What to Expect During the Rising Years of Solar Cycle 25

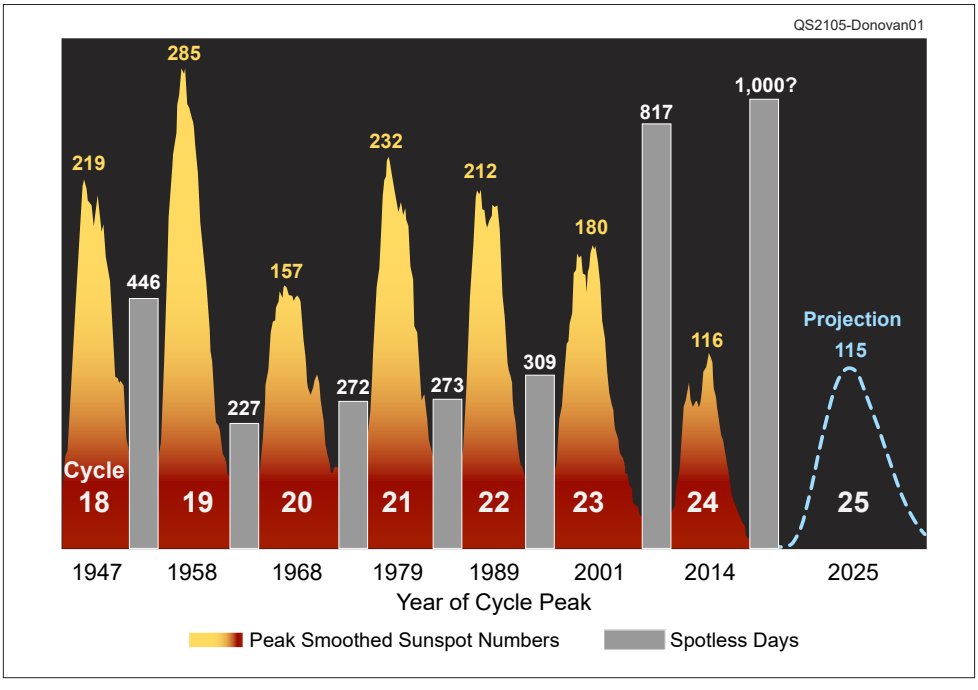
Some predictions for how the next 4 years of the solar cycle will affect HF propagation.

Frank Donovan, W3LPL

Solar Cycle 25 is affecting HF propagation in unexpected ways since we reached the solar minimum of Cycle 24 in December 2019. The next 4 years, which include Cycle 25's rise to solar maximum, will provide many opportunities to enjoy greatly improved HF DX propagation, especially with effective antennas for 30 through 10 meters, which benefit most from increasing sunspot activity.

My own experience on HF began 1 year after Cycle 19's solar maximum in 1958. However, I wasn't able to participate in the best HF propagation in history because I couldn't make contacts beyond a few hundred miles on 80 meters with my 35-foot wire antenna. Listening to the locals snagging DX all over the world on 10 meters convinced me that I, too, could enjoy DXing if I had better antennas. Several local hams helped me erect some simple horizontal dipoles and soon I was making contacts around the globe, earning DXCC in just 1 year.

After experiencing several solar cycles, I began to understand that each one has its own personality, and they always defy prediction. Higher smoothed



Solar cycles since 1945. This chart illustrates downward trends in sunspot activity, upward trends in spotless days, double peaks at solar maximum, and the National Oceanic and Atmospheric Administration's (NOAA) Solar Cycle 25 forecast as a blue dashed line. [Graphic courtesy of the Sunspot Index and Long-term Solar Observations, Royal Observatory of Belgium]

Table 1

Solar Cycle	SSN at 12 Months	SSN at 24 Months	SSN at 36 Months	Months to Solar Max.	Solar Cycle Duration in Years
18	40	112	204	39	10.2
19	33	168	256	47	10.5
20	28	96	134	49	11.4
21	29	99	193	45	10.5
22	45	161	210	38	9.9
23	34	93	143	63	12.3
24	13	42	92	64	11.0

Source: Sunspot Index and Long-term Solar Observations, Royal Observatory of Belgium

Table 2

Solar Max. Year	Solar Min. Year	Spotless Days Between Solar Cycles	Last Month with 10+ Spotless Days Post-Min.
1947	1954	446	8 months
1958	1964	227	9 months
1968	1976	272	8 months
1979	1986	273	5 months
1989	1996	309	11 months
2001	2008	817	18 months
2014	2019	1,000?	14 months so far

Source: Sunspot Index and Long-term Solar Observations, Royal Observatory of Belgium

sunspot numbers (SSNs) indicate improved HF propagation, and a large number of spotless days (with no sunspots at all) often indicate a precursor of a weak solar cycle to follow.

Forecasts and Trends

At least 70 forecasts for Cycle 25 have been published in scientific journals, predicting everything from a very weak to a very strong cycle. The respected National Oceanic and Atmospheric Administration (NOAA) forecast, as well as most other forecasts, anticipates Cycle 25 to be similar to Cycle 24. Referring to Tables 1 and 2, Cycle 24 had low SSNs during its rise to solar maximum compared to other cycles, as evidenced by its SSNs at 12, 24, and 36 months after solar minimum. Cycle 24 took 64 months to reach solar maximum — longer than any cycle since 1945. The sun recently produced more spotless days than usual during the thirteenth and fourteenth months after solar minimum. The Sunspot Index and Long-term Solar Observations (SILSO) World Data Center at the Royal Observatory of Belgium anticipates up to 1,024 spotless days before the transition to Cycle 25 completes, likely before the end of 2021.

A Brief Introduction to Cycle 25

Cycle 25 produced 180 spotless days and some occasional weak sunspots through October 2020. The weak sunspots had little effect on HF DX propagation, as evidenced by the 10.7-centimeter solar flux index (SFI), never exceeding 75 SFI until late October. SFI is the most widely used short-term indicator of increased sunspot activity that improves HF propagation.

Fortuitously, 17 sunspots suddenly appeared in a new solar region just as the November CQ World Wide CW DX Contest began, an exceptionally rare event for the opening year of any solar cycle. The SFI reached 110 during the first day of the contest — the highest in more than 3 years — and stayed above

100 through early December 2020. Enhanced sunspot activity greatly improved propagation throughout the contest, providing worldwide 15-meter propagation from sunrise until sunset, and opening 10 meters to most of the world for many hours during both contest days. Excellent 30- through 10-meter DX propagation occurred for many hours every day until the active region rotated to the back of the sun on December 6. The region again rotated onto the sun's visible disk in late December, enhancing 30- through 12-meter DX propagation for several hours a day through early January 2021. The region made a rare third appearance in late January, but with very low sunspot activity.

A Slow Start in 2021

The SFI hasn't exceeded 78 and has been mostly below 74 since January 6, much lower than the corresponding months of Cycle 24. Only a few weak sunspots having little effect on HF propagation have appeared from early January through at least March 7, 2021. No sunspots showed for 20 days in a row from January 28 to February 17, which was unusual during the corresponding months of any solar cycle.

Cycle 25 sunspots strong enough to improve HF propagation have so far appeared only in the sun's southern hemisphere, a condition known as hemispheric asymmetry, which has caused double peaks during every solar maximum since 1958. Based on similar weak solar cycles, Cycle 25 is likely to rise more rapidly later this year when the more active solar southern hemisphere influences increased sunspot activity in the northern hemisphere.

Improved Propagation This Fall

The bands 160 – 40 meters are likely to remain unchanged, while 30 meters should improve during nighttime hours, as should 20 meters during the hours after sunset. Seventeen meters is likely to greatly improve, while 15 meters is likely to have more frequent excellent DX propagation, interspersed with weaker propagation. DX on 12 and 10 meters will probably remain spotty and unreliable, but look for 6-meter sporadic-E propagation every day during June and July in northern hemisphere temperate zones, owing to infrequent geomagnetic disturbances in the early years of Cycle 25 and low geomagnetic activity typical of June and July.

Improving Propagation in 2022 and Beyond

Improved propagation in 2022 will depend on upward trending sunspot activity during 2021. Propagation improvement during 2023 similarly depends on increasing sunspot activity during 2022. If the SFI persists below 90 through December 2021, then propagation should improve gradually until a solar maximum weaker than Cycle 24's arrives in 2025. If the SFI persists above 100 through December, then propagation is likely to rapidly improve until a solar maximum similar to Cycle 24's arrives in 2025. If the SFI persists above 125 through December, then propagation is likely to improve more rapidly until a solar maximum stronger than Cycle 24's arrives in 2025.

Be Prepared for Cycle 25

Prepare to capitalize on propagation opportunities when they're available. It's crucial to have effective antennas for 30 through 10 meters, the bands that benefit the most from increased sunspot activity. Even simple antennas such as horizontal dipoles can be very effective DX antennas. Learn to use propagation tools such as the Reverse Beacon Network (RBN) that help you identify every DX opportunity, no matter how brief. Proficiency with popular digital modes such as FT8 will greatly add to your DXing success. Most importantly, enjoy the greatly improved DXing opportunities during Cycle 25. They've been a long time coming!

Frank Donovan, W3LPL, began his ham radio journey at 12 years old, during the W1OP/1 Providence Radio Association 1959 ARRL Field Day. His multioperator, multitransmitter DX contest teams have completed more than one million contacts in the CQWW and ARRL DX contests. He retired 10 years ago as a Chief Engineer at General Dynamics, after a 45-year career in electronics and systems engineering. Frank can be reached at **donovanf@erols.com**.

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