



Propagation Topics – Cycle 24

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Agenda

- Recent Cycle 24 data
- Cycle 24 Predictions
- Cycle 24 FAQs
- Waller Flag observations
- Anomalies in the F₂ region

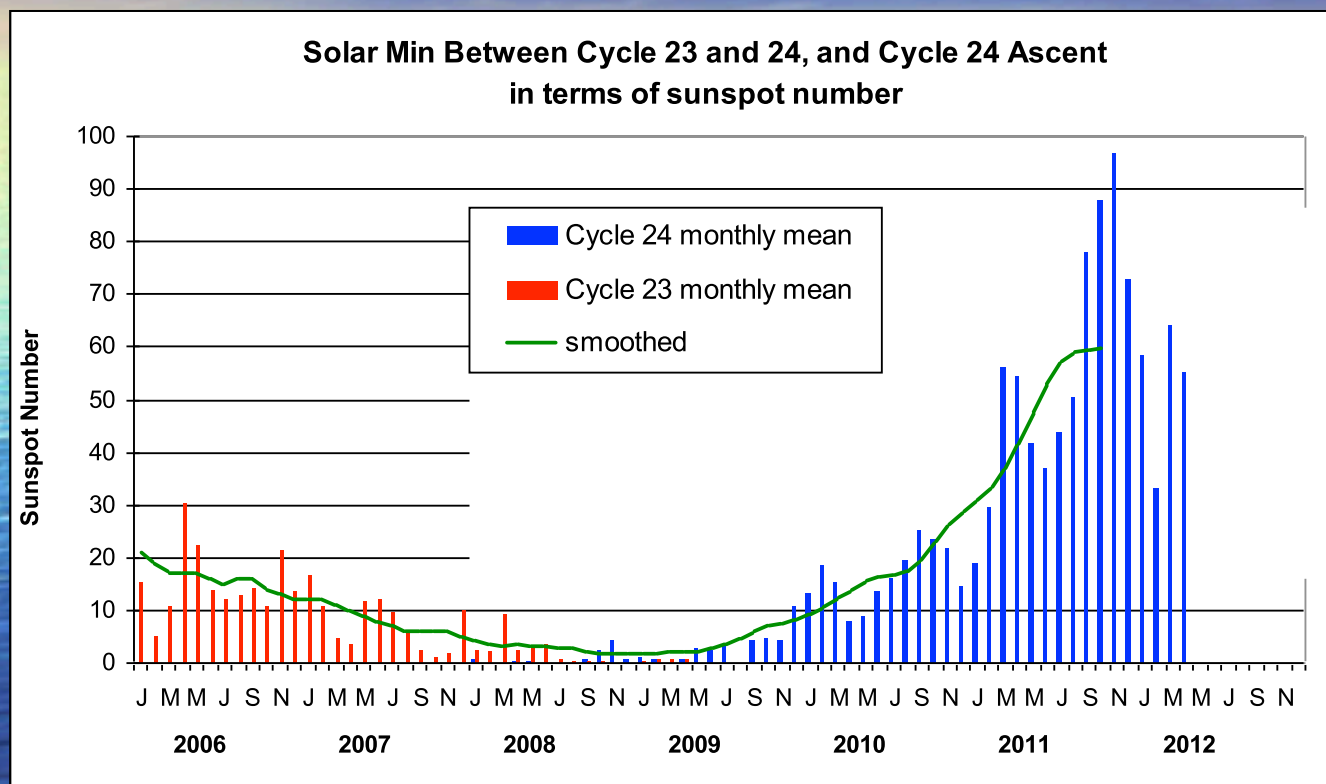
more propagation in the Contest Forum

My 2nd Op



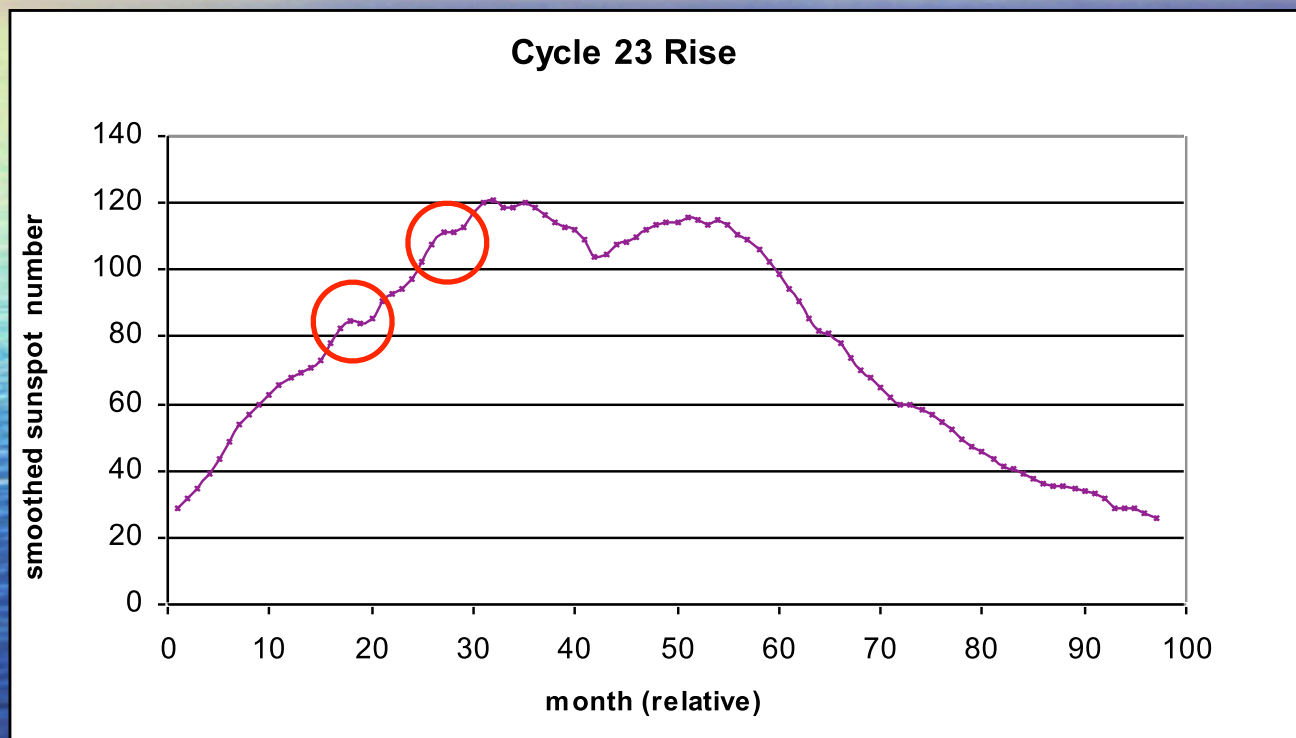
B/H = ???

Recent Cycle 24 Data



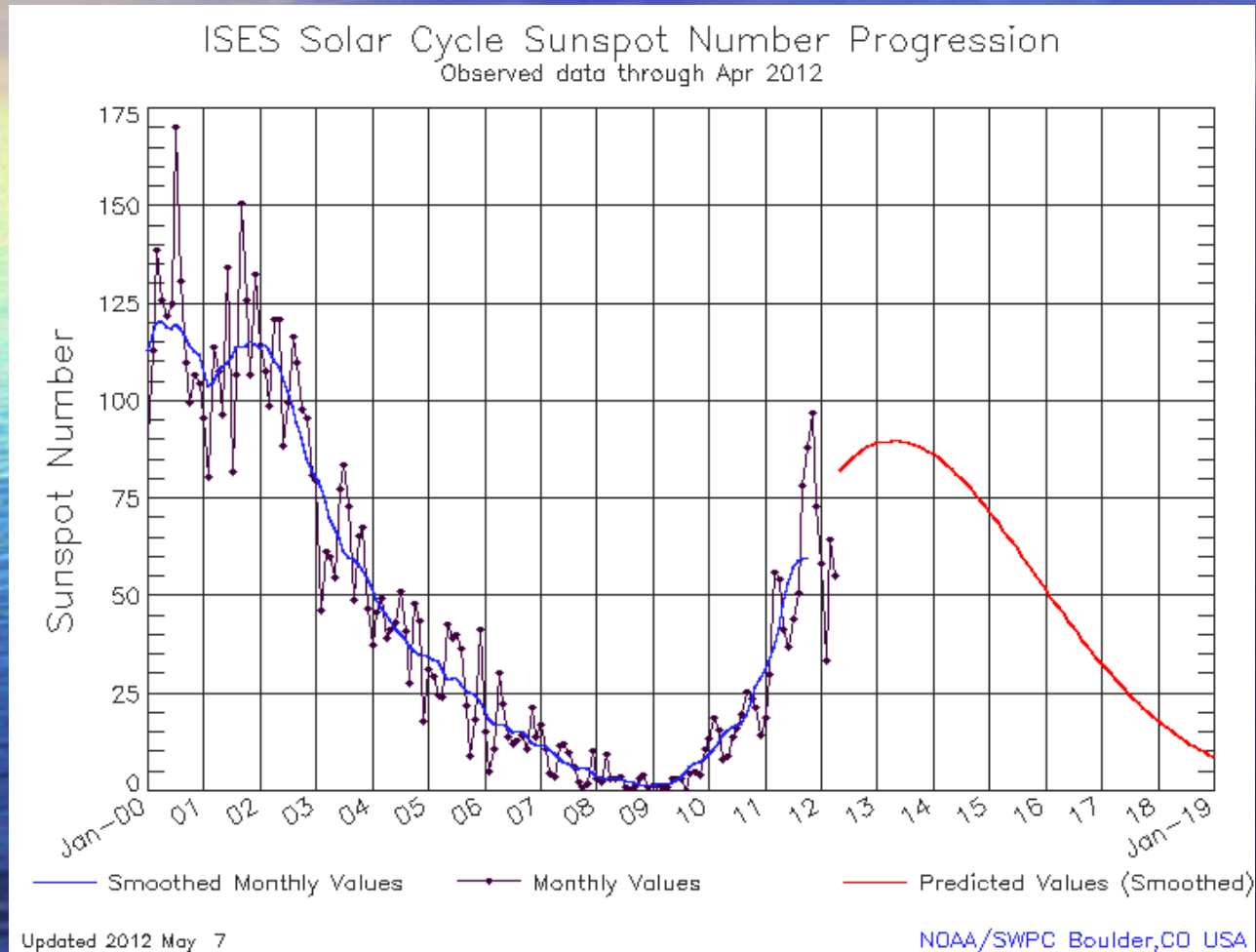
- Monthly means have not been impressive
- This results in smoothed value leveling off
- Is this just a temporary slow down or are we at

Slow Down in the Ascent



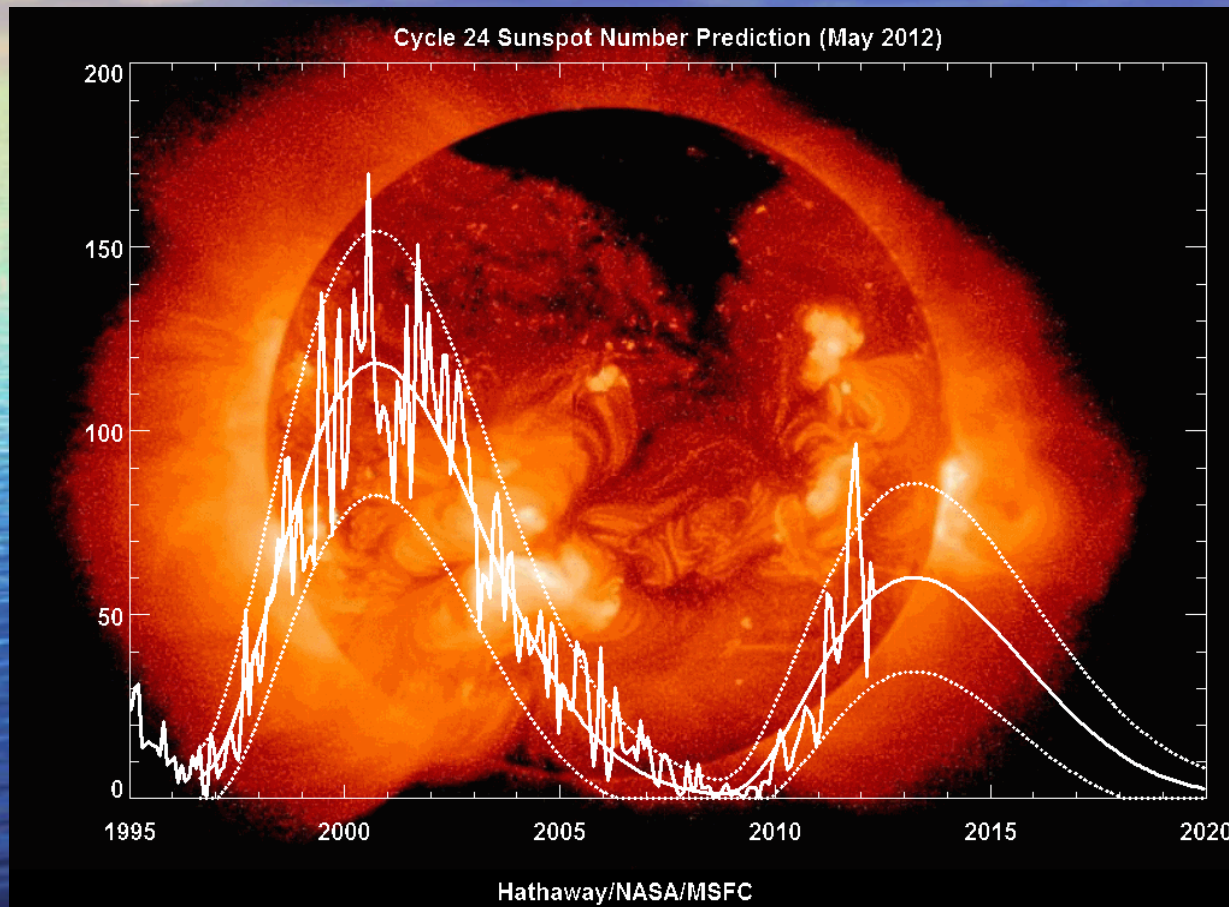
- Been seen before
- It's possible Cycle 24 will pick up and continue to rise
- What happens in the next several months will be interesting

ISES Cycle 24 Prediction



- Maximum of 90 in early 2013
- Monthly means in the next months need to be high to push the smoothed value up to 90

MSFC Cycle 24 Prediction



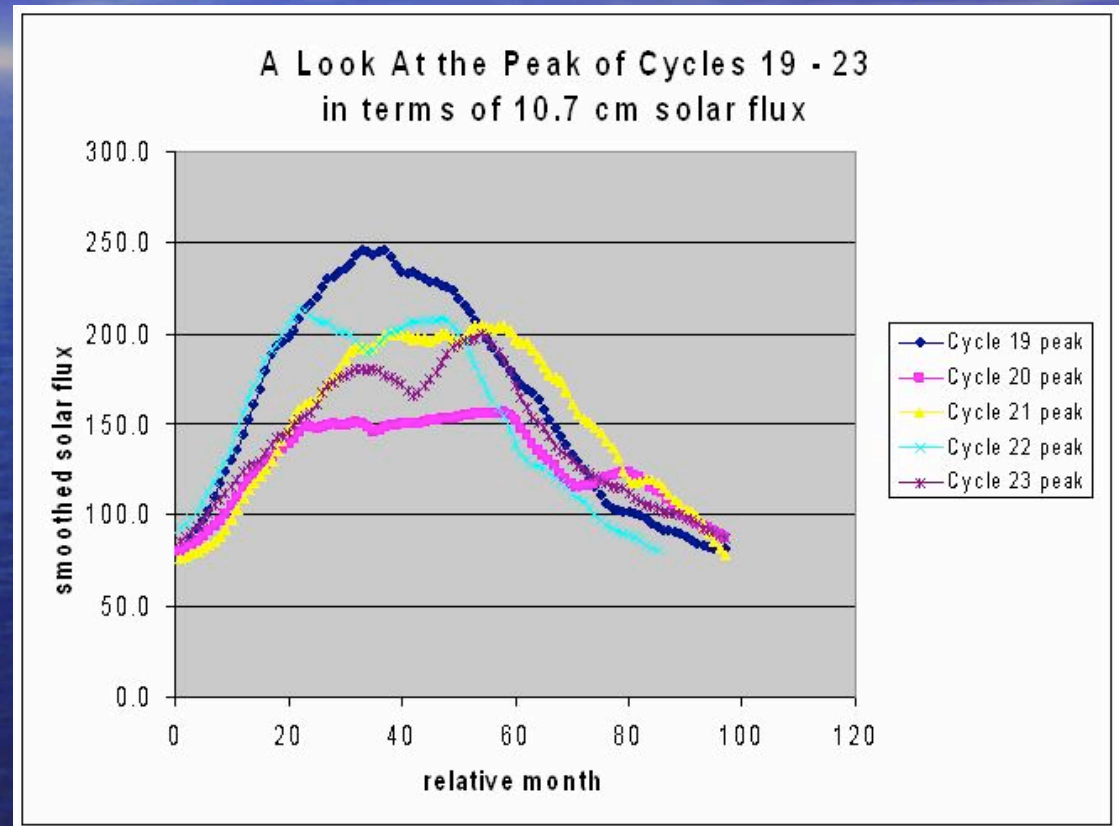
- We may be there
- Let's keep our fingers crossed for the high-side prediction

Four Cycle 24 FAQs

- Is Cycle 24 going to have two peaks?
- Is Cycle 24 going to offer any 6-Meter F2 propagation?
- Are sunspots disappearing?
- Are we headed for another Maunder Minimum?

Two Peaks?

- Cycle 19, 20, and 21 didn't show much of a second peak
- Cycle 22 and 23 did show a definite second peak
 - Cycle 23's second peak made 6-Meter DXers very happy in the Winter of 2001



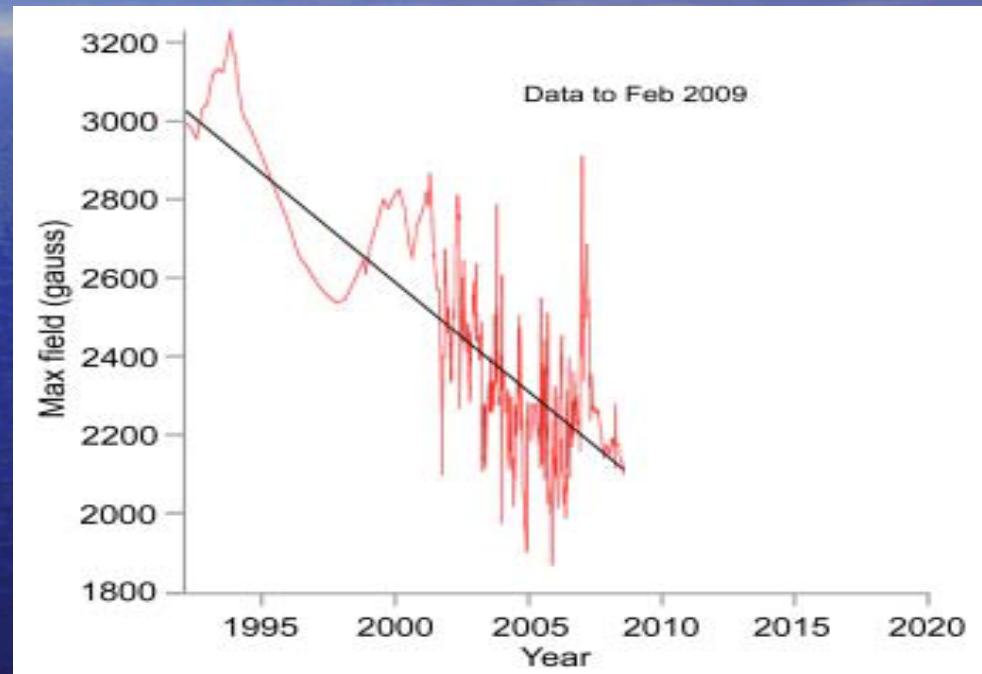
Cycle 24 has a decent chance of a second peak

6-Meter F₂?

- Paths not involving the equatorial ionosphere are very unlikely with the current Cycle 24 prediction
 - TEP is still possible
- If F₂ does happen, it would be most likely during the Spring, Fall, and Winter of 2013
- To reiterate, Sporadic E should still be there
 - Late morning and early evening in the Summer
 - Early evening in December

Are Sunspots Disappearing?

- W. Livingston and M. Penn measured the maximum strength of magnetic fields of sunspots
- Strength has been declining since 1992
- Need about 1500 gauss for sunspots to be visible
- Extrapolating their data says sunspots will disappear by 2015
- 2012 update – declining trend continues thru 2011



Remember that sunspots are a proxy for the true ionizing radiation (EUV), which still appears to be alive and well

Another Maunder Minimum?

- Maunder Minimum - lack of sunspots from 1645-1715
- Cycles -11, -10, and -9 showed a smooth decrease in group sunspot number leading up to the Maunder Minimum
- It's generally agreed that the Sun is "slowing down"
- Cycles 22, 23, and 24 exhibit a smooth decrease, too
- Where Cycle 24 ends up and the duration of the solar minimum between Cycle 24 and 25 will be interesting, and may suggest where we're headed

Waller Flag Observations

- In last year's Antenna Forum, Larry W8VVG talked about the Waller Flag
 - Doug Waller NX4D
- Included N4IS comments

“I would like to add few comments about the HWF; it is terrific for long path pointing south, east and west. The VWF works better to North and sometimes E – W but never due south.”

Polarization

- There's more order to polarization than we generally acknowledge
 - Yes, the ionosphere is dynamic and there are short-term polarization changes
- At HF, circular polarization is the norm
- At 1.8 MHz, highly elliptical polarization is the norm – tending towards linear

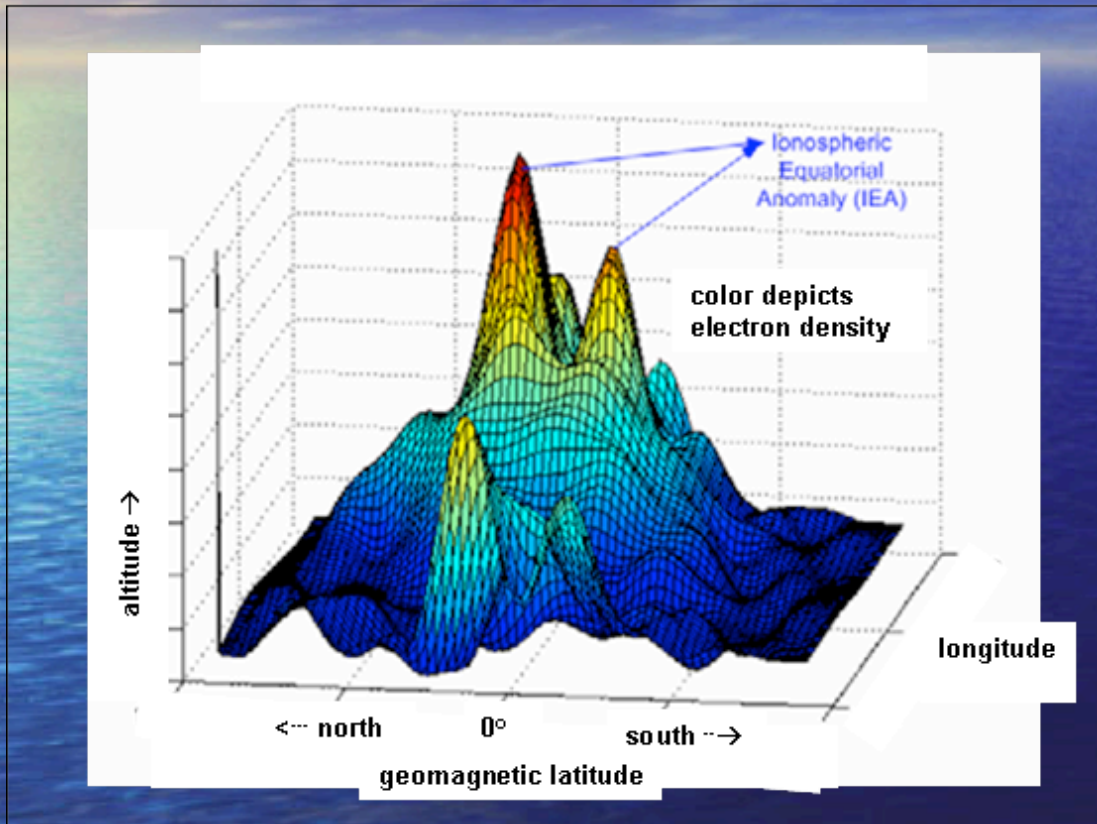
Your QTH Does Matter

- At 1.8 MHz, the extraordinary wave suffers significantly more absorption than the ordinary wave
- Your first encounter with the ionosphere is important
 - Orientation of the magnetic field
 - Major axis of ordinary wave parallel to magnetic field
- At mid and high latitudes, vertical polarization couples best to the ordinary wave (magnetic field more vertical)
- At low latitudes
 - To the north, vertical polarization couples best to the ordinary wave (magnetic field more vertical)
 - To the south, southeast, and southwest, horizontal polarization

Anomalies in the F₂ region

- We know a lot about the F₂ region
- Model of it in our propagation prediction programs is a monthly median model
- We can predict F₂ openings over a month's time frame with decent results
- But short-term stuff still happens that we can't explain

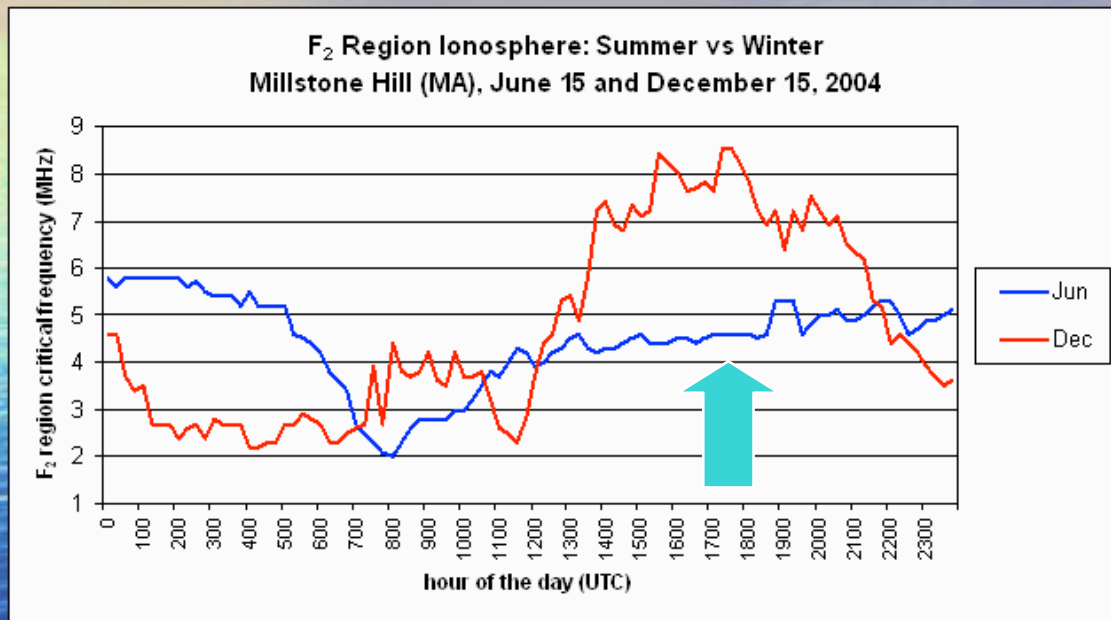
Equatorial Anomaly



- The “fountain effect” causes two clumps of high electron density on either side of the geomagnetic equator
- Gives us TEP

Not much of an “anomaly” anymore

Winter (or Seasonal) Anomaly

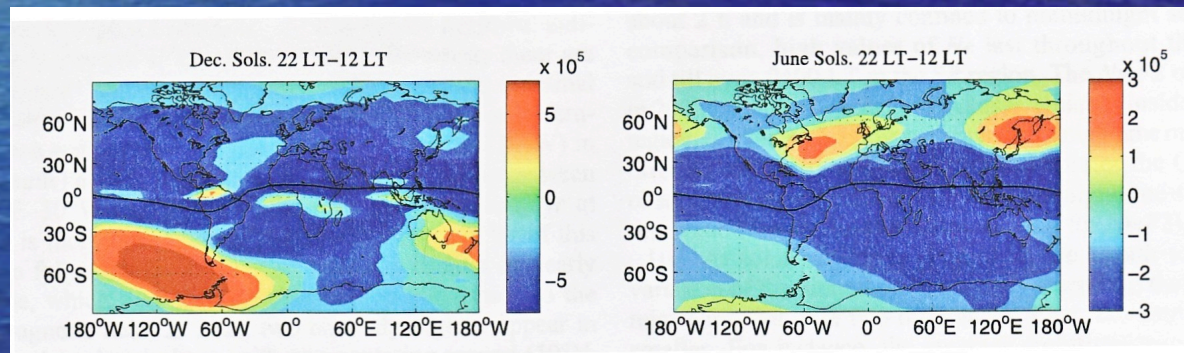


Not much of an “anomaly” anymore

- Daytime MUF at mid latitudes in winter higher than daytime MUF at mid latitudes in summer
- Contrary to solar zenith angle
- Due to change in ratio of O to N₂ and O to O₂

“Weddell Sea Anomaly”

- In the summer, the F₂ region maximizes during the night, not during the day
- Three worldwide areas



may occur due to drift of electrons from equatorial crests

Single-Day Dayside Enhancements

- Looked at worldwide ionosonde data from 1958-2006, but results reported confined to Europe
- 890 events with MUF > 1.4 times the 30-day centered median value
 - 60-90 degrees of longitude
 - Mostly in the morning local time
 - Mild to moderate geomagnetic activity ($K \leq 4$)
 - Mostly during equinox months at solar minimum
- Helps explain some of my 'how did this happen?' QSOs
 - N2MF to 3B7C on 10M at 1218 UTC in September 2007

Summary

- Cycle 24 has leveled off
 - Is this temporary or are we at the peak?
 - Next several months will be give us a clue
- Cycle 24 has decent chance of two peaks
 - Hopefully prolongs propagation on the higher bands
- 6M F₂ propagation probably restricted to equatorial ionosphere
- Sunspots may decrease, but EUV will likely still be there
- Too early to tell if we're headed for another Maunder Minimum
- F₂ region anomalies give us unusual openings