UNDERSTANDING SOLAR CYCLE 25: WHAT IT MEANS FOR HAM RADIO

The sun has always played a significant role in the world of amateur radio, dictating the quality of the propagation conditions that allow us to make those thrilling long-distance (DX) contacts. Solar activity has a direct influence on the ionosphere, and understanding these cycles can greatly enhance our ability to work rare DX more often on the higher bands, with low power and simple antennas, making it possible to reach distant stations that were previously out of reach with modest stations. We are currently well into Solar Cycle 25, and it's time to take a closer look at where we are in this

cycle, what we can expect for our operating conditions, and how solar flares could temporarily limit the enjoyment of our hobby, whilst at the same time, improve them.

Where Are We in Solar Cycle 25?

The solar cycle follows an approximately 11-year period of varying solar activity, characterised by peaks and troughs in sunspot numbers. During the peak, solar activity is at its highest, which benefits HF propagation, while during the trough, solar activity diminishes and conditions become less predictable. We are currently approaching the peak of Solar Cycle 25, which is expected in 2025, just a few months away. The rise in solar activity is much faster than the drop-off, and we are already experiencing sunspot numbers and **Solar Flux Index (SFI)** levels that are much higher than anticipated for this peak. Recently, we have seen an X9 solar flare and SFI well over 300 as this piece is being written. Elevated solar activity is providing a window of enhanced radio propagation, and at this point in the cycle, we are enjoying frequent bursts of DX opportunities. Conditions are already very favourable, and should continue to improve until we reach the peak.

The period leading up to the peak is often a time of great anticipation for **amateur radio** operators. As solar activity increases, we are experiencing vastly improved propagation conditions. Bands that have been relatively quiet during the past few years are now opening up, providing more opportunities for long-distance contacts. For new operators, this is an excellent time to discover the magic of HF radio and make QSOs across the globe. The increased ionospheric activity naturally boosts signal strength and reliability, making it easier for everyone to enjoy successful QSOs.

The excitement during this phase is palpable. Many operators are dusting off old equipment or building new antennas to take full advantage of the improving conditions. Clubs and groups are also becoming more active, hosting events and contests to celebrate the upswing in solar activity. DX

contests, which occur every year throughout the solar cycle, see significantly higher participation during solar peaks, as many more hams with simple antennas can enjoy them and rack up points that would otherwise not be possible. These activities foster camaraderie and provide an excellent learning opportunity for newer operators, helping them understand the impact of solar conditions on their ability to communicate effectively.

Elevated DX Conditions, E-Layer Propagation, and the Tail-off Period

Not all propagation is influenced by solar activity, and an important phenomenon to consider is E-layer propagation, often referred to as sporadic E (Es). Unlike **F-layer propagation**, which is heavily impacted by solar cycles, E-layer propagation is less dependent on sunspot activity and is more commonly observed during specific periods of the year. The most prominent period for sporadic E occurs during mid-summer, particularly in June, with a secondary, smaller peak in December.

Sporadic E events can provide excellent propagation opportunities on the VHF bands, such as 6 meters, and occasionally on higher frequencies. During these events, signals are reflected off the ionised patches in the E-layer, allowing for long-distance QSOs that would not normally be possible at those frequencies. Multi-hop Es can provide very long-distance contacts, but these openings tend to be much less frequent and can be very brief, often requiring bigger stations with directional antennas to make the most of them.

The unpredictability of sporadic E can be both a challenge and an exciting opportunity for operators. Those with well-equipped stations and the ability to act quickly when openings occur can experience thrilling DX on bands that are usually limited to local contacts. Even modest stations can sometimes take advantage of these events, especially during the peak months, making sporadic E one of the most interesting propagation modes for VHF enthusiasts.

The elevated DX conditions brought on by an increase in sunspot numbers are a dream for HF operators. Sunspots boost the ionisation levels in the upper layers of our atmosphere, particularly the F2 layer, which is crucial for long-distance HF communications. This increase in ionisation improves the reliability and range of our transmissions, allowing signals to travel much further than during periods of low solar activity. As the solar activity continues to rise, the increased ionisation will mean better propagation on higher frequency bands, such as 15m, 12m, and 10m, with even modest stations achieving impressive global coverage.

For many operators, this is a golden opportunity to work rare DX stations that are often elusive during solar minima. The higher bands, which are typically dormant during low solar activity, are now alive with signals from around the world. Operators who enjoy working QRP (low power) can take advantage of the enhanced propagation, often making contacts with just a few watts and simple wire antennas. The thrill of achieving a DX contact under these conditions is unmatched, especially when using minimal equipment.

This period of excellent conditions will last several years beyond the peak, giving us a broad window to take advantage of enhanced DX. However, as we move toward the tail-off period, likely starting around 2027-2028, the sunspot numbers will begin to decline, and with it, so will the quality of propagation on the higher HF bands. Lower bands like 20m and 40m will still be effective, but we can expect a reduction in opportunities on the higher frequencies as solar activity diminishes. During this tail-off period, operators will need to adjust their strategies, focusing more on the lower bands, where conditions will remain more stable and consistent.

It is also worth noting that during the tail-off period, the importance of understanding propagation nuances becomes even more critical. Operators will need to be more mindful of time-of-day variations and seasonal changes to make the most out of available propagation opportunities. The higher bands may not open as often, but they will still provide occasional windows for contacts, especially during geomagnetic disturbances or minor solar

events that temporarily boost ionisation. Flexibility and adaptability will be key during this phase, as conditions can change rapidly, requiring operators to be prepared to switch bands and modes as needed.

The tail-off period is also an ideal time for experimenting with new antennas and refining operating techniques. As conditions become more challenging, operators can benefit from optimising their station setups to extract the maximum performance from their equipment. This might include trying different antenna configurations, experimenting with digital modes that perform well under weak signal conditions, or exploring new bands that may offer better opportunities as solar activity declines.

The Impact of Solar Flares and Space Weather

While high solar activity can mean great propagation, it also comes with some risks—most notably, **solar flares** and **coronal mass ejections (CMEs)**. Solar flares are intense bursts of radiation from the sun that can cause sudden ionospheric disturbances, leading to signal fadeouts on the sunlit side of the Earth. These fadeouts, known as radio blackouts, can last anywhere from a few minutes to several hours, depending on the size of the flare. When a major solar flare occurs, even the most well-prepared operator can experience sudden loss of signals, which can be frustrating but is an inherent part of the hobby.

CMEs can also disrupt propagation, especially if they are Earth-directed. These massive ejections of plasma can cause geomagnetic storms, which can interfere with HF and VHF communications, sometimes causing complete signal loss. However, such events can also create auroral propagation opportunities on VHF bands, offering a different kind of excitement for radio operators. The aurora can act as a reflector for VHF signals, allowing contacts over distances that are usually out of reach. While these contacts can be challenging due to the rapid fading and signal distortion caused by the aurora, they are highly prized by many VHF

enthusiasts. Additionally, while solar flares can cause temporary radio blackouts, when conditions return, they are often exceptionally elevated, providing some of the best opportunities for DX.

It's not just amateur radio that is affected—essential services such as aviation communications, maritime operations, and GPS systems can also experience disruptions during significant solar activity. For hams, staying informed about space weather forecasts is a good practice. Sites like **NOAA's Space Weather Prediction Center** or dedicated amateur radio resources can help operators prepare for and take advantage of changing conditions. Many modern transceivers and logging software also incorporate space weather data, making it easier than ever to keep track of solar activity and plan operating times accordingly.

In addition to monitoring space weather, operators can take practical steps to mitigate the impact of solar flares and CMEs. This includes having backup communication plans, using lower frequencies that are less affected by ionospheric disturbances, and being prepared to switch modes or bands as conditions change. Understanding the relationship between solar events and radio propagation can turn potentially frustrating situations into opportunities for learning and adapting.

Making the Most of Solar Cycle 25

For the next few years, we are in for some exciting times as Solar Cycle 25 progresses toward its peak. Elevated solar activity means more chances to make those elusive DX contacts, even with modest antennas and power levels. The key is to be active, monitor solar conditions, and make the most of the favourable propagation when it's available. The tail-off period will eventually come, but until then, we can enjoy the sun's gift of enhanced global communication. Being proactive and ready to operate when conditions are favourable is the best way to take full advantage of what this solar cycle has to offer.

Remember to keep an eye on solar indices like the Solar Flux Index (SFI) and K-index to gauge when conditions will be at their best. A high SFI generally means better propagation on the higher HF bands, while a low K-index indicates stable geomagnetic conditions, which are ideal for HF operation. And don't forget—when those solar flares do occur, be patient. The sun gives, and the sun takes away, but the cycle always continues. Even during periods of poor propagation, there are still opportunities to experiment with different modes, antennas, and bands, all of which add to the richness of the amateur radio hobby.

Ultimately, Solar Cycle 25 is a time for amateur radio operators to come together and make the most of the opportunities it presents. Whether you are chasing new DXCC entities, experimenting with digital modes, or simply enjoying casual QSOs with operators in distant lands, the coming years will provide many chances to expand your skills and make unforgettable contacts. Embrace the ups and downs of the solar cycle, and remember that every contact, no matter how brief, is a testament to the wonders of radio and the power of the sun.

As **Solar Cycle 25** progresses, consider joining local clubs or online communities to share your experiences and learn from others. The knowledge gained from seasoned operators can be invaluable, especially when conditions become challenging. Participating in contests and events can also be a fun way to test your skills, try new bands, and push the limits of what your station can achieve. There is no better time to be an active part of the amateur radio community, as the increased solar activity brings with it not only better propagation but also a renewed sense of excitement and exploration.

Whether you are a seasoned DXer or a newcomer to the hobby, Solar Cycle 25 offers something for everyone. Take the time to understand how solar activity impacts propagation, experiment with different setups, and, most importantly, enjoy the process. The beauty of amateur radio lies in its

diversity and the endless opportunities for learning and connecting with others around the world. With the sun on our side, the possibilities are truly limitless.

For more information, please visit our **online store** or **contact us** and our staff will be happy to assist you.