 'small' solar cycles
  - Cycles 5-7, 12-16
- With Cycle 24, we appear to be in a third period of small solar cycles



Will Cycle 25 get us out of this third period of small solar cycles?

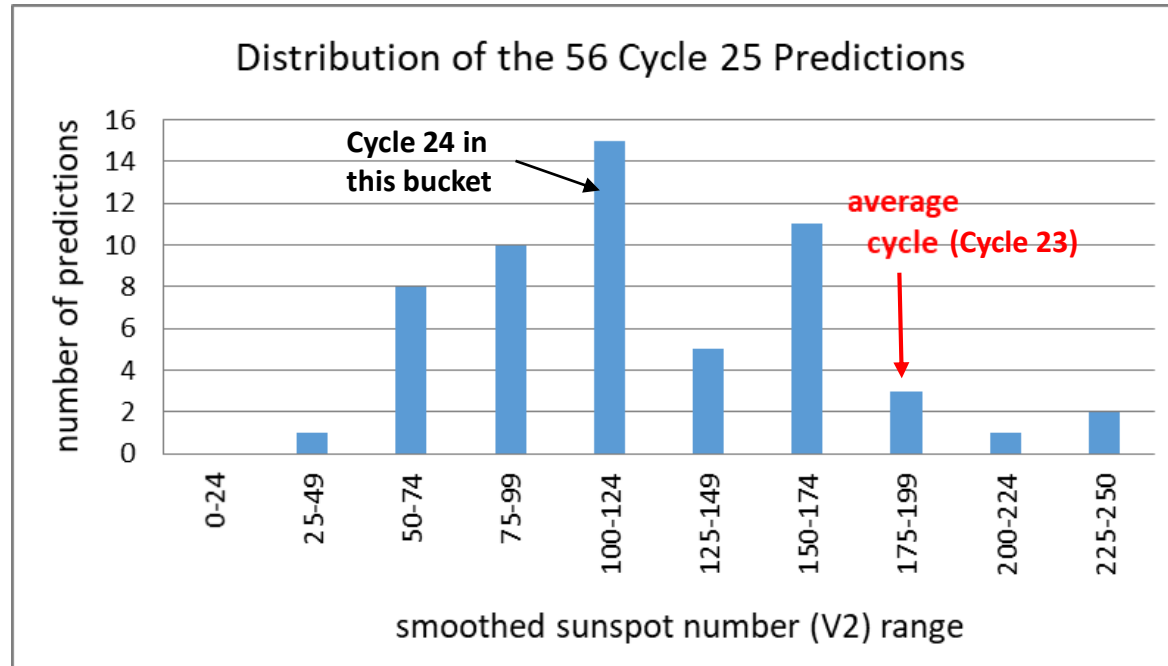
# Cycle 25 Predictions

- I'm aware of 56 predictions for Cycle 25
- Why so many?
- Because we don't fully understand the sunspot cycle process
  - We know it has to do with how magnetic fields move inside the Sun and how plasma flows inside the Sun – but the nitty-gritty details are not yet fully clear
- Thus many methods are used to make a prediction
  - Precursor, spectral analysis, others



here's one of many methods

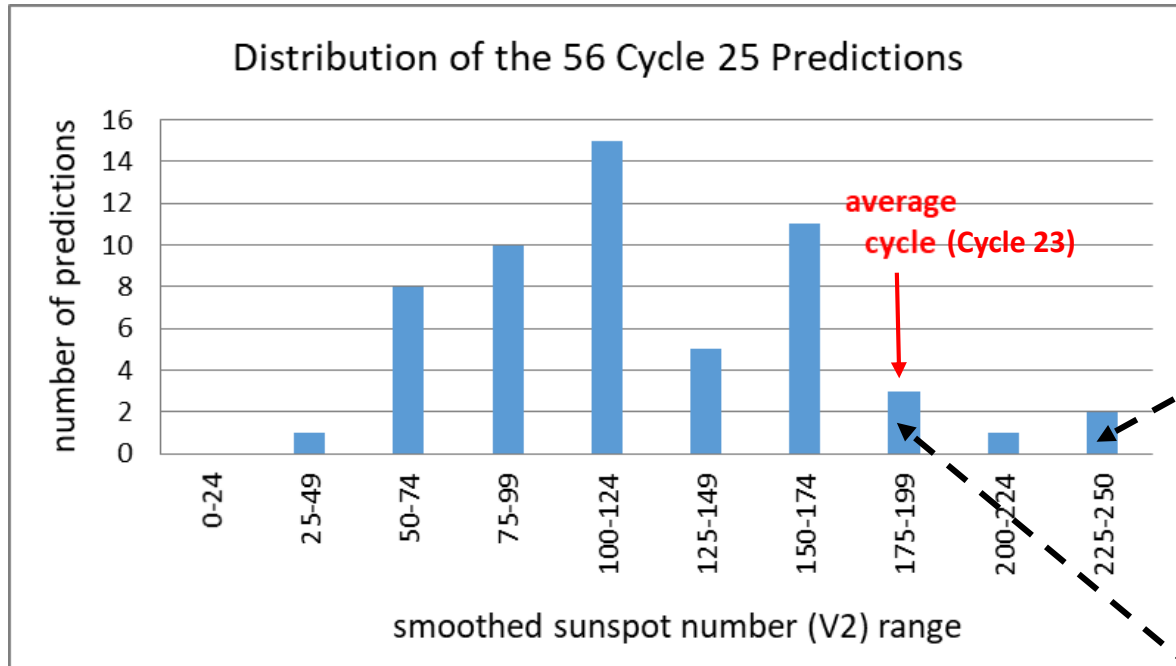
# Distribution of the 56 Predictions



average cycle is 179

- 50 of the 56 predictions (89%) are for a below average cycle
- 3 are for an average cycle
- 3 are for a larger-than-average cycle

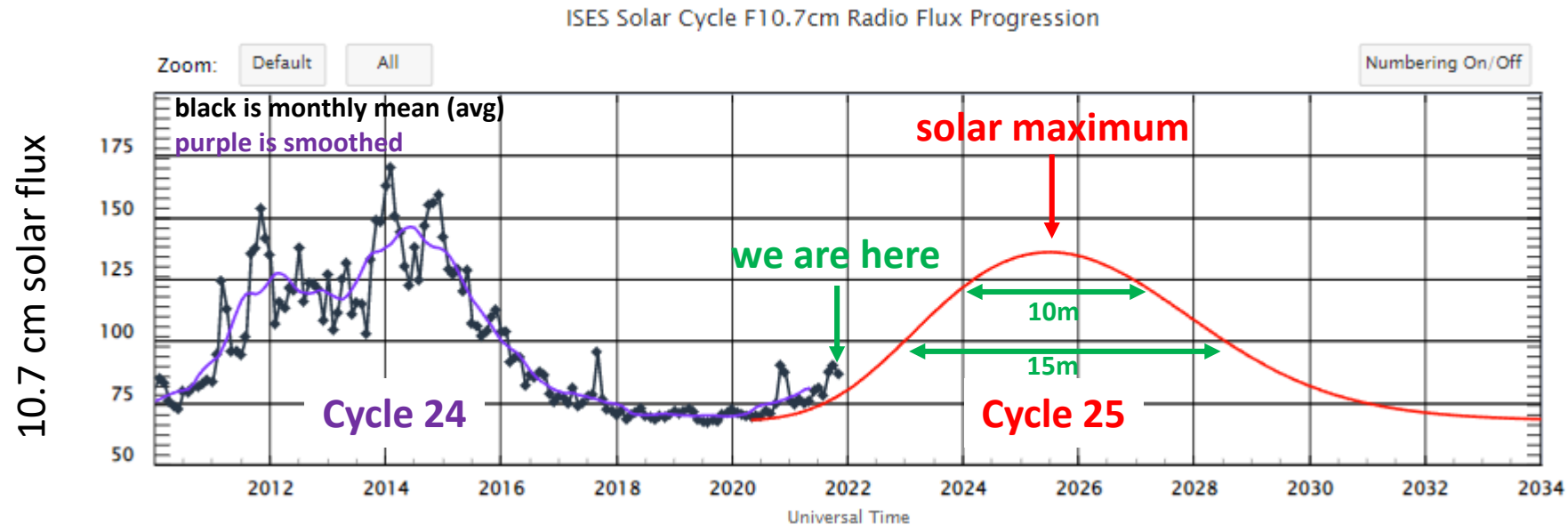
# McIntosh Prediction for a Big Cycle 25



- Initial McIntosh prediction was in June 2020 at 229 +/- 25
- Similar to Cycles 21 and 22
  - Excellent worldwide 10m and 6m F2 propagation for several years

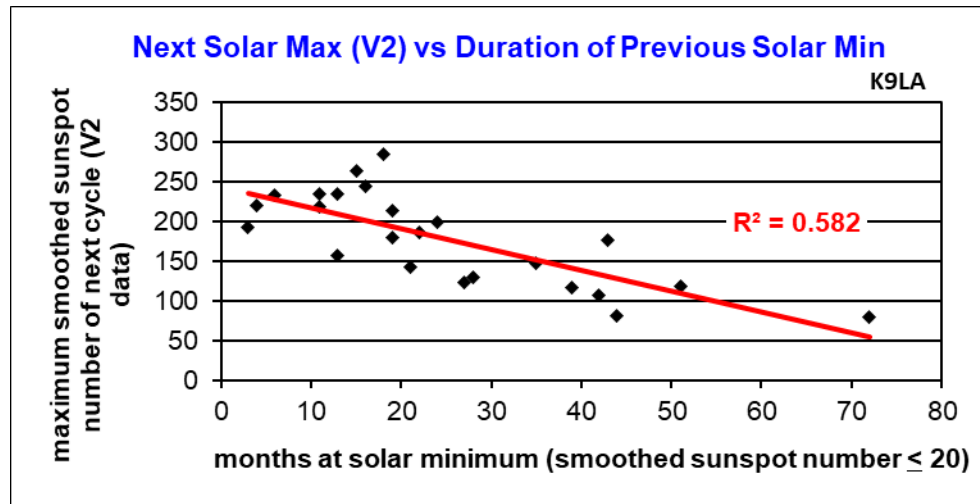
- McIntosh prediction revised in August 2021
  - 195 +/- 17
  - This indicates an average cycle – similar to Cycle 23 – - - - ->
- Will there be another revision if Cycle 25 continues tracking Cycle 24?

# NOAA/NASA Cycle 25 Prediction

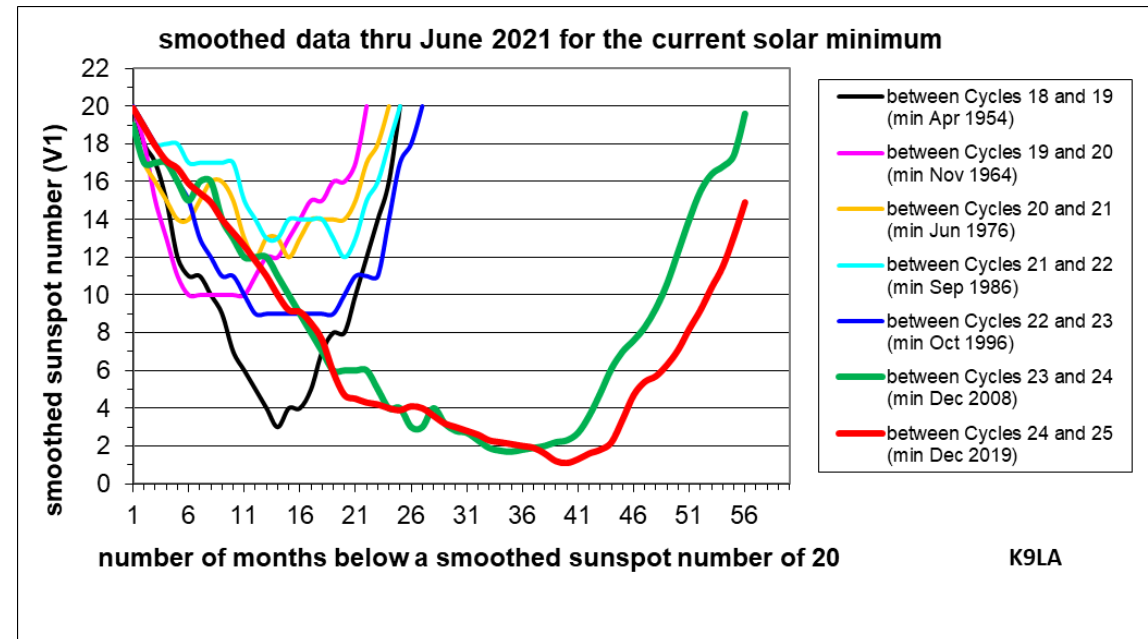


- This is one of the 50 predictions for a Cycle 25 similar to or smaller than Cycle 24
- The green arrowed lines indicate when 15 meters and 10 meters should be open on a daily basis

# Prediction from a Precursor Method

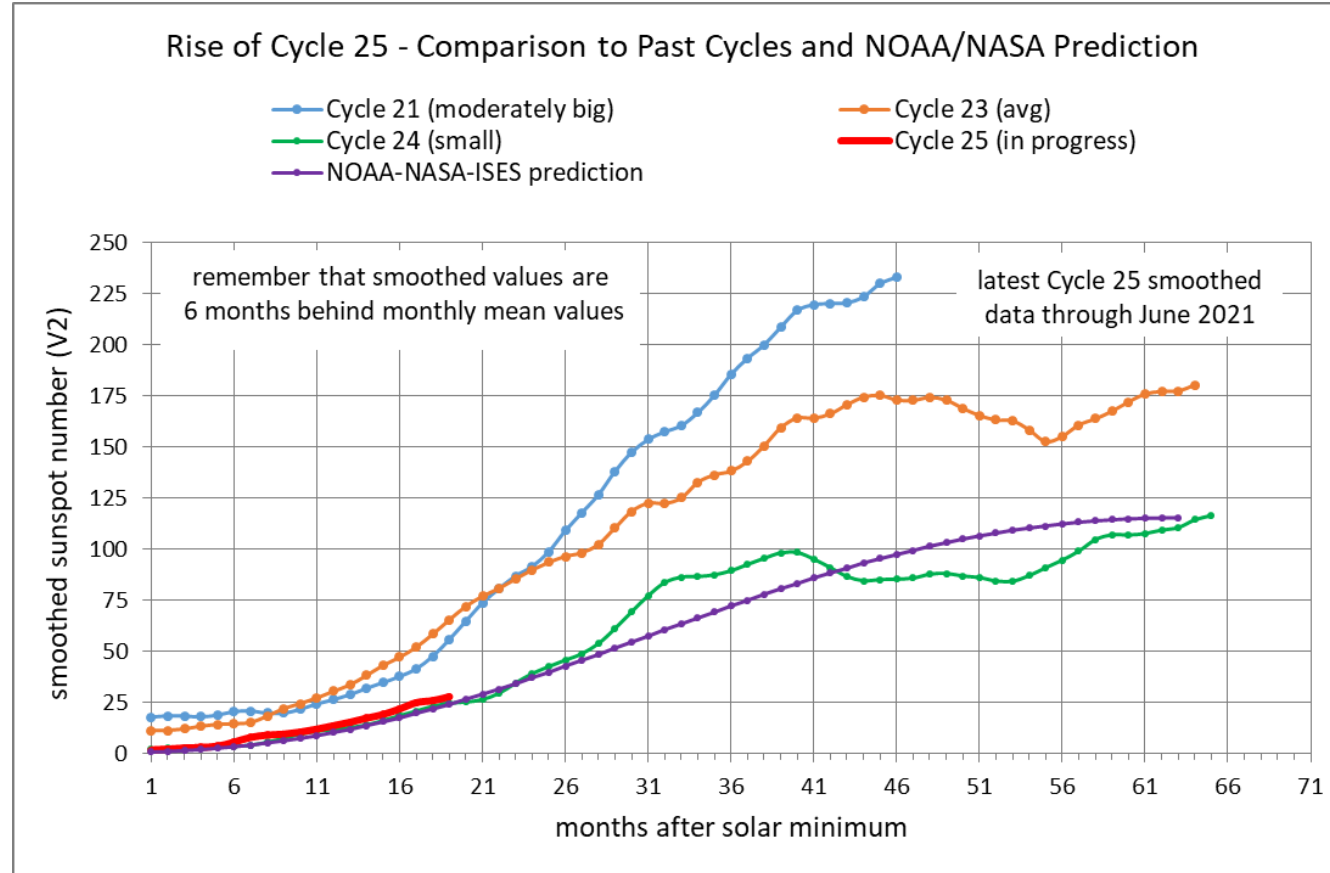


- Historical data suggests that the longer we're at solar minimum, the smaller the next cycle will be
- It's not a perfect correlation



- Solar minimum between Cycles 24 and 25 will be slightly longer than solar minimum between Cycles 23 and 24
- Suggests a small Cycle 25

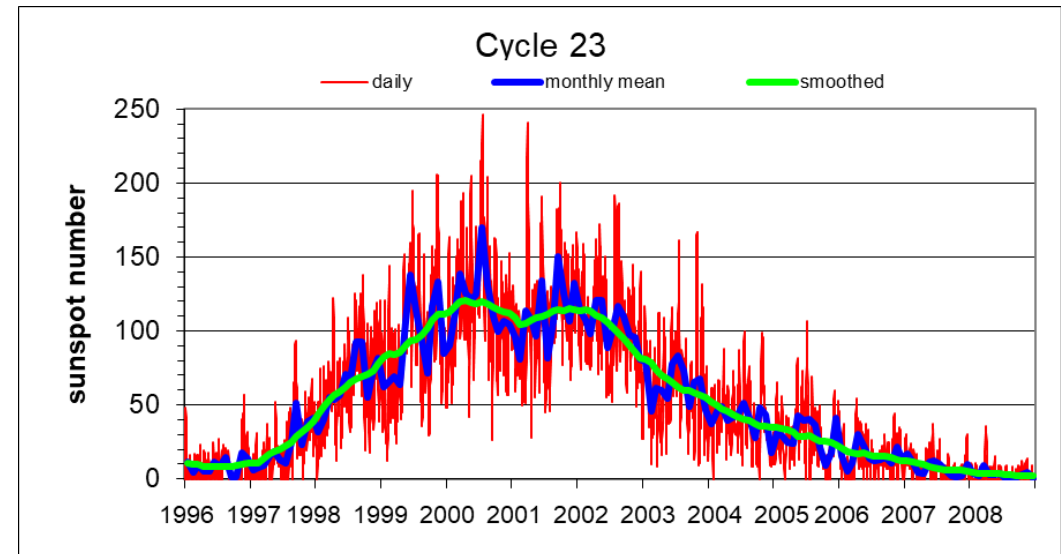
# How Is Cycle 25 doing?



- Cycle 25 appears to be tracking the small Cycle 24
- There's always hope that something interesting will happen, but . . .

# What Is a Smoothed Value?

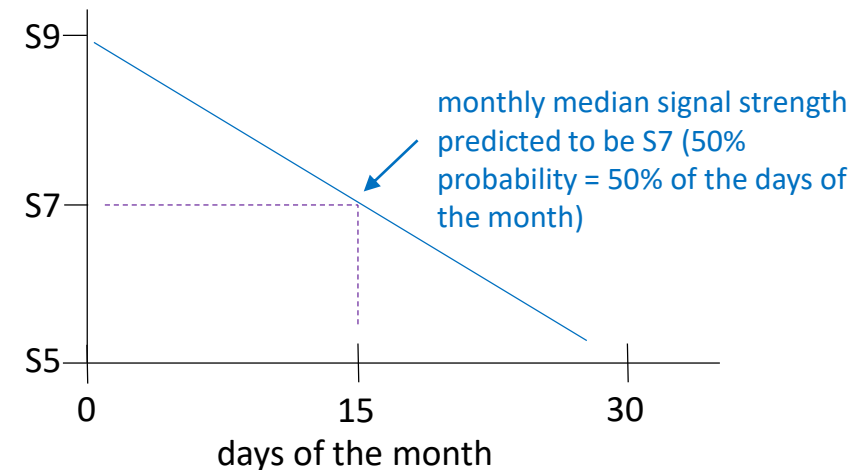
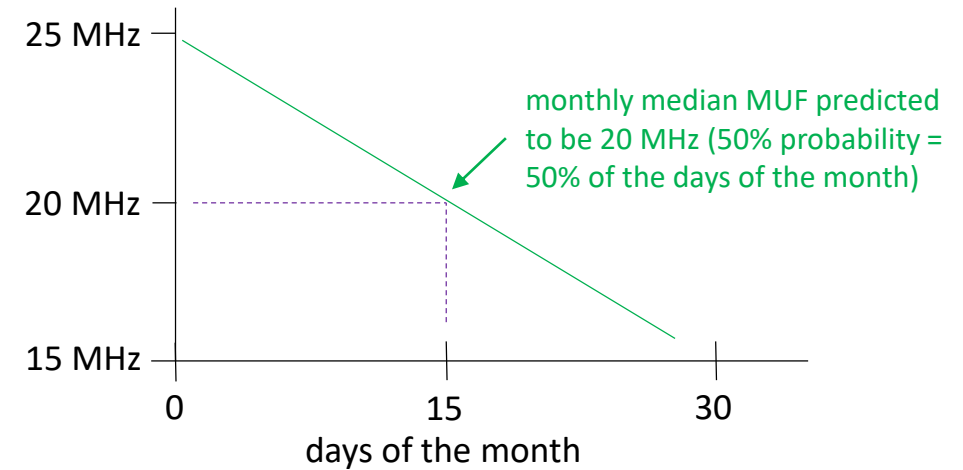
- Smoothed sunspot number has been mentioned on several slides
- Count the number of sunspots each day – **daily sunspot number (very spiky)**
- Calculate average over a month – **monthly mean (less spiky)**
- Calculate running average of monthly means over 12 months – **smoothed sunspot number (spikes averaged out)**



- One reason to use smoothed values – gives a better picture of a solar cycle
- Second reason is because our propagation predictions are a correlation between a smoothed value and monthly median (50% probability) ionospheric parameters
  - We do not have daily predictions – they are statistical over a month's time frame

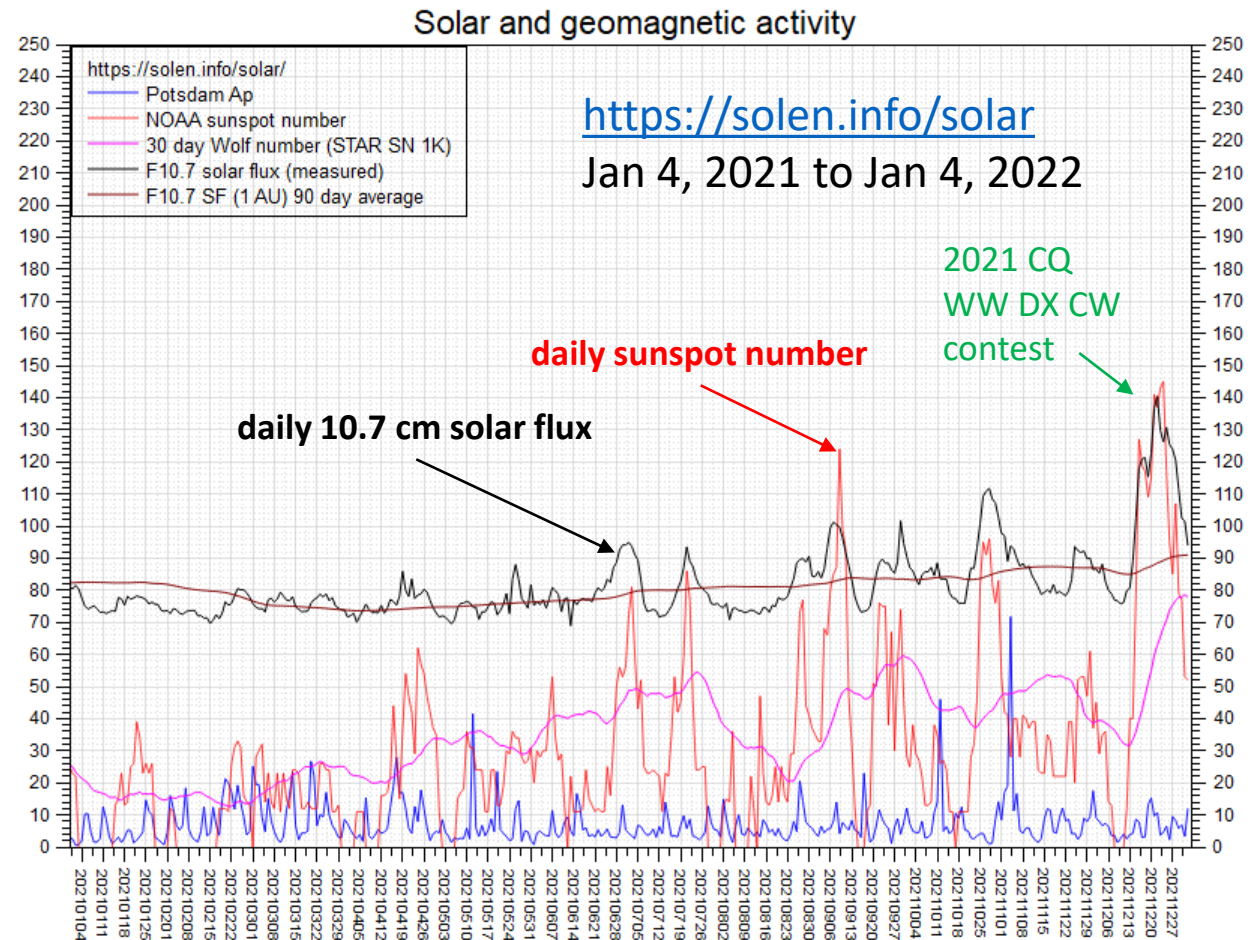
# Propagation Predictions

- The last slide said “*Second reason is because our propagation predictions are a correlation between a smoothed value and monthly median (50% probability) ionospheric parameters*”
- When we input a smoothed sunspot number (either directly or converted from a smoothed 10.7 cm solar flux), the outputs are a MUF (maximum useable frequency) and a signal strength (or signal power)
- MUF and signal strength are monthly median values – they have a distribution about them



# Short-Term Propagation Opportunities

- Slide 7 indicated that 15 meters might not be open on a daily basis until late 2022/early 2023
  - Daily openings on 10 meters even farther out
- Thank goodness that the sunspot number and the 10.7 cm solar flux are spiky
- These spikes can give us short-term openings
- Keep an eye on the sunspot number and 10.7 cm solar flux

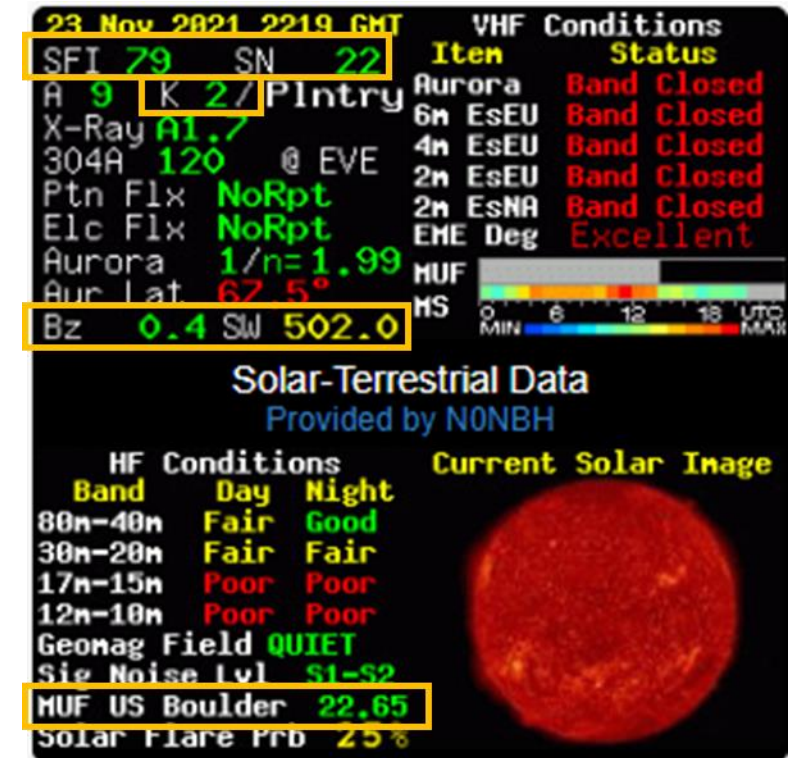


# Space Weather – Which Parameters?

- Focus on these parameters
  - SFI – daily 10.7 cm solar flux
  - SN – daily sunspot number
  - MUF US Boulder – Boulder MUF assuming it's the midpoint of a 3000 km path
- K index – how disturbed the Earth's magnetic field is
- Bz – if the Interplanetary Magnetic Field is coupling to the Earth's magnetic field
- SW – solar wind speed

these 3 are correlated – they can tell us how much F2 region ionization there is

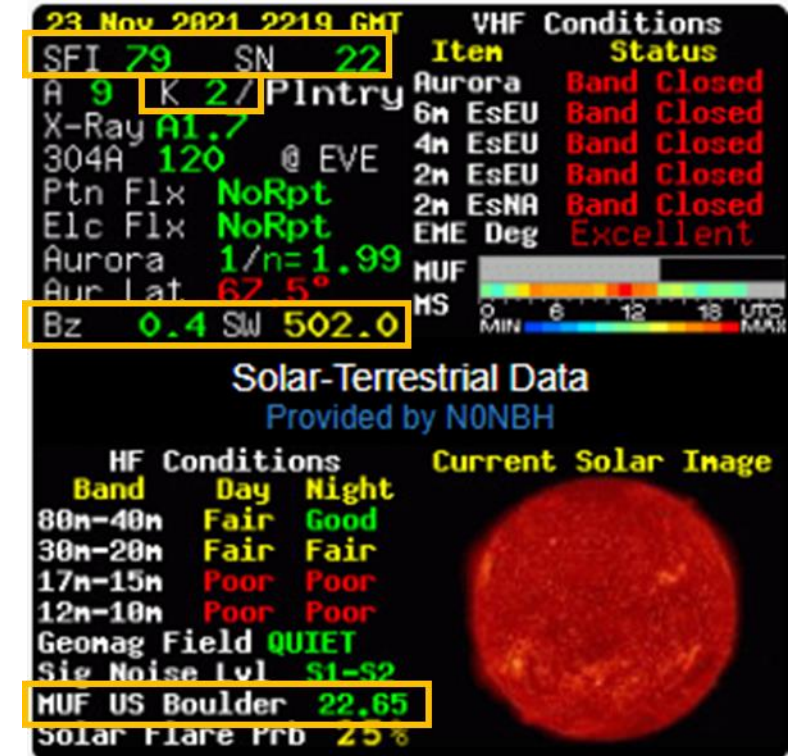
these 3 are correlated – they can tell us if the F2 region is disturbed



NØNBH banner at [www.qrz.com](http://www.qrz.com)

# Space Weather – What We Desire

- SFI
  - > 90 for 15m
  - > 120 for 10m
- SN
  - > 35 for 15m
  - > 70 for 10m
- MUF US Boulder
  - As necessary for the band of interest
- $K \leq 3$
- Bz positive
  - slightly negative (-5 to -10) is okay
- SW not too much greater than 400 km/sec

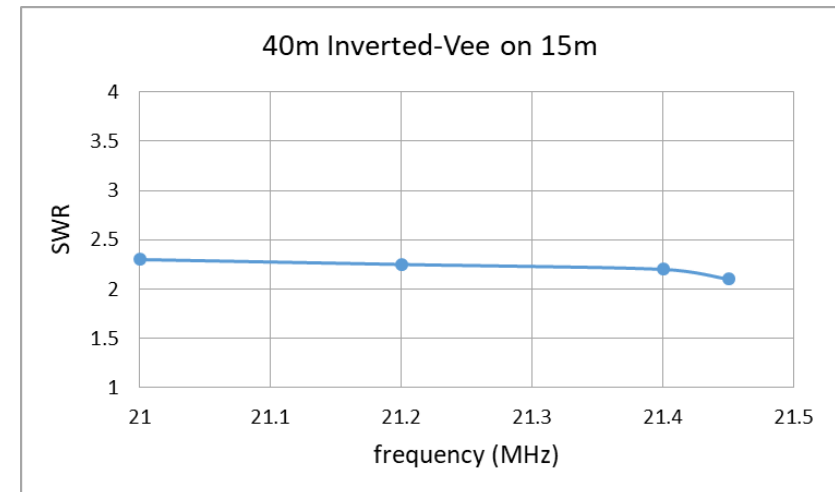
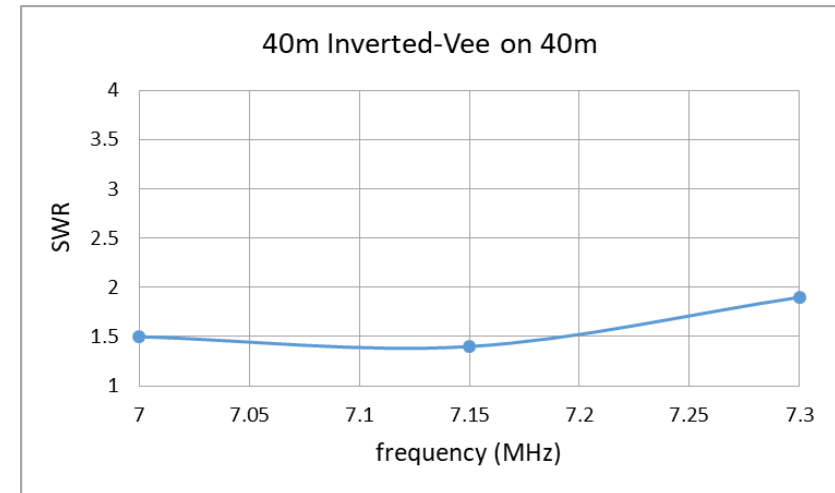


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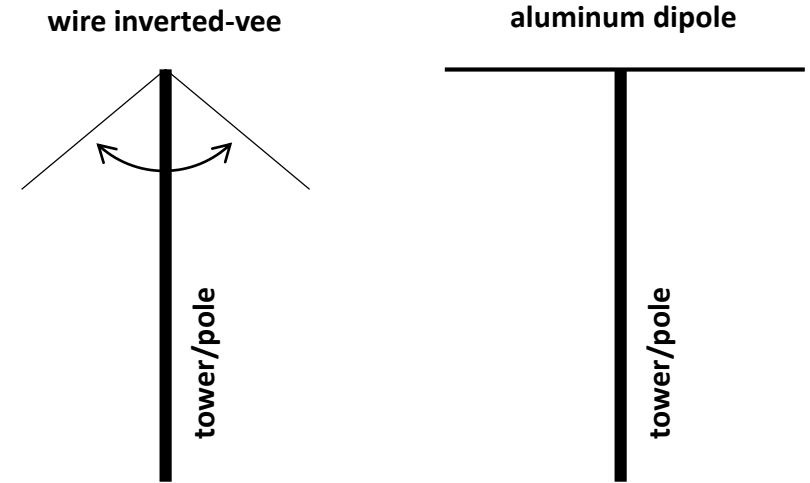
# Getting on 15 Meters

- Use your 40 meter dipole/inverted-vee
  - 3/2-wavelength antenna on 15 meters
  - Some gain in preferential directions
- Resonance will be above band on 15 meters – VSWR in the neighborhood of 2.5:1
  - Use rig's internal tuner
  - Or use external tuner
  - Or don't worry about it if you're using a vintage tube rig



# Getting on 12 Meters and 10 Meters

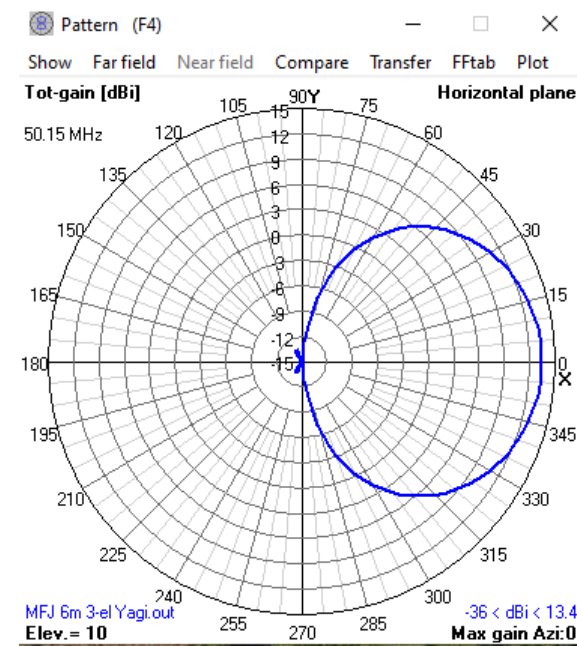
- Inverted-vee or dipole
- 12 meters
  - Each side about 9.25 feet
- 10 meters
  - Each side about 8.25 feet
- Put it up around 20 feet
- Yagi antennas are getting small on these two bands
  - 2-element – about 5 dB gain over dipole
  - 3-element – about 7 dB gain over dipole



# Getting on 6 Meters

- 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 (theoretically!)
- What do you do when  $E_s$  is open in more than one direction?
  - Just about any antenna will work that has a reasonable SWR on 6m
  - I've even used my 40m inverted-vee

MFJ-1762



# Summary

- Cycle 25 is ascending
  - Predictions are interesting, but actual data trumps predictions
  - Data so far suggests another small cycle
- Solar maximum around mid 2025
  - If the rate of ascent increases, solar max will be a bit earlier
- Use space weather data or dxmaps.com to get an idea of what propagation is right now
  - Watch for spikes in sunspot number and 10.7 cm solar flux
    - These are proxies for extreme ultra-violet radiation (F2 region)
- Antennas for 15m, 12m, 10m, 6m are small
- Even if Cycle 25 is small, we should have a couple years of great worldwide propagation with modest power and modest antennas

**Get radio-active on HF!**