A LOOK AT PROPAGATION FOR THE 2017/2018 CONTEST SEASON

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THANKS TO THE WWROF FOR SPONSORING THIS WEBINAR

World Wide Radio Operators Foundation

wwrof.org

And thanks to Ken K4ZW for facilitating this Webinar

AGENDA

- Cycle 24, Cycle 25, solar minimums
- Disturbances to propagation
- Mitigation for disturbances

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- Band-by-band summary
- DX contest strategies as Cycle 24 declines

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- K4ZW's XW dilemma

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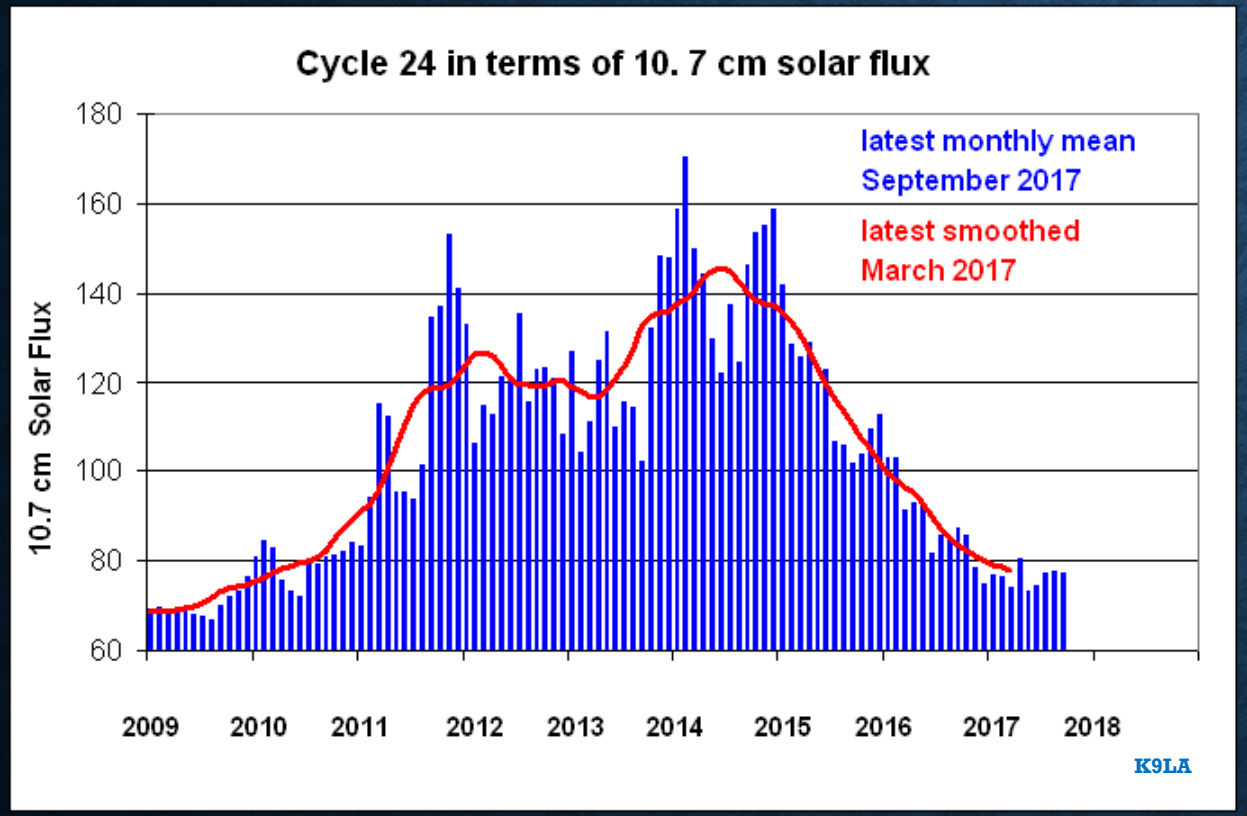
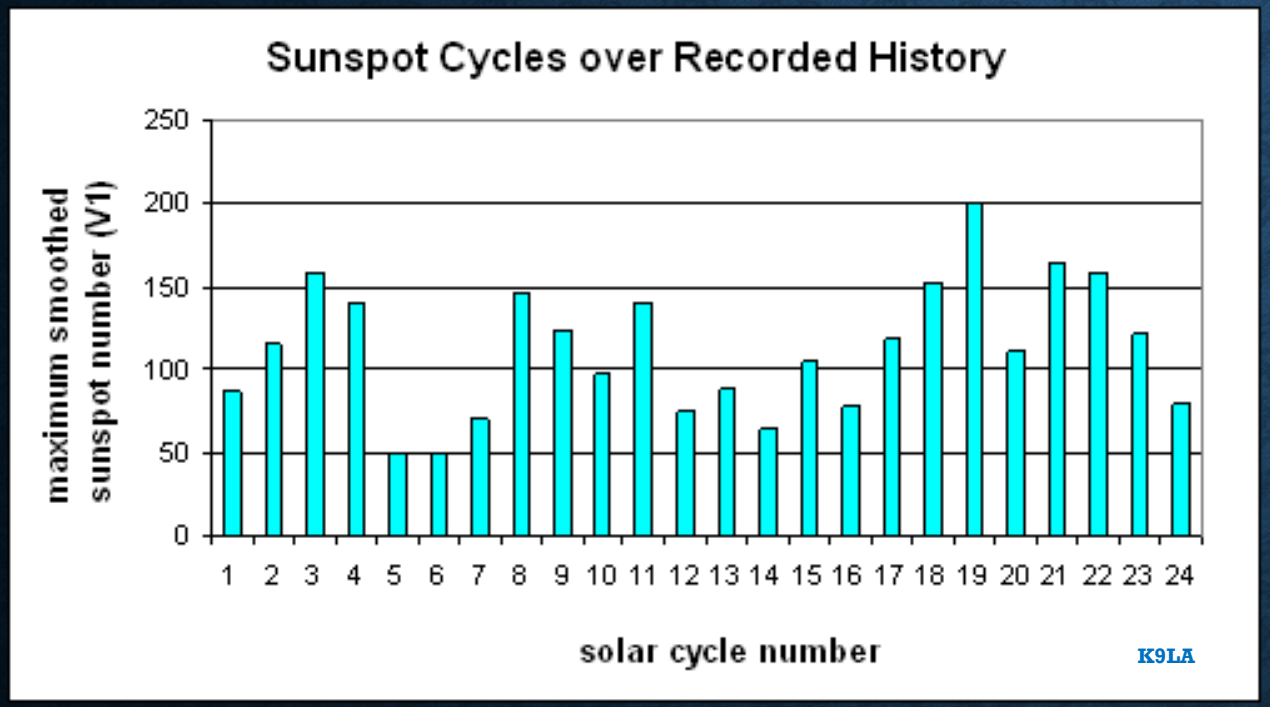
CYCLE 24 STATUS



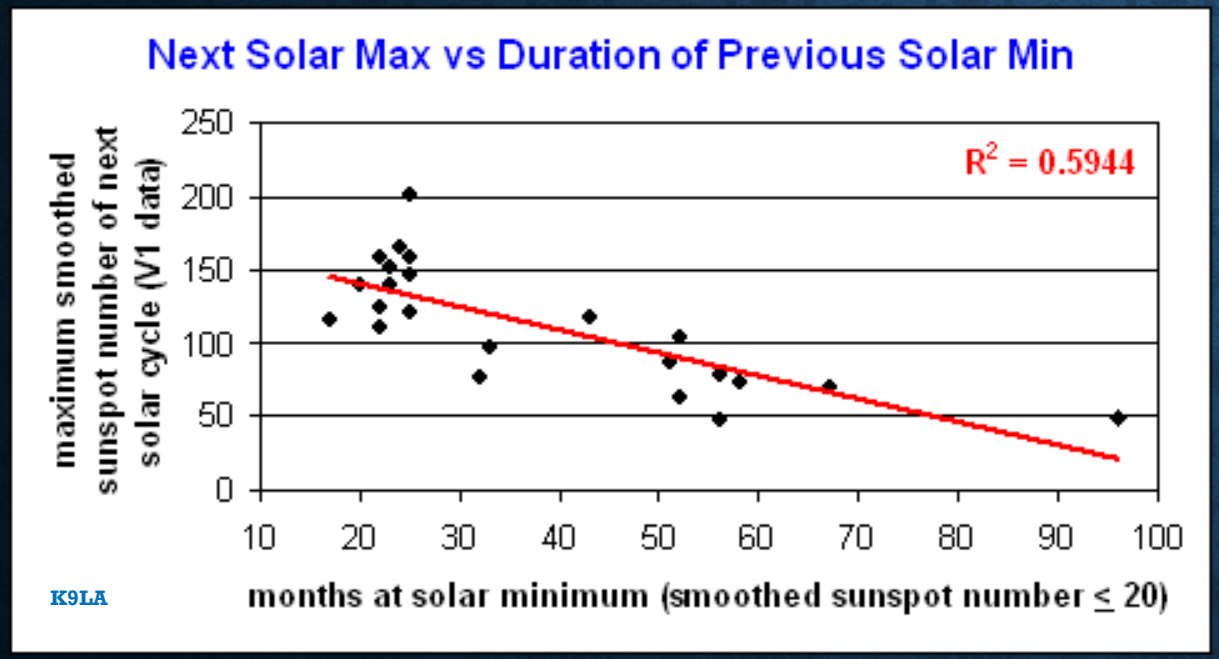
- Smallest in our lifetimes
- We still enjoyed the short second peak of Cycle 24
  - Even had 6m F2 openings
- Still have about 2 years to solar minimum

OUR PREDICTION FOR CYCLE 25



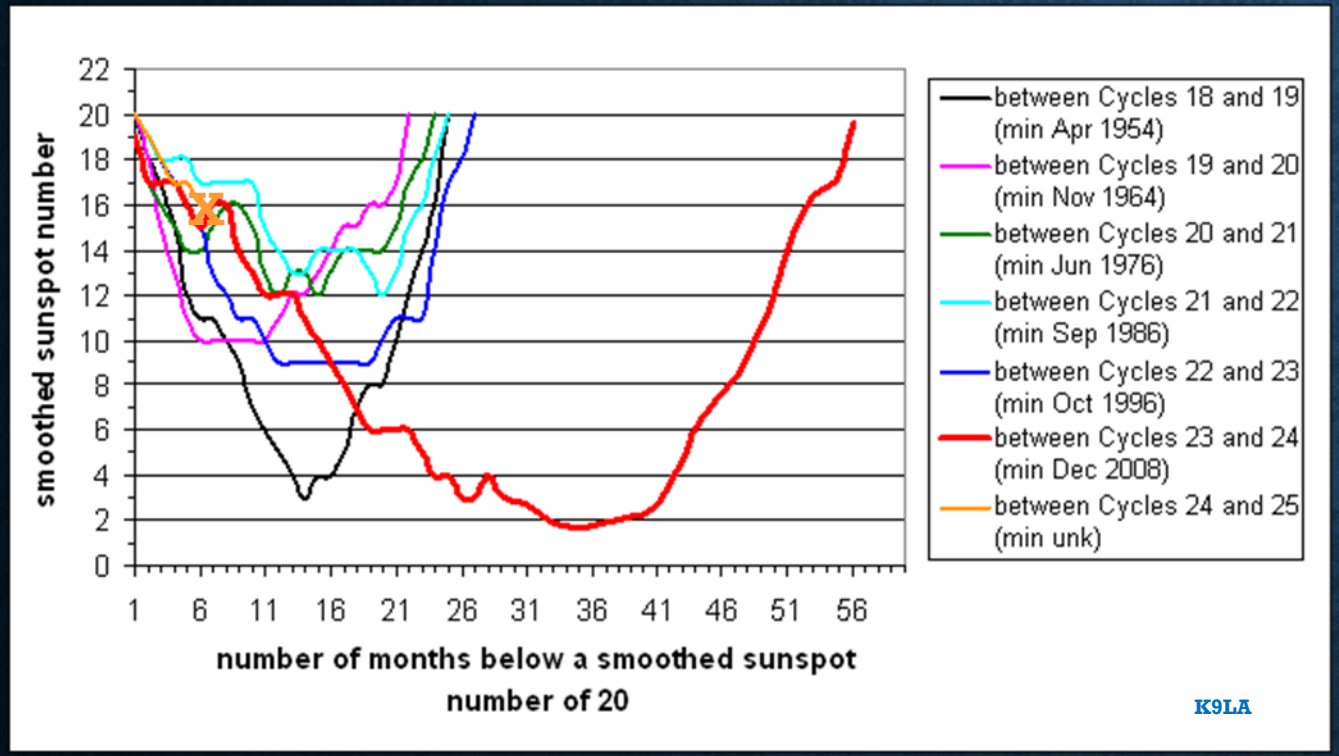
- 3 periods of big solar cycles
- 2 periods of small solar cycles
- It appears that we're entering another period of <u>small cycles</u>
- Solar scientists so far are in agreement

DURATION OF SOLAR MINIMUM



- The longer we're at solar minimum, the smaller the next cycle
- Conversely, the smaller the cycle, the longer the solar minimum preceding that cycle

WE'VE BEEN SPOILED



- Most of our solar minimums were about 2 years . . .
- Except for the minimum prior to Cycle 24
  - Almost 5 years!
- We may be in for another <u>long</u> solar minimum since Cycle 25 is expected to be <u>small</u>

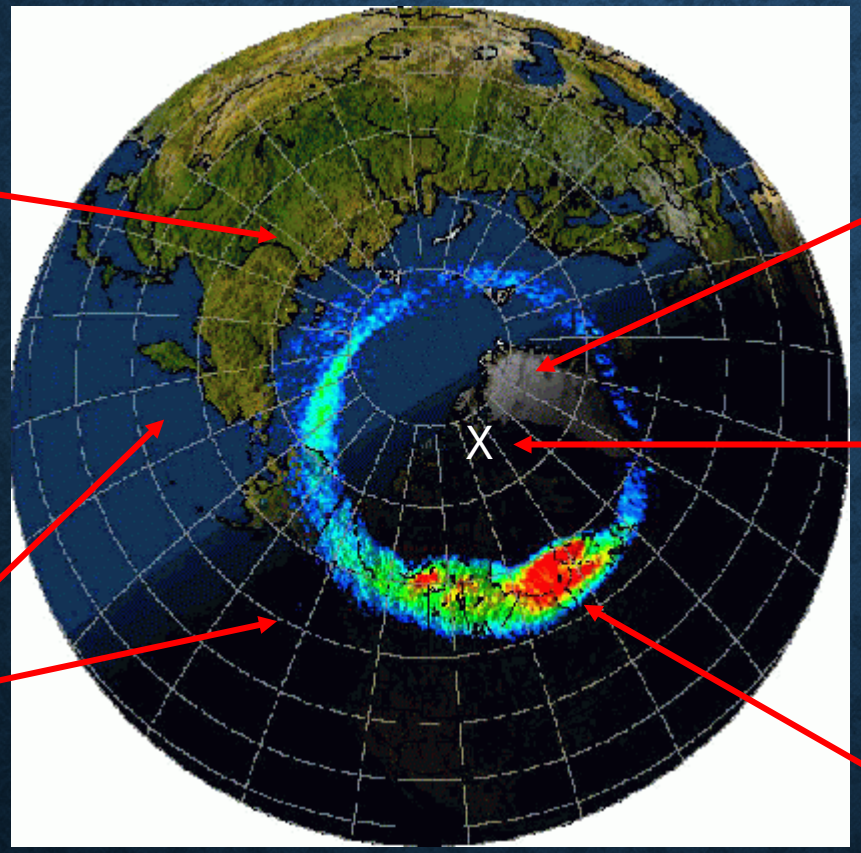
DISTURBANCES – THE BIG PICTURE

R = Radio blackout

X-ray radiation from M or X class solar flare can result in more absorption on the daylight side of the Earth

G = Geomagnetic storm

Elevated K indices can decrease F region MUFs at high and mid latitudes both day and night – but can enhance low latitude ionization



S = Solar radiation storm

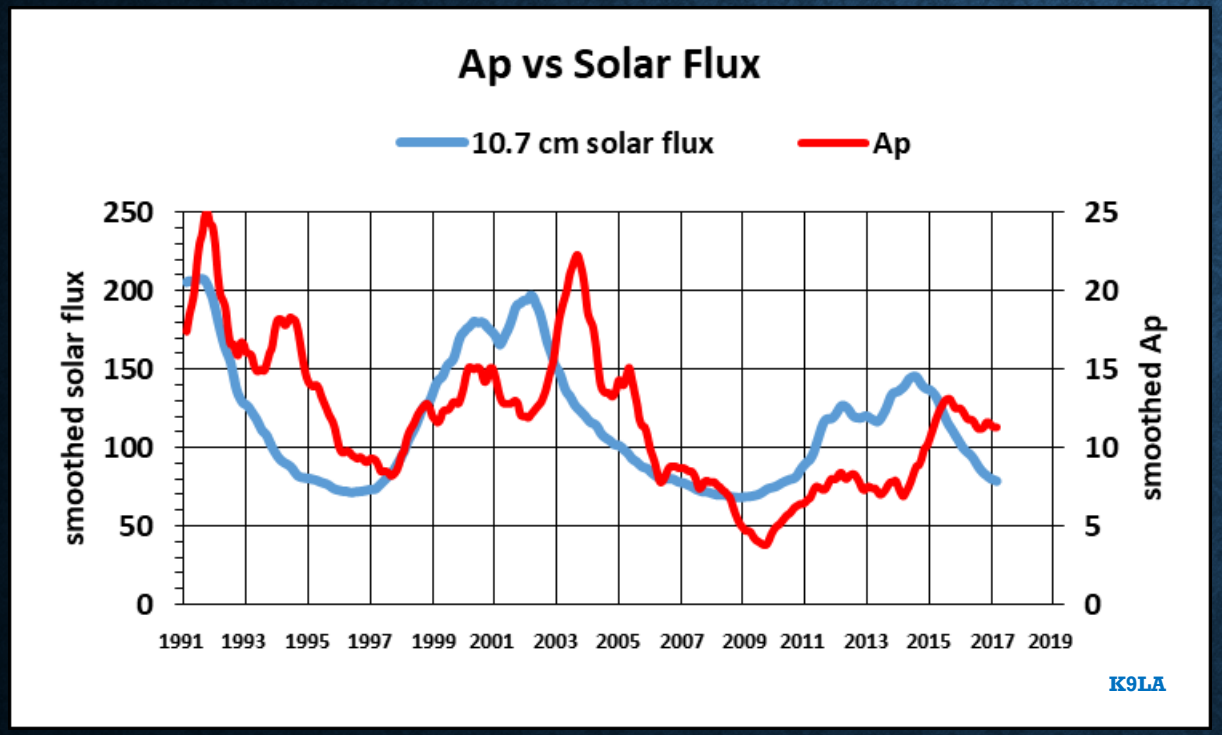
Protons from M or X class solar flare can result in more absorption in the polar cap

X marks the spot – the North magnetic pole

G = Geomagnetic storm

Elevated K indices can cause increased auroral ionization (more absorption and VHF aurora)

GEOMAGNETIC ACTIVITY VS SOLAR CYCLE



- Ap highest (most disturbed) at solar max and especially during the declining phase
- Ap lowest (quietest) at solar min and initial ascent
- Frank will have more on this

MITIGATION TO DISTURBANCES

- Geomagnetic storms (most of the time a depleted F2 region)
  - Cause: CMEs (most prevalent at solar max) and coronal holes (declining phase)
  - Mitigation: QSY to lower freqs, look for enhanced low latitude paths, look for skewed paths on the lower bands
- Solar radiation storms (energetic protons into the polar cap)
  - Cause: M and X-Class solar flares (most prevalent at solar max)
  - Mitigation: avoid polar paths, look other way around (long vs short path)
- Radio blackouts (radiation at X-ray wavelengths)
  - Cause: M and X-Class solar flares (most prevalent at solar max)
  - Mitigation: QSY to higher freqs (less loss & possible enhancement), look for paths in darkness

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ADAPTING YOUR DX CONTEST STRATEGIES TO THE STEADILY DECLINING SOLAR CYCLE

- Spotless days are now much more frequent
  - Probably more than 100 spotless days this year
  - Many more spotless days during the next five years
- Solar flux will continue its decline to much lower levels
  - 60s and 70s will be increasingly common for at least five years
- Frequent geomagnetic disturbances until Solar Minimum
  - at least until the onset of solar minimum in about 2019
  - Mostly driven by frequent -- often intense -- coronal hole activity
  - Solar flares and coronal mass ejections (CMEs) will be much less frequent
  - Geomagnetic disturbances will be much less frequent after solar minimum in about 2019

MAJOR IMPROVEMENT IN 160 METER WORLDWIDE PROPAGATION

- Stronger DX signals
- More reliable DX openings especially to Europe and Japan
- Lower absorption
  - During increasingly common periods of less intense geomagnetic activity
  - Especially for a few years after solar minimum during about 2020-2022
- Less daytime D layer absorption
  - DX openings begin just before sunset and continue just after sunrise
- Less intense night time E layer absorption as the E layer MUF drops

MAJOR IMPROVEMENT IN 160 METER WORLDWIDE PROPAGATION

- Continuous openings to Europe, Mid-east and north Africa 2200-0830Z
- Frequent strong JA openings at sunrise mid-Nov to mid-Feb 1200-1230Z
- More frequent direct short path polar opening to central Asia 2300-0100Z

- More crowded band conditions
  - Especially when there is no strong 40 and 80 meter propagation to Europe

SIGNIFICANTLY IMPROVED 80 METER WORLDWIDE PROPAGATION

- Stronger DX signals
- Much more reliable DX openings especially to Europe and Japan
- Consistently low absorption
  - During increasingly common periods of less intense geomagnetic activity
  - Especially for a few years after solar minimum during about 2020-2022
- Less daytime D layer absorption
  - DX openings begin well before sunset and continue well after sunrise

SIGNIFICANTLY IMPROVED 80 METER WORLDWIDE PROPAGATION

- Continuous east coast USA openings to Europe, Mid-east and north Africa
  - 2130-0830Z
- Regular strong east coast USA to JA openings at sunrise mid-Nov to late Feb
  - 1130-1300Z
- Direct short path polar opening to central Asia will be much more frequent
  - 2130-0200Z
- Much more crowded band conditions
  - Especially when there is no strong 40 meter propagation to Europe

NEARLY 24 HOUR WORLDWIDE 40 METER PROPAGATION

- Much less daytime D layer absorption
- Nearly 24 hour DX openings during CQWW CW in late November
- DX openings to Europe will often begin before east coast USA mid-afternoon
  - Especially from mid-November through late February
- But DX openings to Europe will often end shortly after sunset
  - Especially from mid-November through late February
  - Direct short path to Europe often opens again at European sunrise
- Trans-polar propagation will become much less frequent
  - East coast US to East Asia propagation will often be via the South West skew path
  - Strong direct short path often opens at east coast sunrise

NEARLY 24 HOUR WORLDWIDE 40 METER PROPAGATION

- Europe, Mid-East and north Africa propagation
  - Activity QSYs to 40 meters before mid-afternoon ~1930Z
  - Don't miss the strong mid-afternoon/evening openings 2000-0200Z
  - Propagation often fades/fails a few hours after sunset 0200-0600Z
  - Strong openings usually resume at sunrise in Europe ~0600-0900Z
- Japan, Far East and Central Asia propagation
  - Brief direct short path opening at JA sunset 0800-0900Z
  - Weak skew path opening at about 240° azimuth ~0900-1130Z
  - Strongest short path JA opening from the east coast ~1130-1300Z
  - Strong long path Asia signals at 150° azimuth 2130-2215Z
- VK/ZL and southeast Asia long path at 90-150° azimuth 2100-2300Z
- Southeast and central Asia long path at ~240° azimuth ~1130-1300Z

SHORTER DURATION WORLDWIDE 20 METER PROPAGATION

- Mostly a daytime DX band from November to late February
- All DX propagation usually ends well before midnight on the east coast
  - Especially from mid-November through late February
- DX openings to Europe usually begin about an hour before east coast sunrise
- But DX openings to Europe usually end shortly after sunset in Europe
  - Especially from mid-November through late February
- Much shorter duration east coast USA propagation to east and central Asia
- US to central and east Asia propagation will often be via the South West skew path
  - Especially from 1200-1400Z at 240 degrees azimuth

SHORTER DURATION WORLDWIDE 20 METER PROPAGATION

- All DX propagation usually ends well before midnight ~0300Z
  - Sporadic, weak night time Africa & south Pacific openings 0500-0700Z
- Europe, Mid-East and north Africa propagation
  - from before east coast USA sunrise until mid-afternoon ~1000-1900Z
    - the opening is sometimes delayed until after sunrise
    - the opening ends much earlier in the afternoon than in recent years
- Japan, Far East and central Asia propagation
  - short evening short path opening 2100-0100Z
  - morning short path opening 1300-1500Z
  - both openings are much shorter than in recent years
- South Asia and Mid-East morning long path 1300-1500Z
- VK, ZL and south Pacific mid-afternoon long path 1900-2200Z

MUCH SHORTER DURATION WORLDWIDE 15 METER PROPAGATION

- Usually a daytime only DX band from November to late February
- All DX propagation usually ends shortly after sunset on the east coast
  - Especially from mid-November through late February
- DX openings to Europe usually begin about an hour after east coast sunrise
- But DX openings to Europe usually end shortly before sunset in Europe
  - Especially from mid-November through late February
- Very short duration east coast USA propagation to east and central Asia
  - Sometimes via the long path at 150 degrees azimuth

MUCH SHORTER DURATION WORLDWIDE 15 METER PROPAGATION

- Europe, Mid-East and north Africa propagation
  - from about an hour after our sunrise until early afternoon 1300-1800Z
  - shorter openings than we've enjoyed in recent years
- Japan and Far East propagation
  - weak unreliable late afternoon short path opening 2130-2300Z
    - sometimes only via long path to 150 degrees azimuth 1300-1400Z
  - much shorter openings than we've enjoyed in recent years
- 15M usually closes shortly after our sunset ~2200Z
  - always stays closed all night

NO LONGER A WORLDWIDE DX BAND
10 METER PROPAGATION

- Strictly a daytime only DX band
- All DX propagation ends before sunset
- There are no short path DX openings to Europe
  - There are weak scatter openings at 140 degrees azimuth
- But DX openings to Europe usually end shortly before sunset in Europe
  - Especially from mid-November through late February
- There are no short path DX openings to Asia
  - Rare very weak signal scatter openings to east Asia at 230 degrees azimuth

NO LONGER A WORLDWIDE DX BAND
10 METER PROPAGATION

- South America, Caribbean and Central America
  - PY and LU activity has increased significantly in recent years
  - usually opens about an hour after our sunrise ~1300Z
  - opening can fade for an hour or two, then return much stronger in the afternoon
  - usually closes about an hour before our sunset ~2100Z
- Europe and north Africa
  - very weak signals on the SE skew path at 110-150° azimuth ~1400-1700Z
- VK/ZL and South Pacific
  - A fairly reliable weak signal opening ~1900-2100Z
- Japan, North Pacific and Far East
  - rare morning weak signal long path at 150° azimuth ~1300-1400Z
  - rare evening very weak signal skew path 200-240° azimuth 2100-2200Z

DX CONTEST STRATEGIES FOR DECLINING LOW SOLAR ACTIVITY

- High antennas are much more important during solar minimum
- Improve your low band transmitting and receiving antennas!
- Start every DX contest on 40 meters
  - The European opening begins before mid-afternoon
  - the strong European opening ***often ends a few hours after sunset***

W3 to EU

Elev	80m	40m	20m	15m	10m
1	7.9	9.5	6.1	7.8	0
2	6.6	8.6	6.9	14.8	0
3	6.6	6.2	6.5	17.4	0
4	3.9	5.8	5.9	16.5	0
5	3.8	4.2	6.3	11.3	0
6	3.7	3.9	6.1	10.4	0
7	4.1	5.5	6.1	6.1	0
8	6.3	7.1	7.8	7	0
9	5.5	7.7	5.6	3.5	0
10	3.8	5.4	5.9	5.2	0
11	4.7	5.4	4.8	0	0
12	5	5.1	2.6	0	0
13	7	4.9	4.1	0	0
14	5.2	4.7	6.3	0	0
15	5.4	3.6	3.3	0	0
16	5.8	4.5	4.3	0	0
17	5.1	1.6	1.3	0	0
18	2.6	1.9	2	0	0
19	1.9	0.8	1.5	0	0
20	1.3	2.1	3	0	0
21	0.9	0.3	0.4	0	0
22	0.8	0.4	2	0	0
23	1.1	0.1	0.4	0	0
24	0.2	0.4	0.4	0	0
25	0.3	0.1	0.2	0	0
26	0.1	0	0.2	0	0
27	0.5	0	0	0	0
28	0	0	0	0	0
29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	0	0
32	0	0	0	0	0
33	0	0	0	0	0
34	0	0	0	0	0
35	0	0	0	0	0

W3 to JA

Elev	80m	40m	20m	15m	10m
1	52.3	37.2	10.6	0	0
2	6.8	15.4	11.1	0	0
3	0	0.8	11.1	0	0
4	0	12.4	19.6	0	0
5	8	8.3	13.8	0	0
6	15.9	7.9	6.9	0	0
7	4.5	4.9	7.9	0	0
8	0	2.3	6.3	0	0
9	6.8	6.4	1.1	0	0
10	5.7	2.3	4.2	0	0
11	0	2.3	3.2	0	0
12	0	0	4.2	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
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29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	0	0
32	0	0	0	0	0
33	0	0	0	0	0
34	0	0	0	0	0
35	0	0	0	0	0

Oct/Nov at solar min
thanks N2IC

DX CONTEST STRATEGIES FOR DECLINING LOW SOLAR ACTIVITY

- Capitalize on improved 160 and 80M propagation 2200-0830Z
  - especially important when 40 meters is not strongly open to Europe
- Strong 40 meter opening after sunrise in Europe 0600-0900Z
- 160, 80 and 40 meter openings to VK, ZL and JA 0900-1230Z
- 20M European opening starts before sunrise 1000-1900Z
- 15M European opening starts about an hour after sunrise 1200-1800Z
- 10 meters opens primarily to the south 1300-2100Z
- Strong 40M afternoon/evening openings to Europe 2000-0300Z
- 20 meter evening openings to Japan 2100-0100Z

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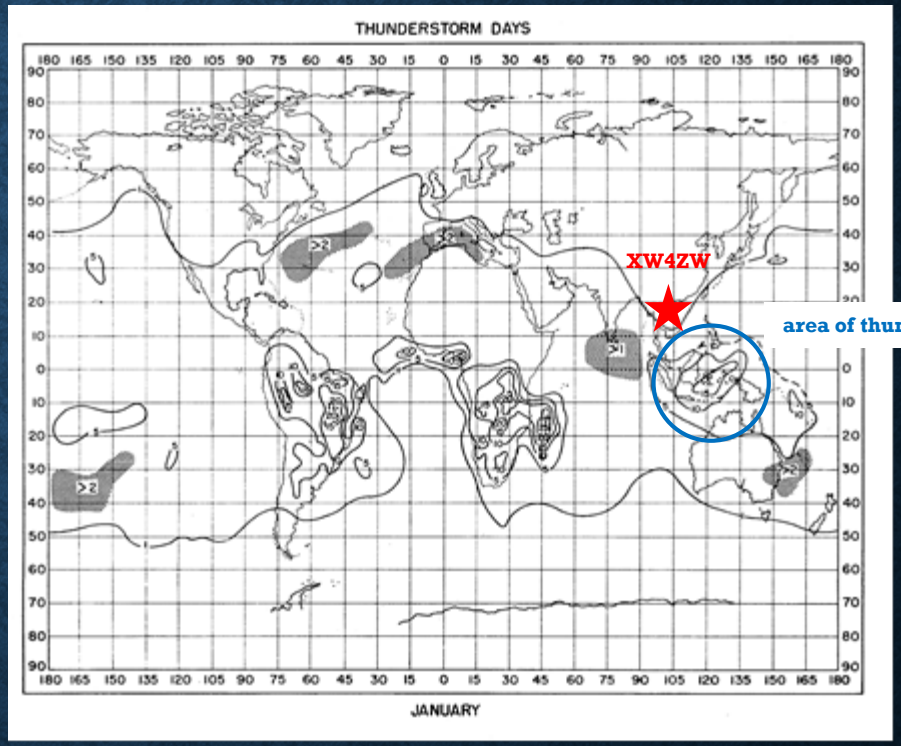
K4ZW'S DXPEDITIONS TO XW

- XW4ZW – January 23-30, 2015
  - 159 NA on 80m, 8 NA on 160m, 1947 total on 80m and 160m
- XW4ZW – January 16-22, 2016
  - 49 NA on 80m, 11 NA on 160m, 987 total on 80m and 160m
- XW4ZW – January 9-15, 2017
  - 52 NA on 80m, 1 NA on 160m, 1233 total on 80m and 160m
- XW to NA is a tough path

K4ZW'S OBSERVATIONS

- Ken says it's pretty quiet to the south (long path) towards NA
- NA signals on 80m are often right at the noise
- Ken says he is being heard much better than he is hearing
- What's the problem?



From USAF Handbook of Geophysics (1960)

If we believe the ITU Radio Noise document, XW4ZW's noise on 80m is about 20 dB worse than noise at W1 – that could contribute to non-reciprocity

MORE BEER MONEY AND A DECK OF CARDS?

- When the noise is in the same direction as your target location, there's not much you can do
- Other possible "RF" causes
  - Charly HSØZCW observes that short path signal strengths from HS on 20m are stronger in EU and NA than the other way
  - The author of a NATO report on the ionosphere says most paths are non-reciprocal in signal strength due to polarization mismatch
- Conclusion: For his next trip, Ken may have a lot of extra time for vices ☺

SWEEPSTAKES

- Although we talked about DX contests, propagation for Sweepstakes and other forthcoming contests will be similar
  - Higher bands not too productive
  - Lower bands best
- All of this could also apply for the next 2-5 years
  - Depends on the duration of the next solar minimum

Q & A