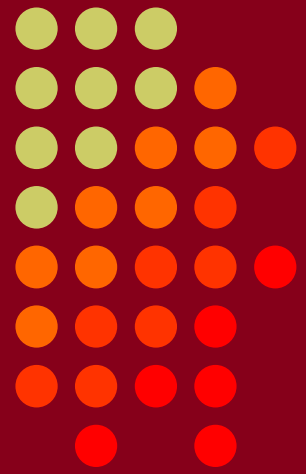
How the Strongest Solar Maximum in 20 Years Affects Contest Planning and Execution

Competitive success often depends more on how you prepare for a contest than it does on what you do during a contest

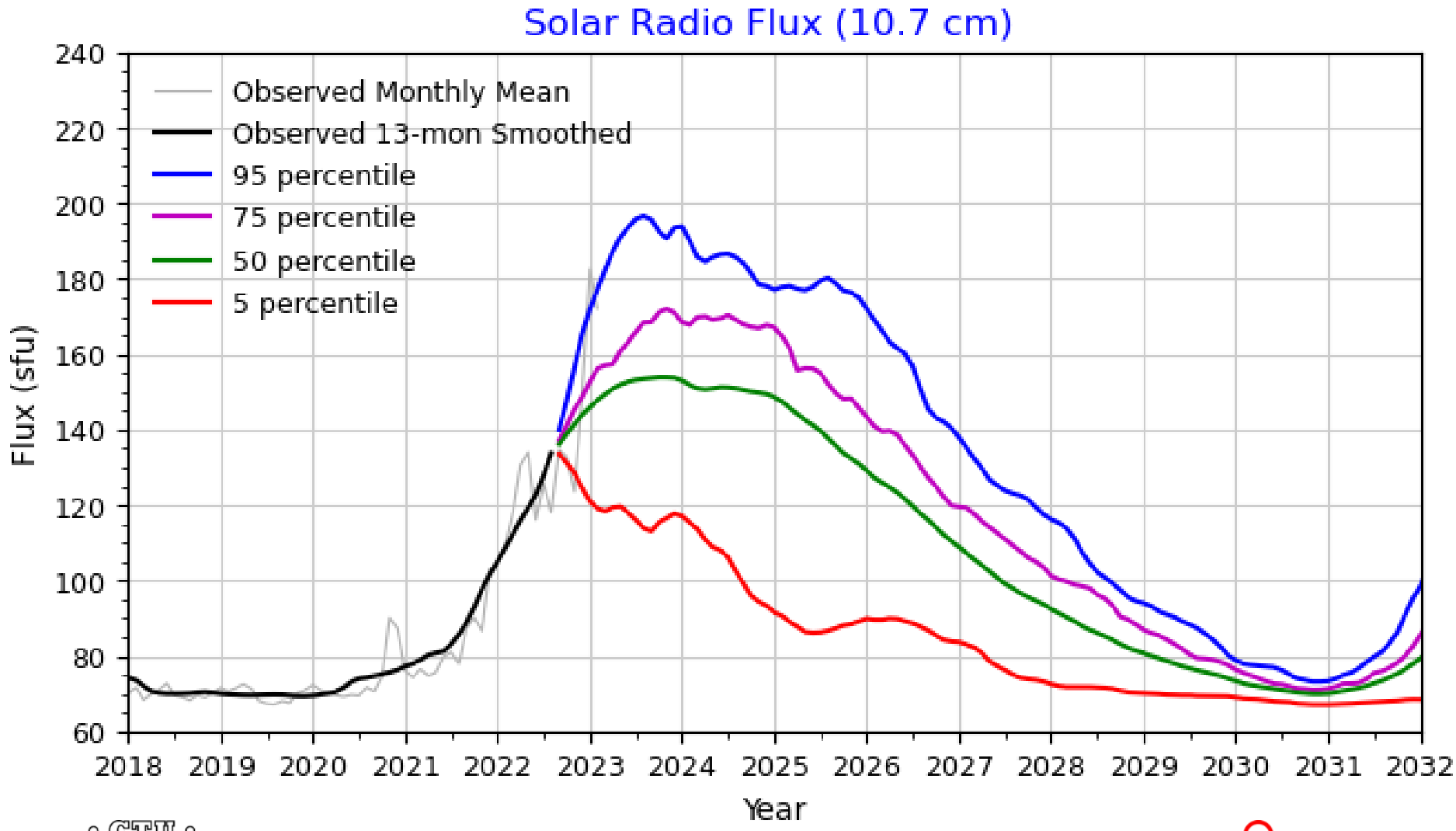
Frank Donovan
W3LPL



• CTU •
CONTEST UNIVERSITY

ICOM

Solar Cycle 25 Solar Flux Index Forecast
NASA Marshall Space Flight Center
2 Mar 2023

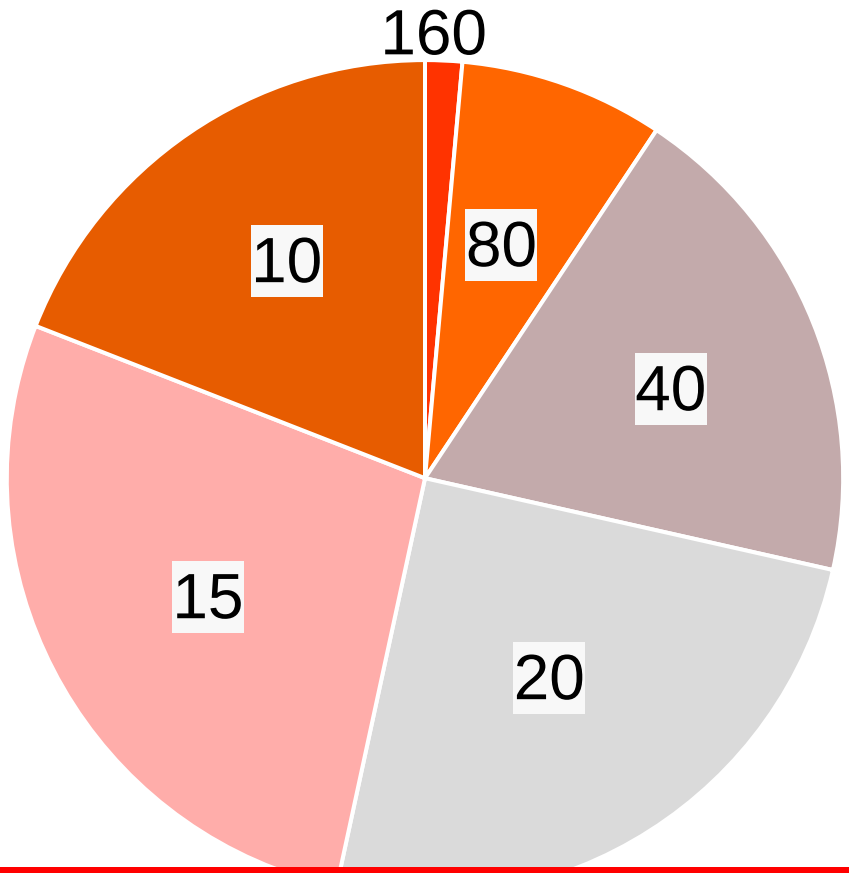


CTU
CONTEST UNIVERSITY

www.nasa.gov/msfcsolar

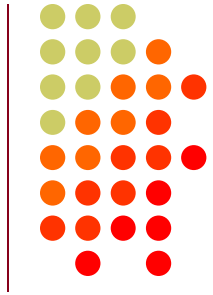
ICOM

CW DX Contest QSOs Per Band as Solar Cycle 25 Nears Solar Maximum



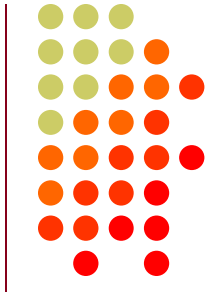
10 and 15 meters are <u>much more</u> important near solar maximum
40 and 20 continue to be very important near solar maximum
160 and 80 are <u>somewhat less</u> important near solar maximum

How Solar Maximum Affects Propagation for the Next Five Years



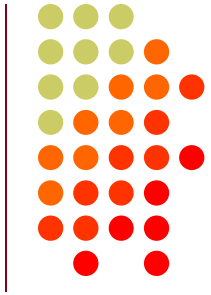
- Solar maximum propagation conditions began in January 2023
- Solar maximum is likely to occur next year
  - 10 and 15 meter worldwide DX will persist later into the night for the next two years
- Disturbed geomagnetic conditions will be much more frequent
  - starting next year
- Excellent 10 meter worldwide propagation will continue
  - until at least late 2026
- The slow decline to solar minimum will begin
  - in about 2028

How Solar Maximum Affects 10 Meter Propagation for the Next Five Years



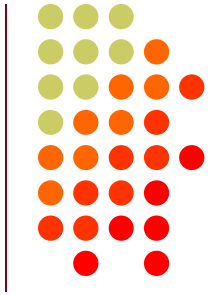
- Worldwide propagation improved dramatically since January 2023
  - almost every day from October through April
  - huge run rates to Europe from sunrise to early afternoon
  - excellent propagation to Japan and Asia after 2130Z for three or four hours
- Propagation between northern hemisphere locations continue to be infrequent during most days from May to mid-September
  - Sporadic-E is the dominant May to August propagation
- Excellent propagation should continue through at least late 2026

How Solar Maximum Affects 15 Meter Propagation for the Next Five Years



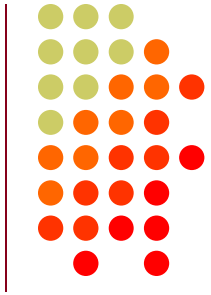
- Worldwide propagation improved dramatically since 2022
  - almost every day from September through May
  - huge run rates to Europe from sunrise to mid-afternoon
  - excellent propagation to Japan and Asia after 2130Z for four hours or more
- Propagation between northern hemisphere locations begins later and is shorter in duration from June to August
  - Sporadic-E is sometimes the dominant propagation mode from June to August

How Solar Maximum Affects 20 Meter Propagation for the Next Five Years



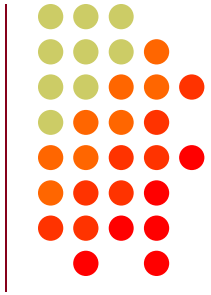
- Nighttime propagation improved dramatically since January 2023
  - now almost 24 hour per day worldwide propagation
    - but not during summer mid-day hours
  - excellent nighttime run rates to Europe from 0700-0900Z
  - excellent run rates resume about an hour before sunrise
  - much of the DX activity switches to the higher bands after 1200Z
- Propagation to Japan and Asia is often stronger through the night until a few hours after sunrise
- Summer mid-day DX propagation is much weaker from June to August

How Solar Maximum Affects 40 Meter Propagation for the Next Five Years



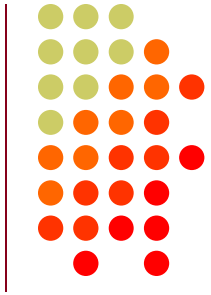
- Nighttime propagation has become more reliable and more long lasting since 2022
  - good run rates to Europe start about an hour before sunset
  - continuing throughout the night until a few hours after European sunrise when Europeans QSY to higher bands
  - the best European propagation and activity is often around European sunrise
- Mid-afternoon propagation to Europe is weaker since 2022
  - much of the DX activity is still on the higher bands
- Propagation from the east coast to Japan and Asia is more reliable since 2022

How Solar Maximum Affects 80 Meter Propagation for the Next Five Years



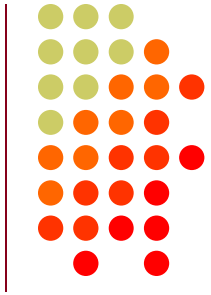
- Propagation has become less reliable since 2022
  - weak unreliable DX propagation begins at sunset
  - good run rates to Europe start several hours after sunset
  - The best European activity is often just before their sunrise
  - continuing until about an hour or less after European sunrise when Europeans QSY to higher bands

How Solar Maximum Affects 160 Meter Propagation for the Next Five Years



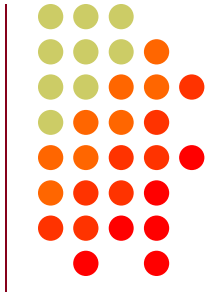
- Propagation has become very unreliable since 2022
  - weak unreliable DX propagation begins after sunset
  - propagation to Europe often improves around midnight for a few hours

Necessary First Steps in Identifying Candidate Station Improvements



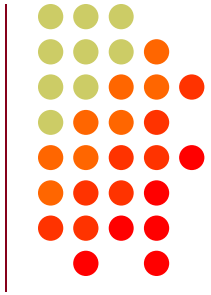
- Identify realistic time phased personal contest goals for selected contests, entry categories and competition region
  - first place regional, national or world winner, or
  - consistently placing in the top three, or
  - consistently placing in the top ten, or
  - successfully competing with selected peers
- Identify the realistic constraints that limit your station improvements
  - desired time frame for achieving your contest goals
  - amount of available time to implement station improvements
  - available physical space for more antennas and station equipment
  - annual funds available to support your improvements
- Achieve a balance between your goals and constraints

Well Before the Contest Evaluate Your Station's Strengths and Weaknesses Compared to Your Peer Competitors



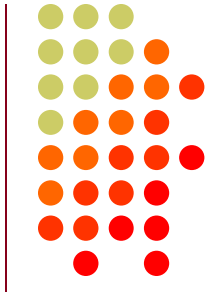
- Identify your station's strengths and weaknesses and evaluate your peer competitor's strengths and weaknesses
  - transmitting and receiving antennas, feedlines and antenna switching
  - transceiver performance -- focusing on receiver performance
  - amplifier output power and reliability
  - audio and CW keying quality
  - computers, software and their internal and external networks
  - all aspects of your station environment that limit operator performance
  - external and inter-station RFI
  - all aspects of station reliability
- Identify opportunities to improve your station's weaknesses and reliability relative to your peer competitors
  - in every category above
  - then prioritize your total list of improvement opportunities

During and After Every Contest Prepare Notes Documenting Your Station's Strengths and Weaknesses Compared to Your Peer Competitors



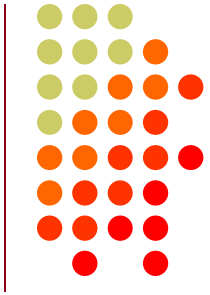
- Identify every aspect of your station's performance that was strongly competitive compared to your peer competitors
- Identify every aspect your station's performance that was not competitive compared to your peer competitors
- Identify improvements that your peer competitors can't match
- Identify every opportunity for station improvement that could have improved your score in this contest, in priority order by:
  - estimated score improvement resulting from each improvement
  - degree of difficulty in achieving each improvement
  - practicality of achieving each improvement
  - impediments to achieving each improvement
  - expense to achieve each improvement

Tower Inspections and Maintenance Will Help You Avoid Mid-Winter Failures and Reliability Problems During Your Next Contest



- Measure all guy wire tensions (7 to 15% of breaking strength)
- Inspect guy wires, guy hardware and guy anchors for damage
- Inspect tower plumb and twist
- Inspect the tower base for standing water and
  - corrosion, settling and cracks at the tower-to-concrete interface
  - regularly remove all debris from tower bases to avoid corrosion
- Inspect rotator performance and play
- Inspect the tower for wind damage
- Pay special attention to damaged, loose, missing or corroded:
  - diagonal and horizontal trusses, welds and hardware
  - especially adjacent to guy attachments

Antenna Inspections and Maintenance Will Help You Avoid Mid-Winter Failures and Reliability Problems During Your Next Contest



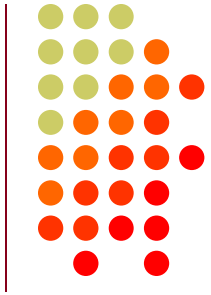
- Inspect coax cable for cuts, cracks, damage and moisture intrusion
  - cuts, chaffing and worn rotator loops
  - water intrusion at electrical and physical attachments to antennas
- Compare coax cable losses and TDR displays to prior results
- Compare antenna VSWRs to prior measurements
- Inspect connector water proofing and PL-259 tightness
- Inspect rope wear -- its much easier to replace rope before it fails
- Inspect antenna wire for wear and connections to feed lines
- Repair or replace unreliable, failing or overloaded rotators
- Inspect antennas and coaxial cables for lightning damage
- Inspect antennas, feed lines and rotators for wind damage

CTU CONTEST UNIVERSITY

Annual inspections are essential to tower. antenna, rotator and coax cable reliability and performance

ICOM

Improving the Competitive Performance and Reliability of Coaxial Cables for Multi-tower Stations



- Coaxial cables longer than 300 feet are often used in multi-tower stations
- Andrew Heliax is an ideal choice for lengths up to:
  - 10 meters: 600 feet of LDF5-50A or 300 feet of LDF4-50A
  - 15 meters: 700 feet of LDF5-50A or 350 feet of LDF4-50A
  - 20 meters: 900 feet of LDF5-50A or 450 feet of LDF4-50A
  - 40 meters: 1200 feet of LDF5-50A or 600 feet of LDF4-50A
- Be cautious of the windload and weight (including ice load) of large Heliax cables mounted on light duty towers
- Failure to adequately protect connectors from water intrusion is a very common cause of coaxial cable deterioration

Improving the Reliability of Coaxial Cable Connectors

- N and UHF connectors are the most common choices
- No significant loss in either N and UHF connectors at HF
- No significant difference in the VSWR of N and UHF connectors at HF
- High quality silver plated UHF connectors provide much more center pin mating force than N connectors
  - eliminates cross-station interference and connector failures from potentially unreliable N connector center pin mating force
  - avoid saving a few dollars on cheap unbranded hamfest connectors
- Avoid use of adapters, but if necessary be sure they are name-brand silver plated adapters, not nickel plated
- Use a wrench to **gently tighten** UHF connectors 1/4 turn
- Inspect SO-239 connectors for center pin mating pressure

Coaxial Cable
Amphenol 83-1SP PL-259 Connector

Shell labeled exactly:
Amphenol 83-1SP

Silver Plated
Center Pin

Silver Plated
Body

newark.com/amphenol-rf/83-1sp/rf-coaxial-uhf-plug-straight-50ohm/dp/59K0534

This is not the place to save money

Coaxial Cable Connector Waterproofing

Cover the connectors with two 50% overlapped layers of Scotch 130C linerless rubber splicing tape stretched to 50% of its original width, sticky side facing out

Cover the Scotch 130C with two 50% overlapped layers of Scotch 33+ vinyl electrical tape

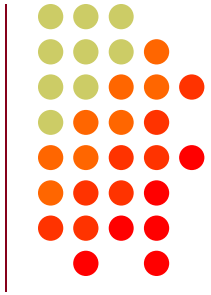
CTU CONTEST UNIVERSITY

ICOM

Indoor Station Performance and Reliability Improvements

- Transceiver performance (sensitivity, dynamic range, filters)
- Amplifier output power and reliability
- Digital wattmeters
- Physical environment that degrades operator performance
  - noise, chair, ventilation, desk height, equipment placement, line of sight
- Keyers and paddles
- Microphones
- Computer keyboards
- Computer monitors
- Computers
- Antenna switching
- DX spotting network displays and alarms
- Propagation map displays from the Reverse Beacon Network
- Connectors: gently tool tightened PL-259s, SO-239 mating force

Execute Your Proof of Station Performance Checklist Before Every Competitive Contest



- Proves that everything in your station is in working properly
  - improve and update your checklist regularly
  - record all performance measurements
- Never enter a competition with unproven station equipment
- Prove that all indoor and outdoor equipment is working far enough in advance so you can make necessary repairs before the contest

Single Operator (not including SO2R) Station Improvement Ideas for the Next 4 Years near Solar Maximum

- Antenna improvements are almost always more effective and less expensive than any other station improvement and they improve both transmitting and receiving performance
- Receiving antennas make a big improvement on 160 and 80 meters
- Identify and mitigate internal and external RFI sources well before the contest
- Many modern transceivers have much improved receiver dynamic range and filter selectivity
  - know how to adjust your receiver for optimum dynamic range
  - verify your receiver's sensitivity every time you sit in front of it
- A wattmeter allows you to monitor transmitter and antenna performance during the contest

Single Tower Station Antenna Improvement Ideas for the Next 4 Years Near Solar Maximum

- 50-60 foot tower and a small rotator (e.g., HyGain Ham-IV)
  - small tribander, Hex-beam or quad
  - 40 and 80 meter dipoles and a 160 meter inverted-L
- 70-80 foot tower and a medium rotator (e.g. HyGain T2X)
  - Cushcraft XM-240 two element 40 meter Yagi
  - large tribander such as the SteppIR 4 element Yagi
  - 80 meter dipole and a 160 meter inverted-L
- 100-140 foot tower and a large rotator (e.g., M2 Orion)
  - Cushcraft XM-240 two element 40 meter Yagi
  - monoband Yagis such as the HyGain LJ series on ring rotators
  - 80 meter dipole and a 160 meter inverted-L

SO2R Station Improvement Ideas in Addition to Single Op Improvements for the Next 4 Years Near Solar Maximum

- Receiving bandpass filters are almost always necessary to protect transceivers from cross-band interference and physical damage
- 100 watt bandpass filters may be needed on transceiver outputs if your transceiver radiates broadband phase noise (many do)
- Stubs may be necessary on amplifier outputs if multiple antennas are in close proximity
- Multiband antennas can cause excessive cross-band interference
- Many operators find it more effective to use multiple networked computers and keyboards
- Identify and resolve all RFI and cross-band interference
  intermodulation caused by transmitted signals entering unprotected consumer electronic devices often re-radiate strong harmonics mixed with AC power or computer network signals creating strong broadband noise modulated sidebands on the transmitter harmonic