Cycle 25
Real-Time Assessment of Propagation
HF Air Mobile

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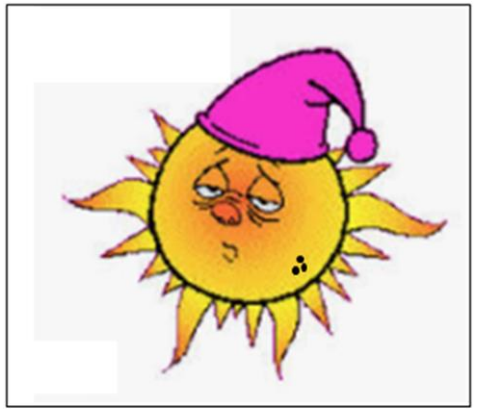
A Little About K9LA

- Novice in October 1961 – WN9AVT
  - General (WA9AVT) in May 1962, Extra (K9LA) in 1977
- BSEE 1969, MSEE 1972 from Purdue University
- RF design engineer (mostly solid-state RF power amplifiers)
  - Motorola – Schaumburg, IL and Ft. Worth TX (1974 to 1988)
  - Magnavox/Hughes Defense/Raytheon – Ft. Wayne, IN (1988 to 2013)
- NCJ Editor 2002-2007
- Currently the Director of the ARRL Central Division
- Wife is Vicky AE9YL

Agenda

- Cycle 25
  - Historical data
  - Predictions
  - Latest data
- Propagation
  - NØNBH banner
  - What's going on right now?
  - Disturbances
- HF Air Mobile
  - First Airplane
  - Cessna 170B
  - 10 Meter contests

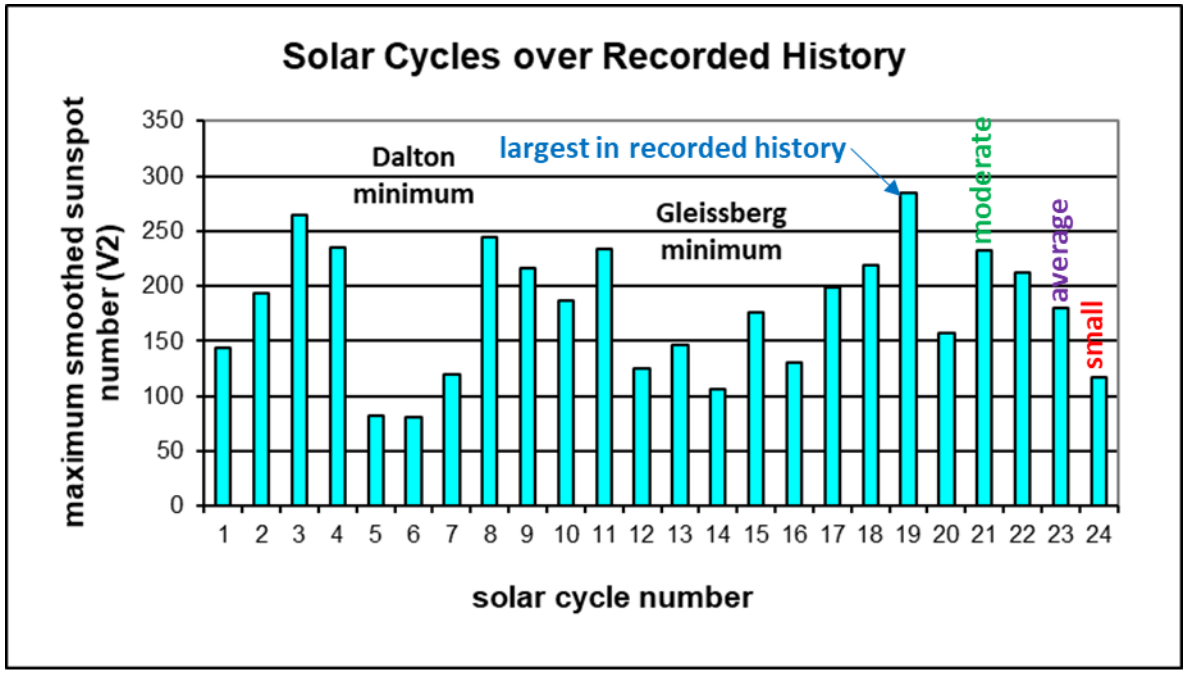


Cycle 25 is awake !!

Cycle 25

Historical Look at All 24 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



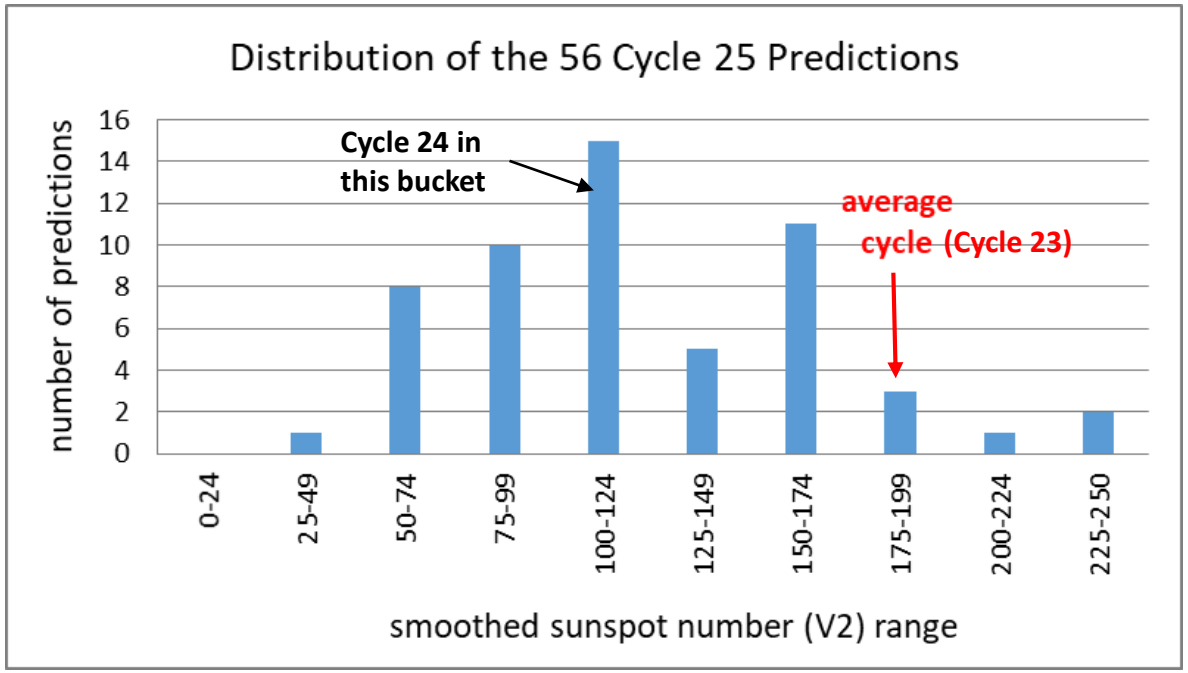
Will Cycle 25 get us out of this third period of small solar cycles?

Cycle 25 Predictions

- I'm aware of 56 predictions for Cycle 25
  - There were over 50 for Cycle 24
- 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 the many methods ☺

Distribution of the Predictions

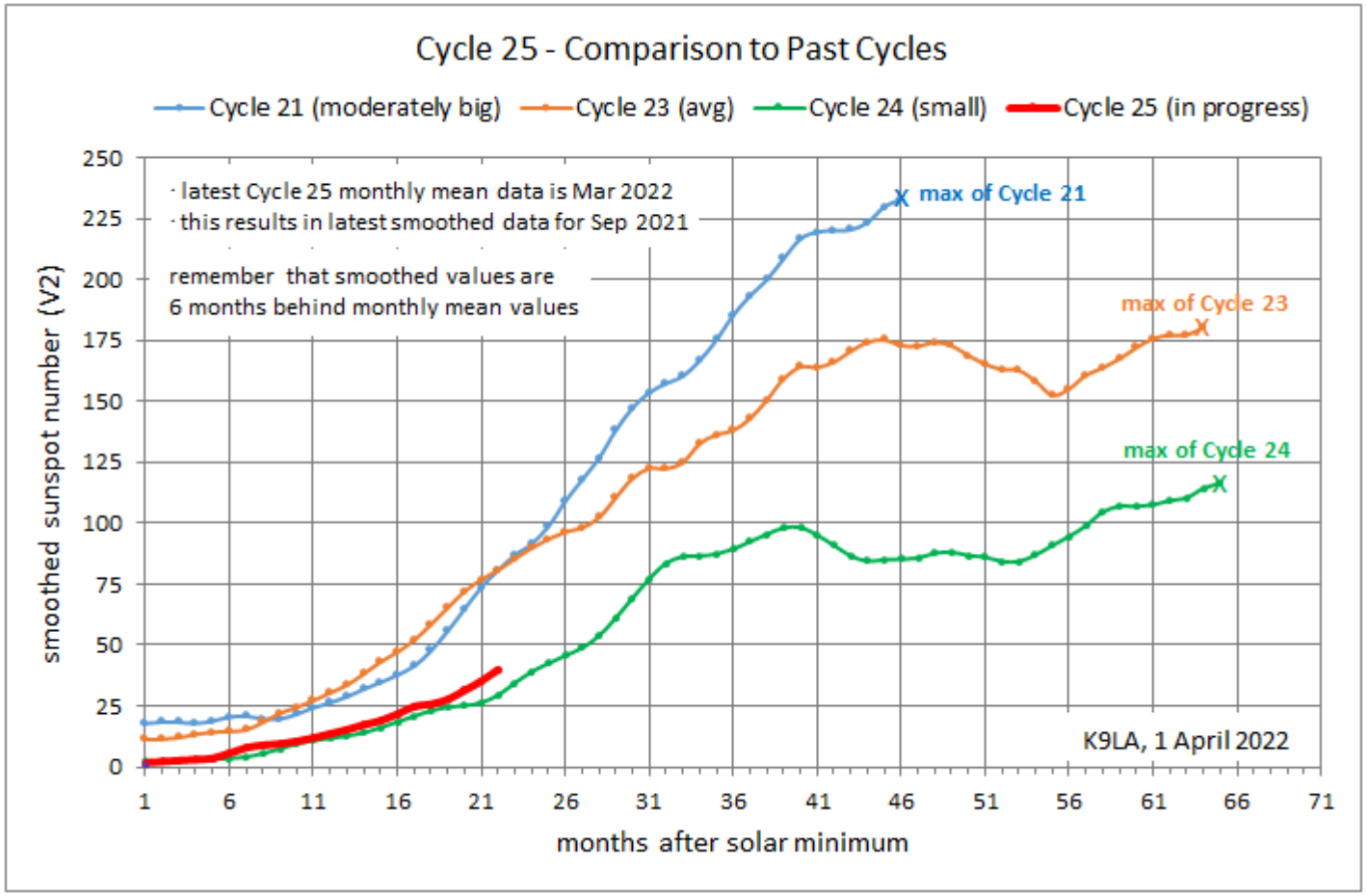


average cycle is 179

- 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

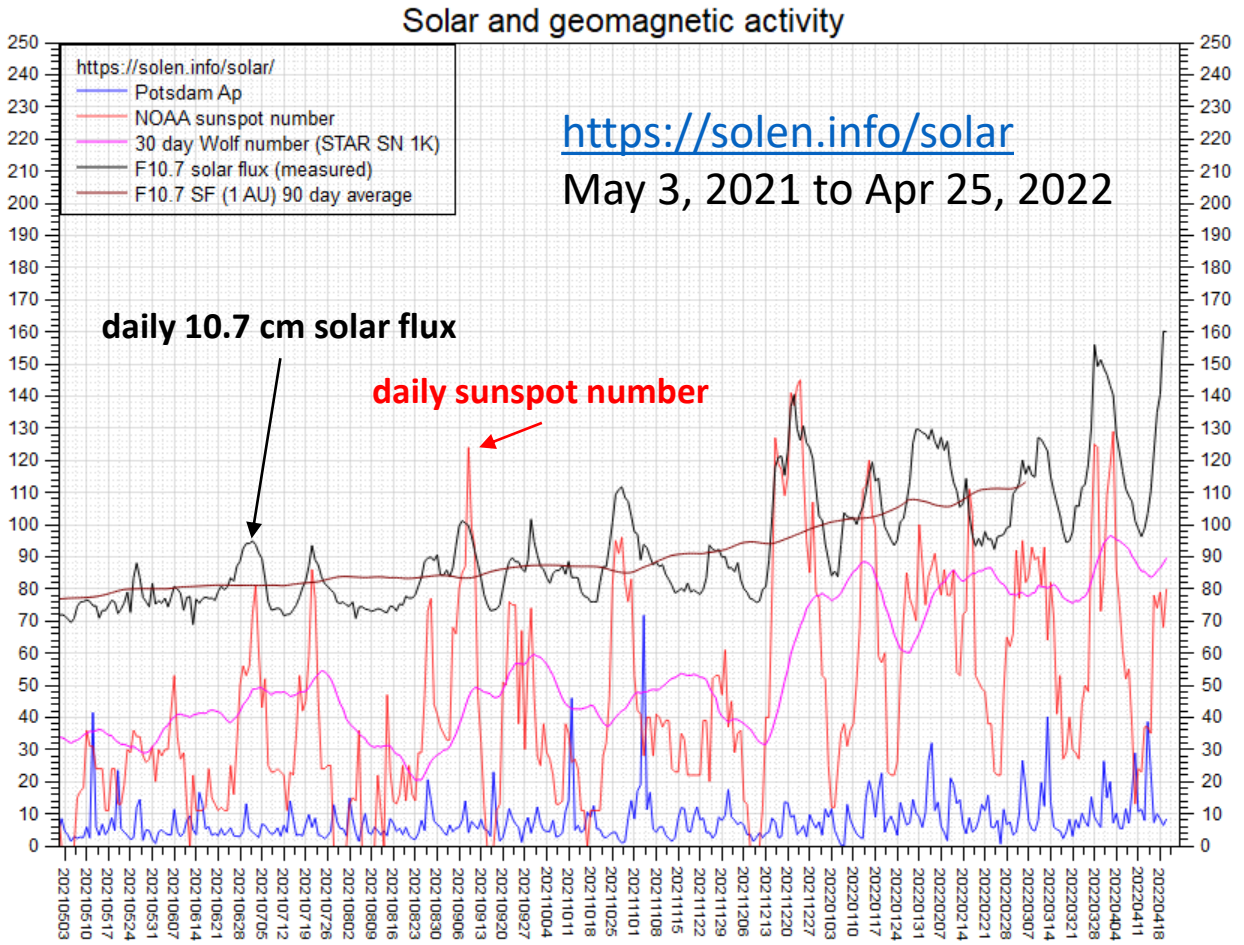
How Is Cycle 25 Doing?

- Solar minimum was in December 2019
- We currently have 22 months of smoothed sunspot number data
- So far we appear to be tracking the small Cycle 24
- Need more sunspots for 15m, 12m and 10m propagation



Short-Term Propagation Opportunities

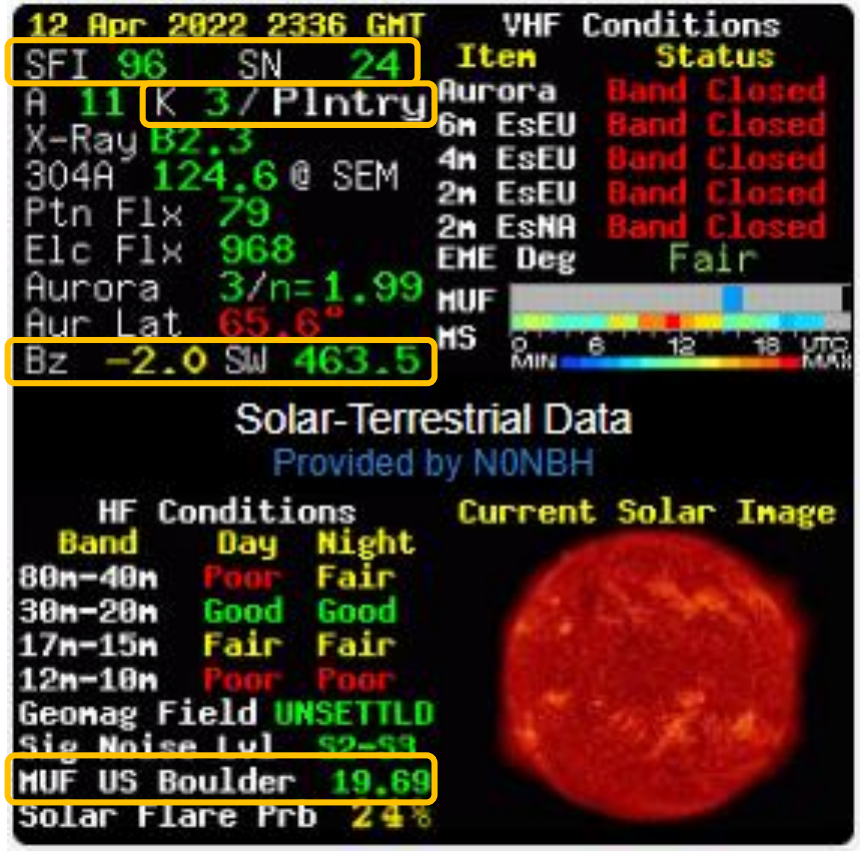
- We still have a way to go before 15m, 12m and 10m will be open <u>worldwide</u> on a <u>daily</u> basis
- Keep an eye on the daily sunspot number and 10.7 cm solar flux
  - Spikes can gives us short-term openings



Real-Time Assessment of Propagation

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

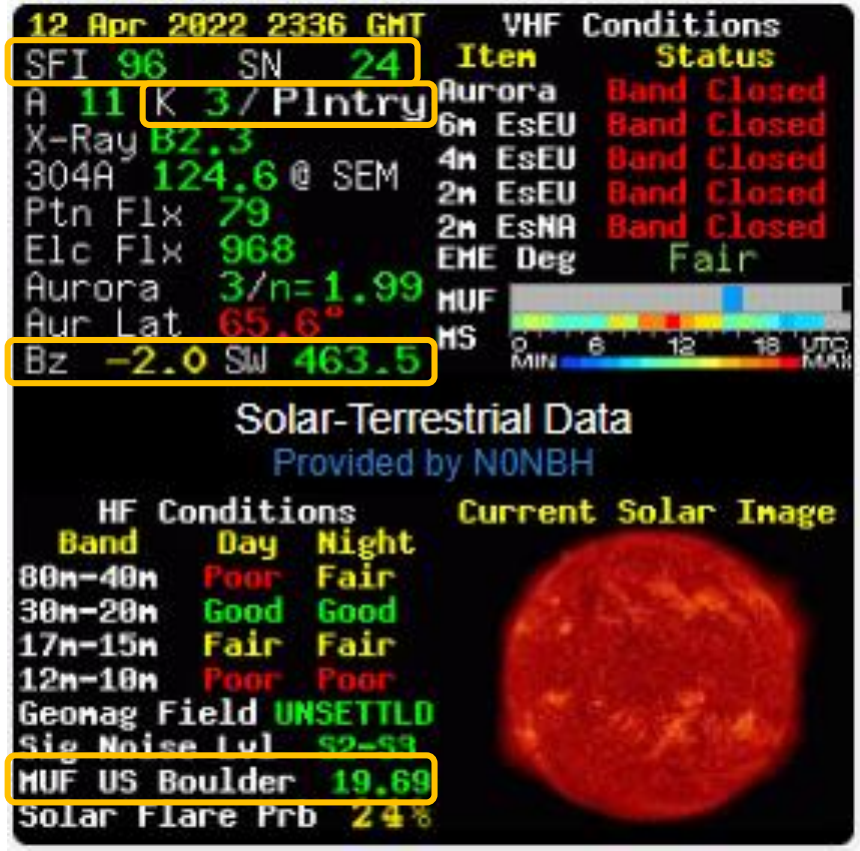


NØNBH banner at www.qrz.com

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 (0 to -10) is okay
- SW not too much greater than 400 km/sec



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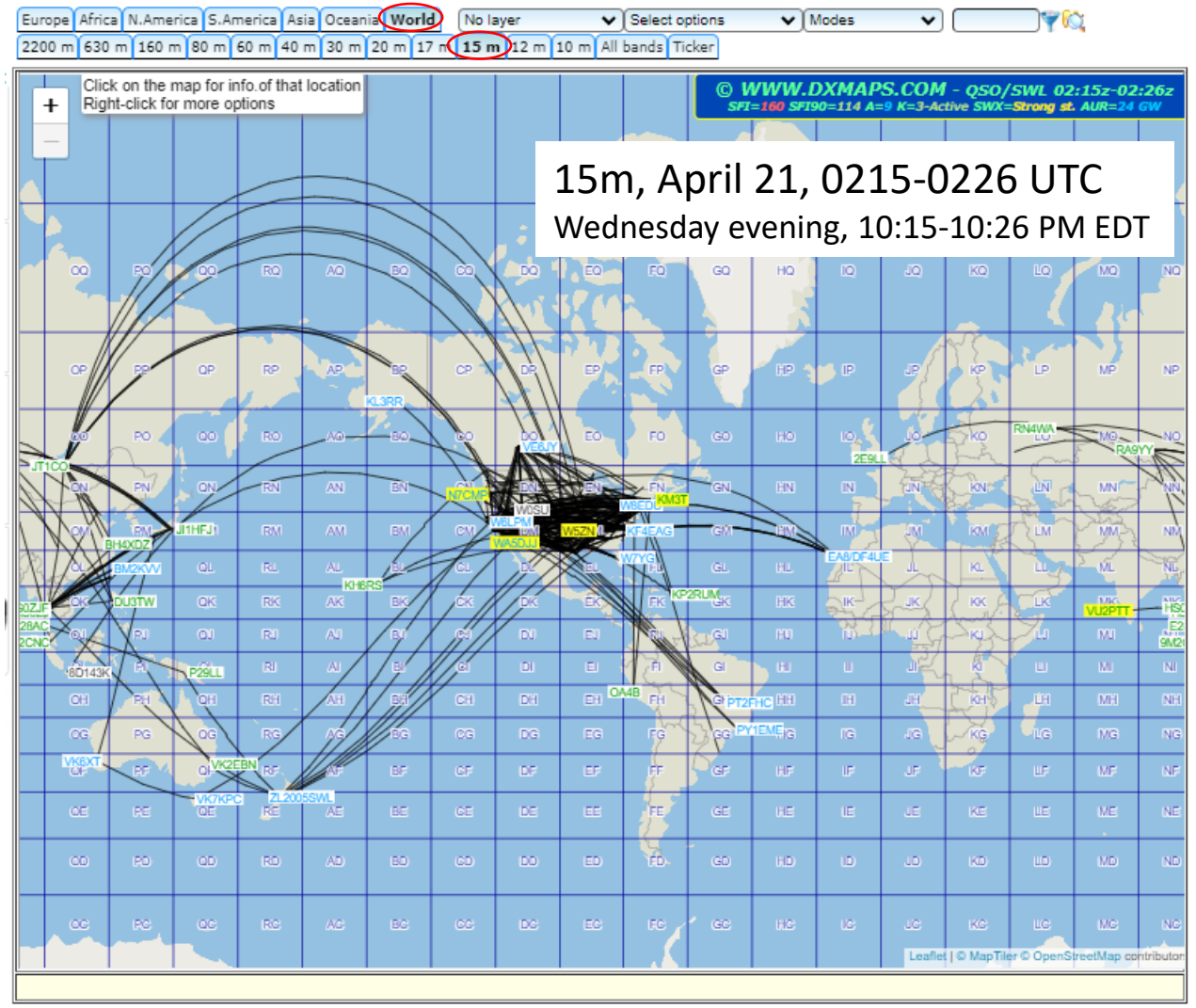
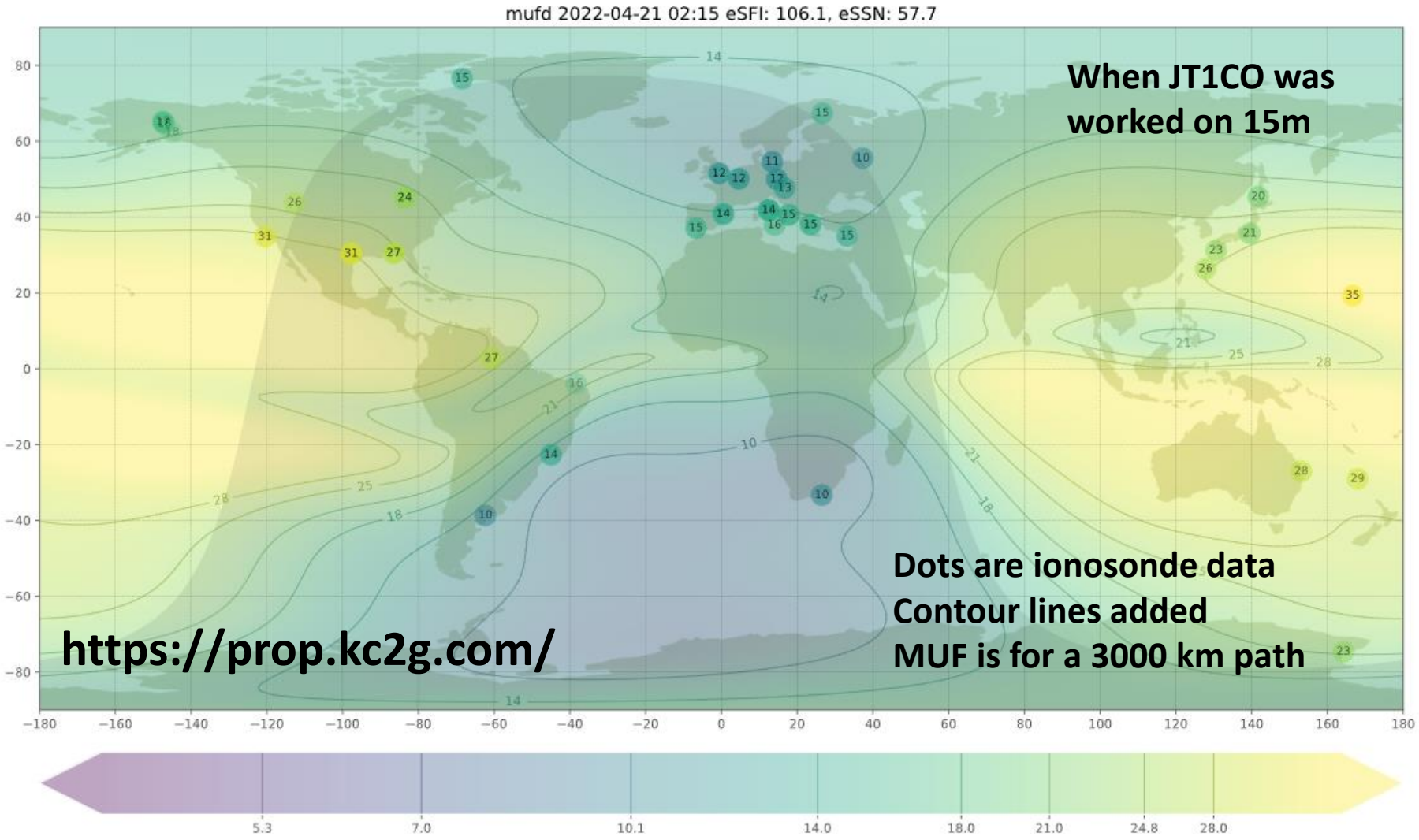
What Are the Bands Doing Right Now?

- If you don't want to mess with propagation predictions or with all those space weather parameters, go to dxmaps.com
- Select a view (world, NA, . . .)
- Select a band
- Other methods
  - KC2G MUF map (next slide)
  - PSKreporter
  - WSPRnet
  - Reverse Beacon Network
  - IARU/NCDXF beacons



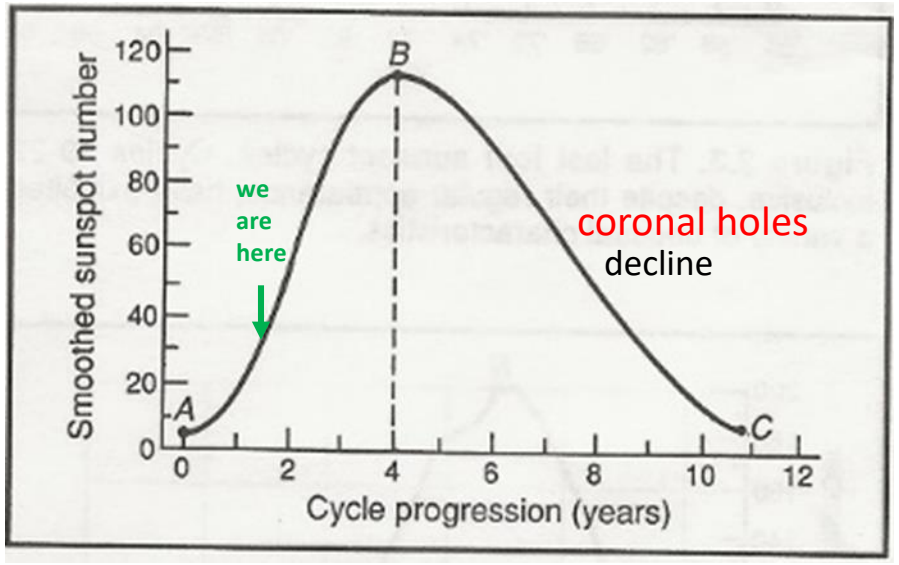
What's the MUF Doing Right Now?



When Do Disturbances Occur?

CMEs and big solar flares

solar max



solar min

solar min

A index maximizes at solar max, and maximizes even higher during the decline

- CMEs most prevalent around solar max
  - Geomagnetic storms
- Big solar flares most prevalent around solar max
  - Solar radiation storms and radio blackouts
- Coronal holes most prevalent during the decline of a solar cycle
- Quietest time is during the ascent of a solar cycle

HF Air Mobile

First Airplane

- When I worked at Motorola in Schaumburg (IL – 1974-1979), my first airplane was an Aeronca Chief
- 2-seat, side-by-side, 65 hp engine, no electrical system
- Did lots of 2m work
- Took the azimuth pattern of a local 2m repeater

Note the wind-driven generator between the main landing gear

Moved Up to a Cessna 170B

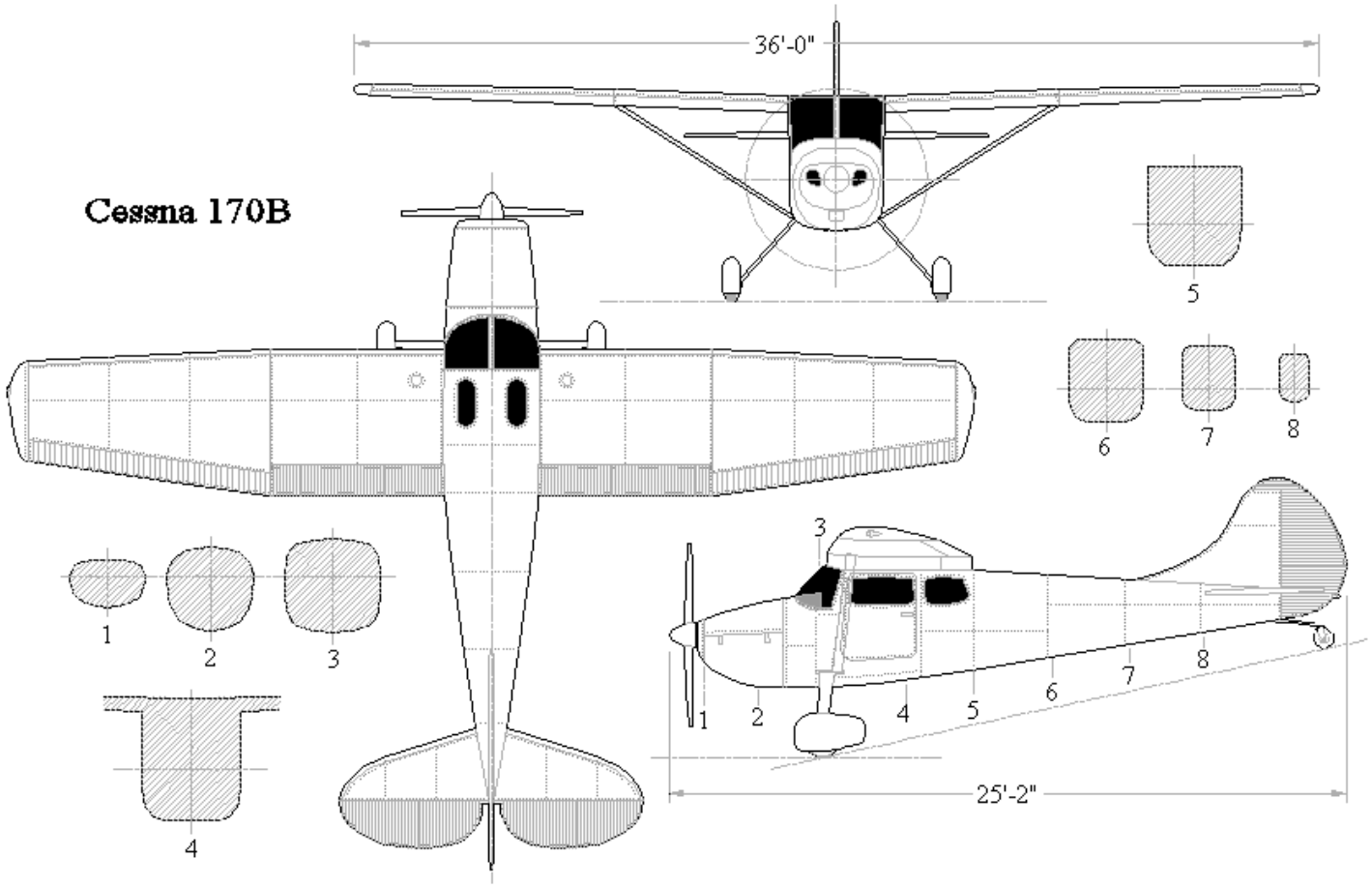
- I was a CFI-AI (Airplane & Instrument)
- I wanted an airplane capable of operating in instrument meteorological conditions
- Found 1634D
- Image is after much work and a lot of $$$
- 4-seat, 145 hp engine, electrical system
- Did lots of 2m work initially

Considerations for HF Air Mobile

- What rig to use?
  - I had a TS-120 at the time
- What antenna?
  - First thought was to use the ADF sense antenna
  - Decided on a short whip capable of 20m, 15m or 10m
    - Mounted on top of the fuselage midway between the trailing edge of the wing and the tail
- How was ignition noise?
  - It was really bad – about S9 – couldn't hear any signals
    - Due to non-shielded ignition harness
  - $$$ resolved that problem
    - Bought and installed a shielded ignition harness

Model of the Airplane

- I was going to make a wire model in 4nec2
- Steve K6OIK advised that there are CAD models that can be imported into FEKO, HOBBIES and WIPL-D
- Haven’t done this yet

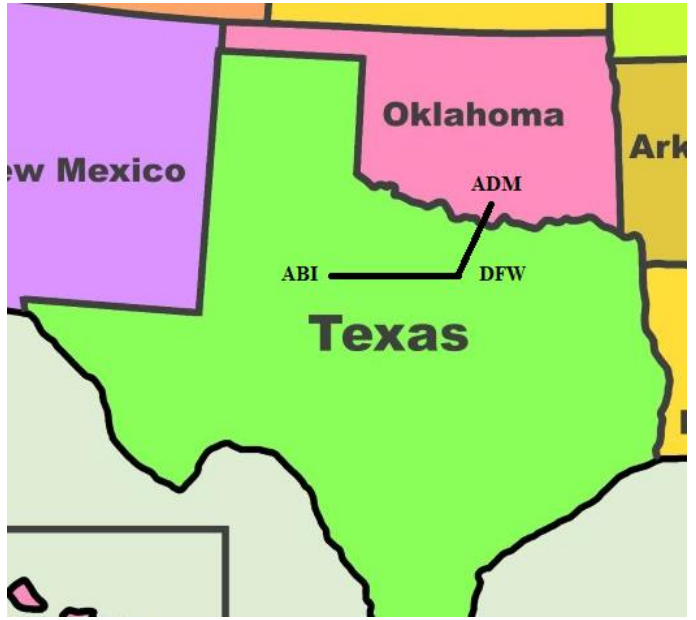


The 10m Antenna

- 13 inch bottom portion
- 2.5 inch long loading coil on a plastic form
- 12 inch tip portion
- Calculated the capacitance of the tip portion
- Wound a coil to resonate with the tip capacitance
- Also made tips for 15m and 20m
- Enough losses to make the feed point impedance about 50 ohms ☺☺☺

10 Meter Contest - 1979

- December 1979 was near the peak of Cycle 21
- Mangham Airport (Ft Worth, TX) to Ardmore, OK
- Charlie WA8MYV/5 came along to operate
- Used K9LA/5
- Made a total of 60 Qs all over the country
  - Best DX was VE1BNN in Nova Scotia
  - Notable calls: W2NSD/1, N6TR, W3LPL



- Plan to show antenna pattern and QSO map at this year's Sea-Pac
- Also did the 10 Meter contest in 1980 from Mangham Airport to Abilene, TX with Mike K9MK/5

What We Learned

- 100W to a short whip at a couple thousand feet still couldn't beat a kW and a Yagi
- The ergonomics of a contest station in a Cessna 170B are **POOR**
  - Charlie and Mike had to hold the TS-120 tightly between their legs
    - Would have been nice to have my ICOM IC-706MKII
  - One hand did the log
  - The other hand held the microphone
  - Had to turn the frequency knob, too – and maybe the volume knob
- Casual operation by myself on 20m and 15m was easy on long flights – as long as I didn't have to change bands
  - Descend for a landing, change the tip on the antenna, go back up

Summary

- Cycle 25 is awake and is in its ascent
- Solar maximum likely around 2025 or so
- So far it kind of looks like another small cycle
  - We'll either confirm or refute that around 2025
- Even if it is a small cycle, around solar maximum should offer worldwide propagation with modest power and modest antennas
- The digital modes offer an advantage over CW and SSB
  - Can decode a signal farther down in the noise
  - This is a big deal on 10m and 6m
- There are tools on the internet to determine what the bands are doing right now

References

- Space weather
  - Dr. Tony Phillips – https://spaceweather.com/
  - NOAA – https://www.swpc.noaa.gov/
  - VE3EN – https://www.solarham.net/
  - WX6SWW - https://www.spaceweatherwoman.com/
- Models
  - D region absorption - https://www.swpc.noaa.gov/products/d-region-absorption-predictions-d-rap
  - Geomagnetic field activity and the F2 region - https://www.swpc.noaa.gov/products/storm-time-empirical-ionospheric-correction
  - GAIM (Global Assimilation of Ionospheric Measurements) - https://www.usu.edu/physics/cass/space-weather-center/