NVIS

NEAR VERTICAL INCIDENT SKYWAVE

- definitely not DX

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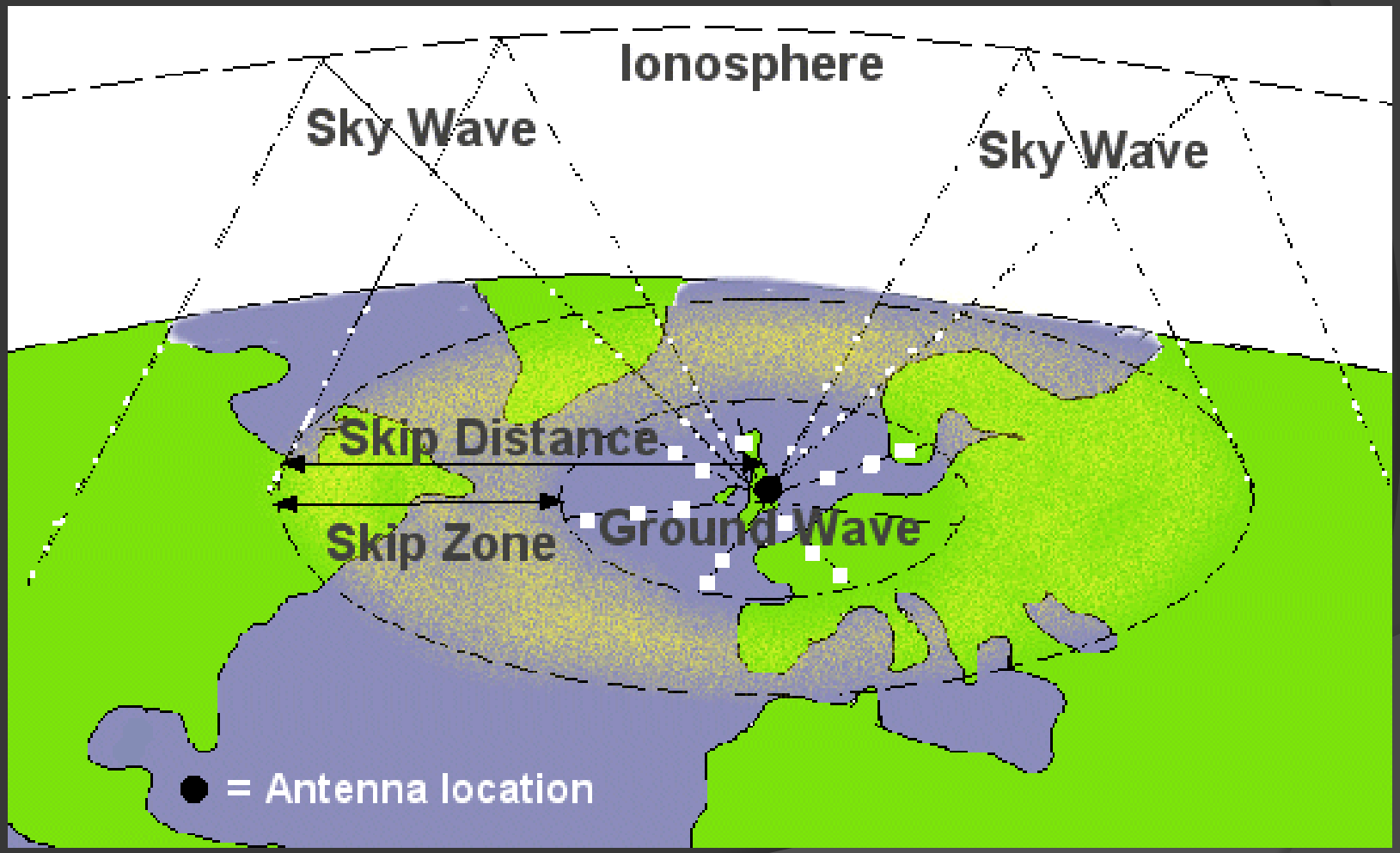
NVIS – a technique, not just the antenna

- NVIS, or Near Vertical Incidence Skywave, refers to a radio propagation mode which involves the use of antennas with a very **high radiation angle**, approaching or reaching 90 degrees (straight up), along with an **appropriate frequency** to establish reliable short range communications

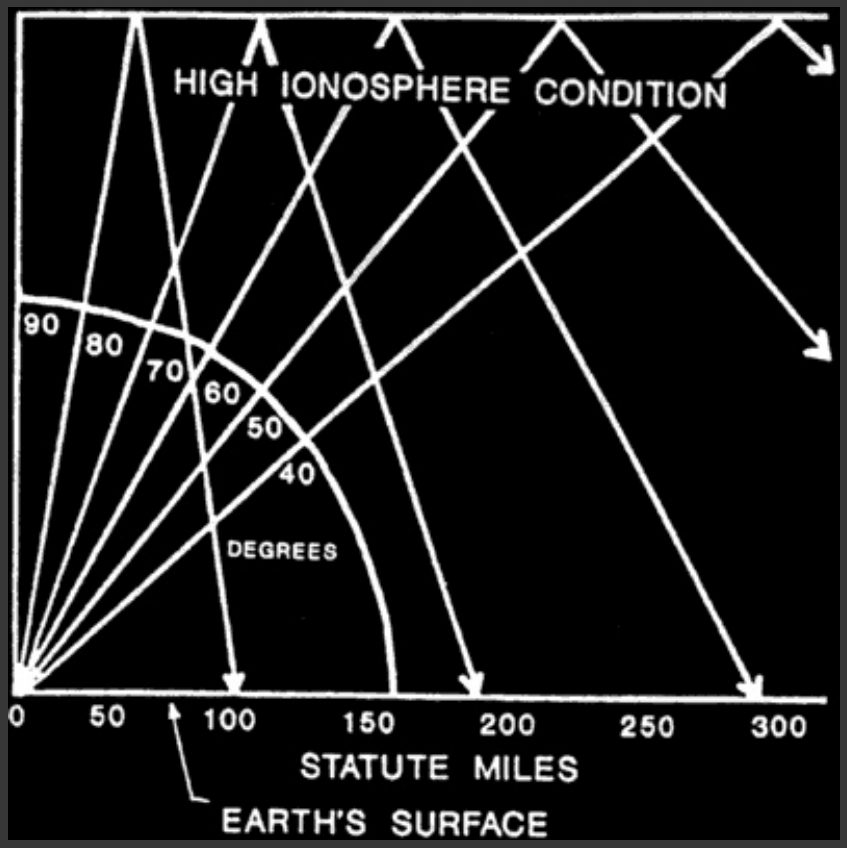
Why NVIS?

- NVIS covers the area which is normally in the skip zone
- Typically too far away to receive ground wave signals, but not yet far enough away to receive sky waves reflected from the ionosphere.

Skip – near or far?



Takeoff angle matters



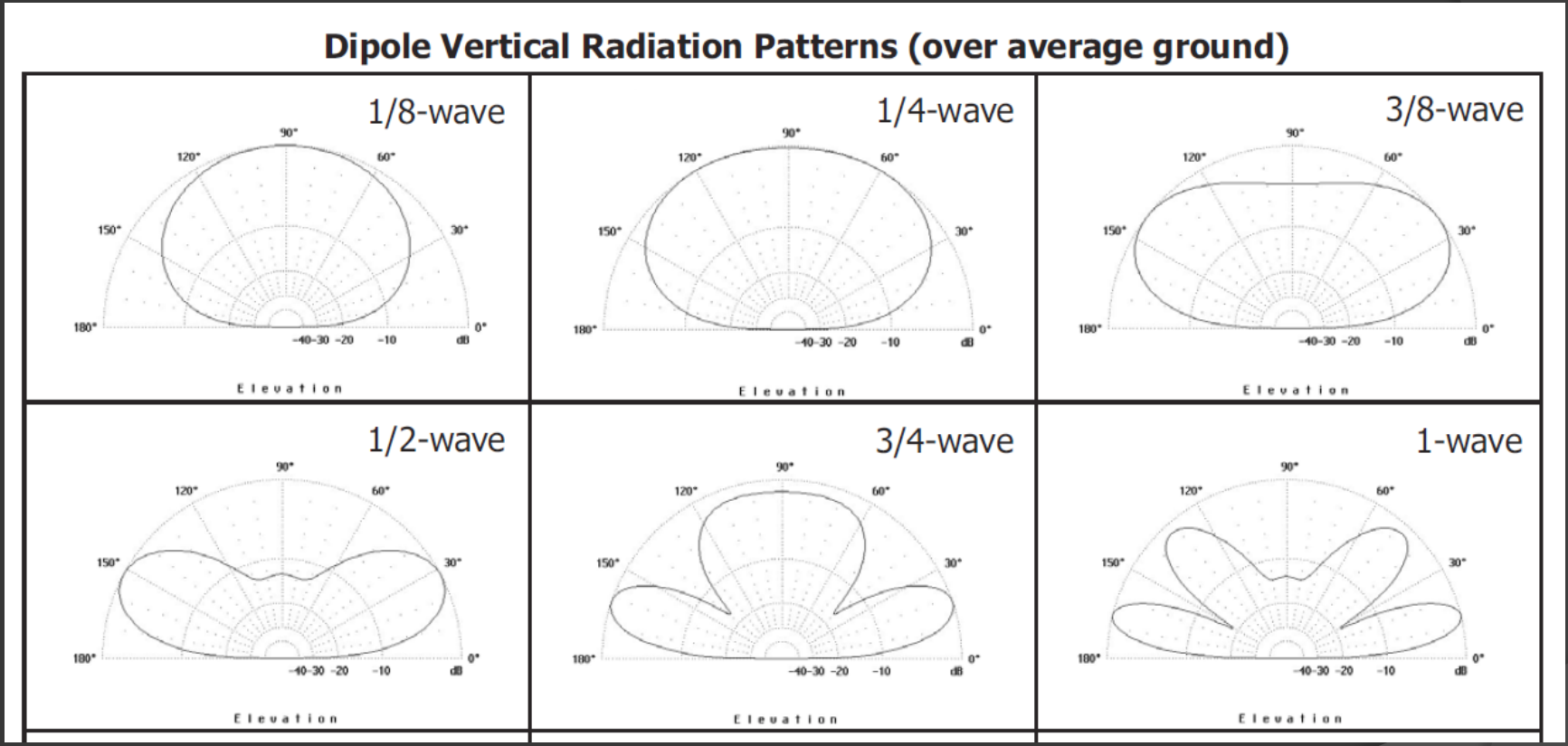
0 to 500 miles coverage requires take off angles of 40 – 90 degrees.

(ARRL Handbook)

Everyone has an angle.....

- Above the **critical angle**, no reflection occurs
- Critical angle varies with frequency
  Higher frequencies = lower critical angles
- High-angle /high frequency signals do not get ionospheric reflection on the higher bands; they just pass on into space

Takeoff angle vs Antenna Height

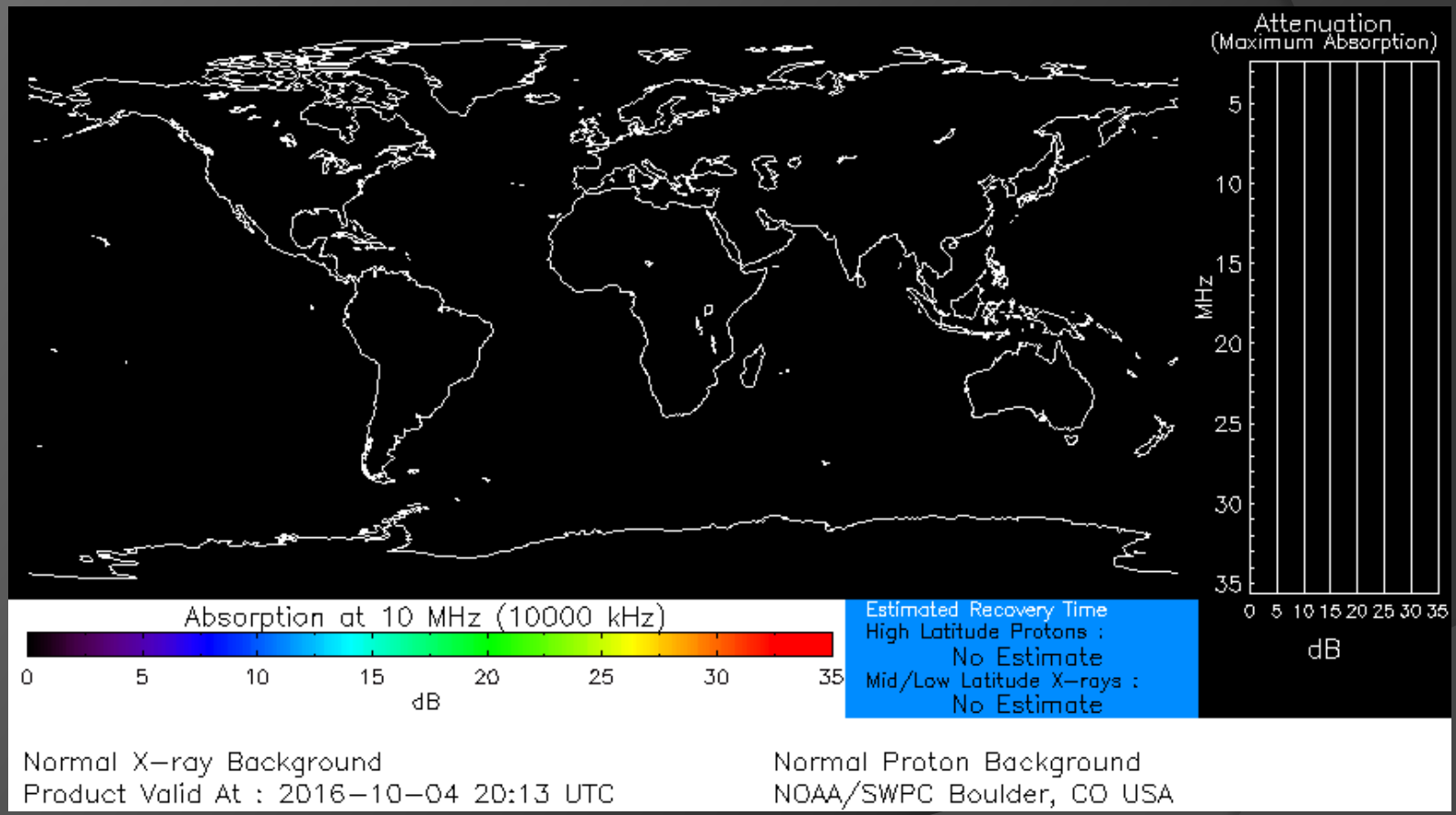


http://www.mapleleafcom.com/PDFs_Downloads/DipolePatternsHeight.pdf

Which layer?

- The Ionosphere – D, E, F1 & F2 layers
- D and to a lesser extent, E, attenuate and absorb lower frequency signals during the day
- F layer is important – We need to know the characteristics of F2 layer – The Critical Frequency (foF2) or Maximum Usable Frequency (MUF) as this one reflects our signals
- Optimum frequency for NVIS work is just below MUF

D Level Absorption



Which band to use?

- Typical frequency ranges used for NVIS are usually between 2.0 and 10 MHz. Lowest values during solar minimums.
- Typically 40m for daytime and 75/80m (or even 160m) for nighttime communications, but depends on MUF!
- The 60m band even with it’s power & antenna limitations can be effective using NVIS techniques.

Why is the band important?

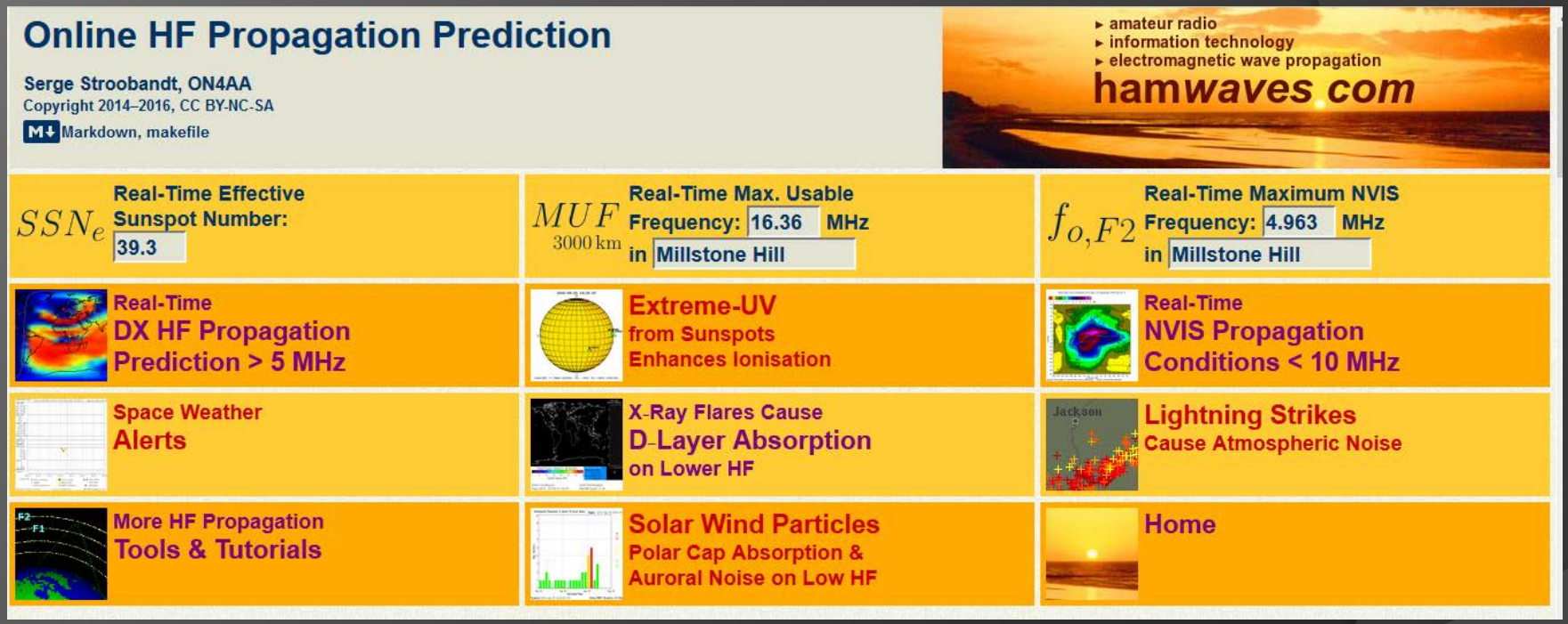
It's all about that the frequency that the F2 layer reflects at any given instant.

One source for a world ionospheric foF2 (MUF) map:

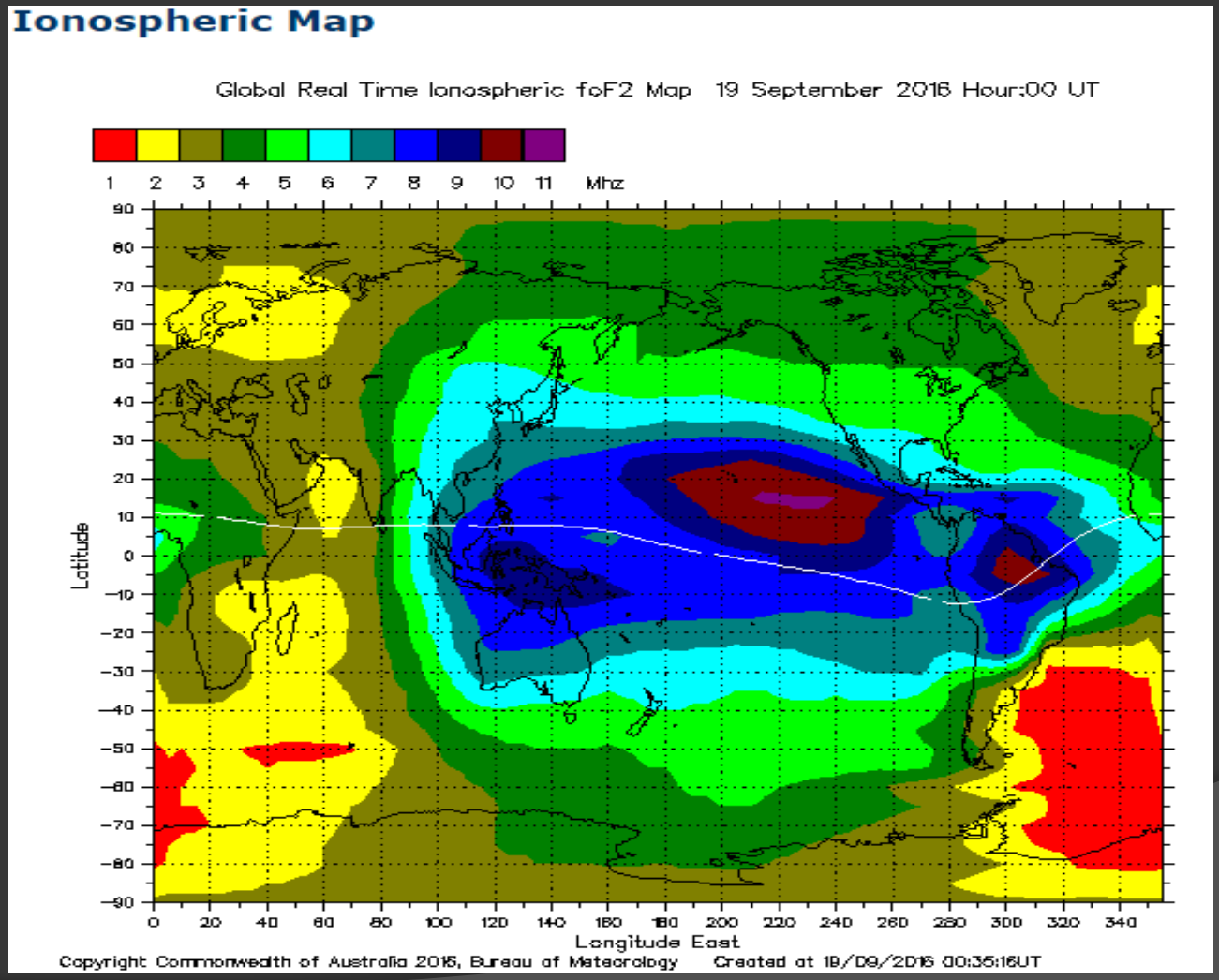
http://www.sws.bom.gov.au/HF_Systems/6/5

Note: This is not the same as 3000KM MUF or other 'DX' MUF maps. (3000 KM MUF is approx 3x the current foF2)

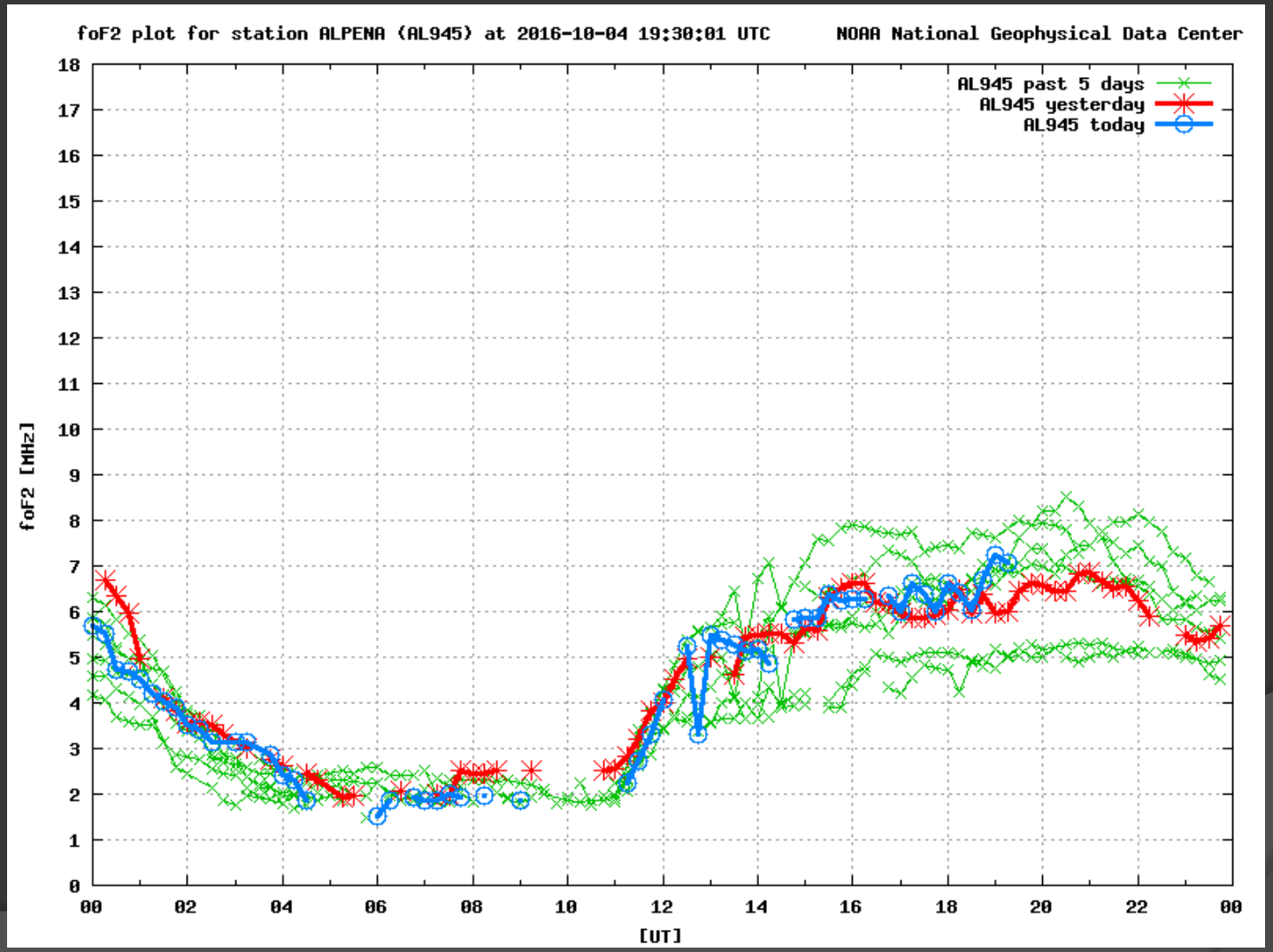
http://www.stroobandt.com/nvis/en/index.html



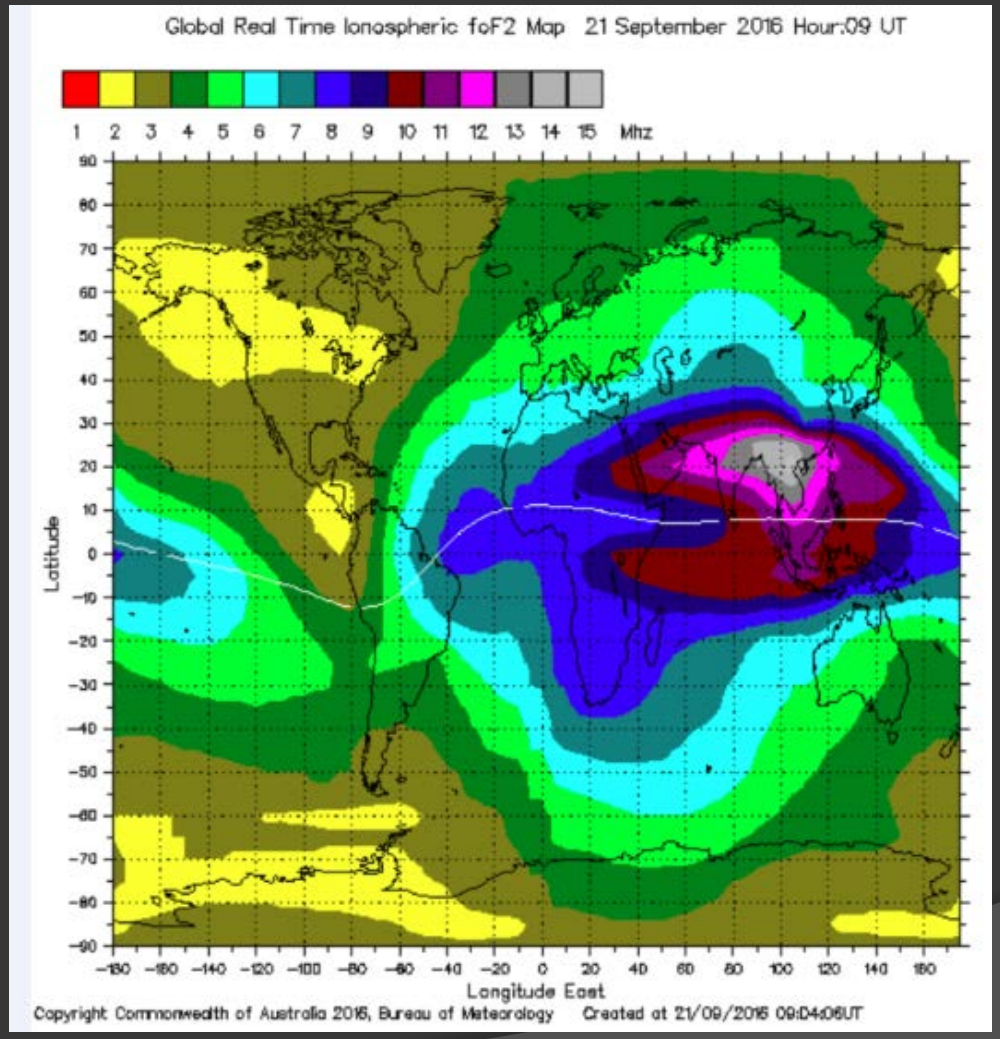
Knowing foF2 or MUF improves your chance to complete the contact



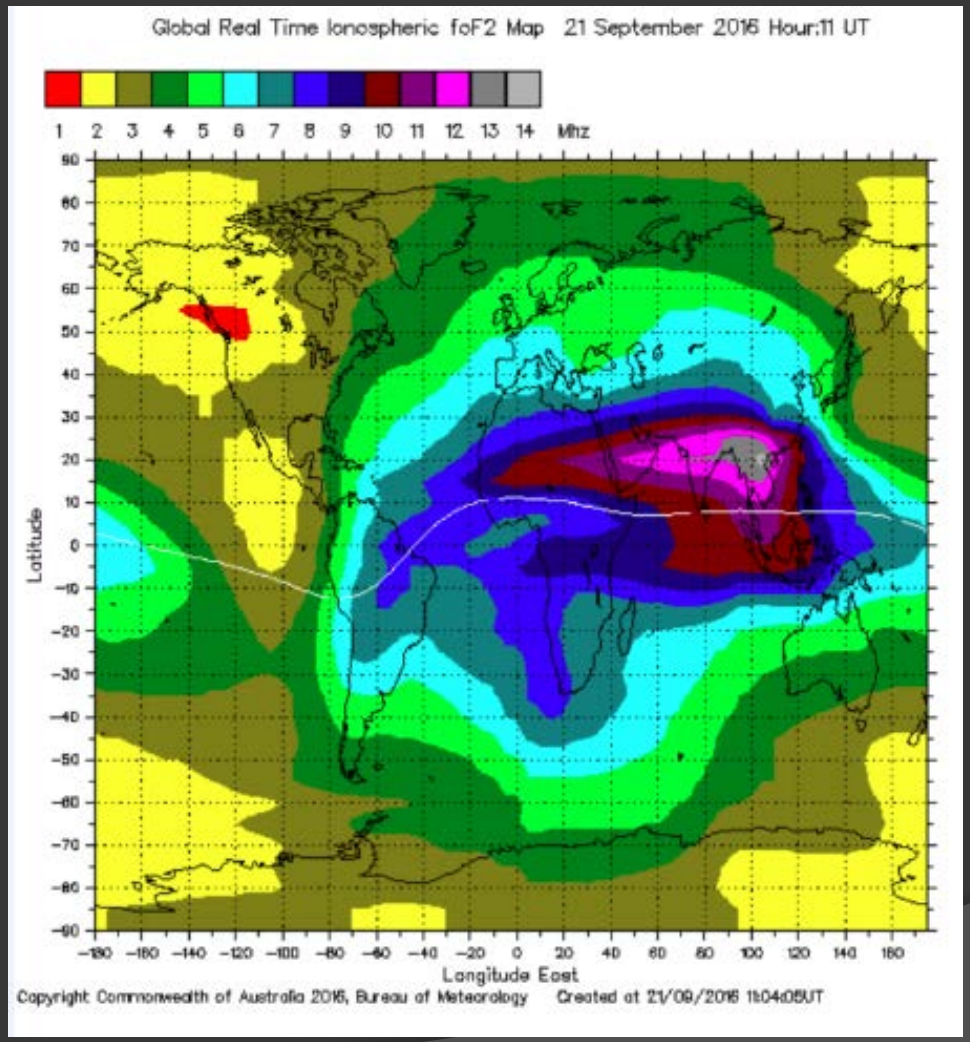
NOAA operates an ionosonde network. This plot is for Alpena MI.



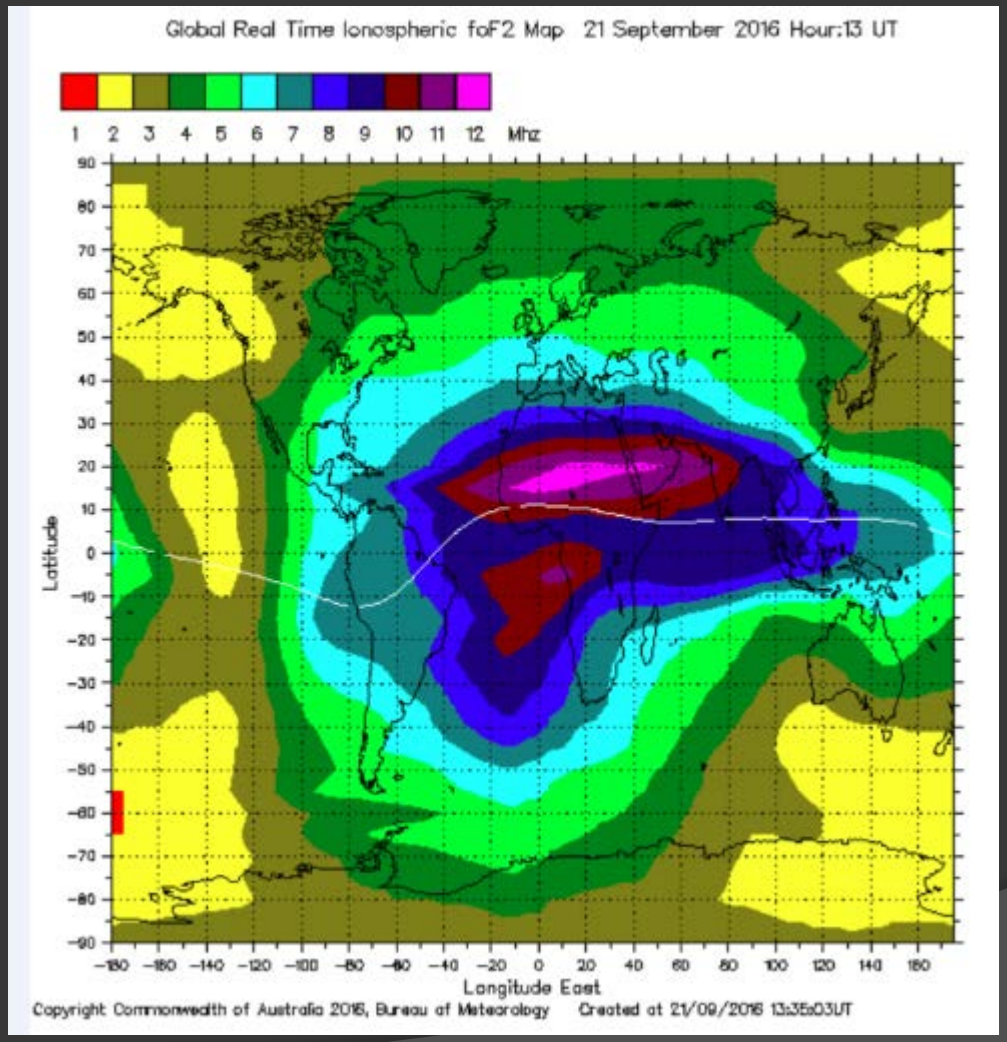
MUF response follows the sun.... 5AM today



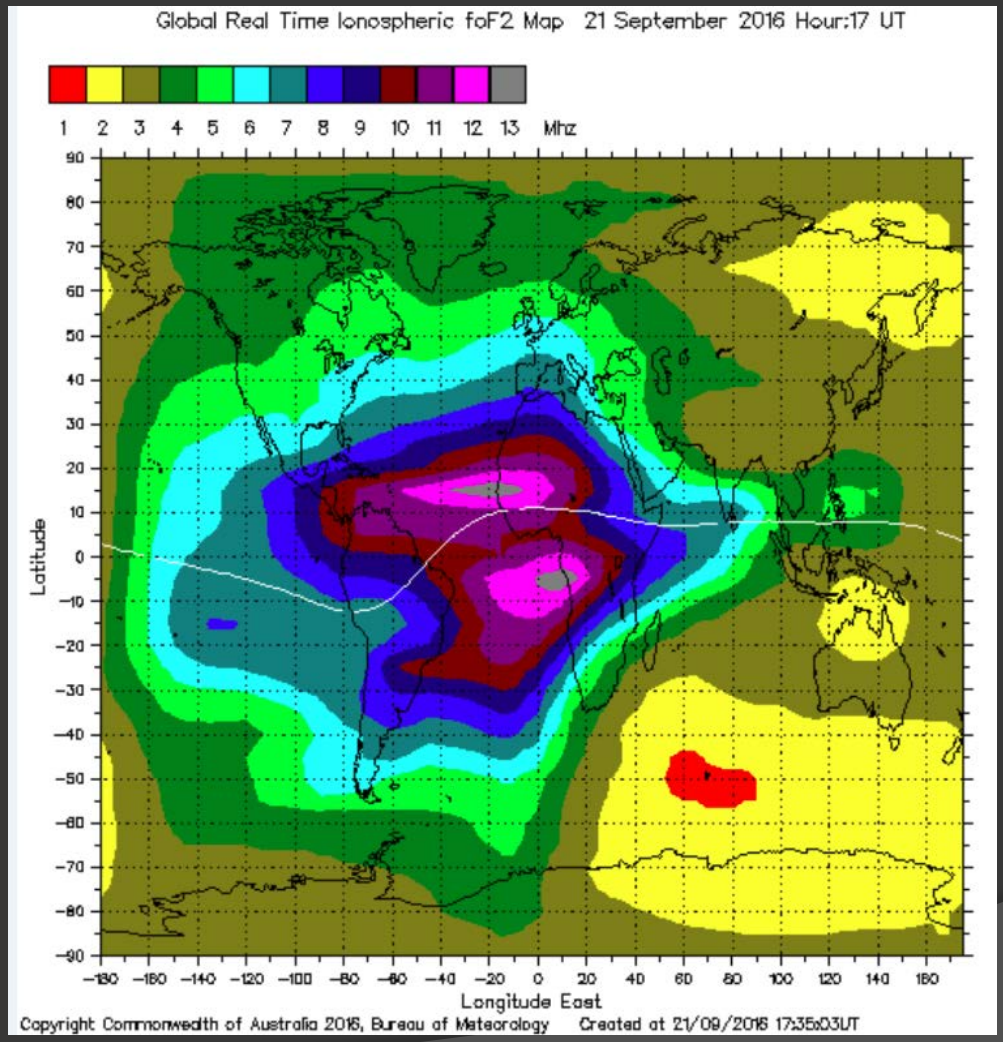
MUF response follows the sun.... 7AM today



MUF response follows the sun.... 9:30 AM today



MUF response follows the sun.... 1:30 PM today



Higher frequency – not higher NVIS performance

- 10- and 15-meter signals are refracted at low angles but not at high angles. So DX = OK, not NVIS.

- 20-meter signals going straight up **might** be reflected, but **only** when sunspots and solar activity are plentiful (need high solar flux and daytime)
  Even then, 20m is seldom optimal for NVIS

Antennas

- For NVIS, antenna height should be at or below 1/4 wavelength above ground
- Closer to ground means less QRM & QRN – but also less signal in and out.
- Some efficiency loss as antenna gets closer to the ground. So QRP may not do the job.

Antenna types – almost anything.

- Resonant dipoles
- Non-resonant doublets
- Off-center-fed (e.g., G5RV, Windom)
- Dipoles over reflector systems (e.g., screens)
- Horizontal loops
- Bent-over mobile whips (U.S. Army discovery)
- AS2259 military NVIS antenna

Our proposal for an NVIS ‘event’:

- On Sunday, Oct 16th from 1 – 4PM EDT we propose to have an on air gathering to learn about and test NVIS capabilities with other stations on 40 – 60 – 80 meters.

- We have many clubs interested so far: York, Hamilton, Kingston, Frontenac, Niagara, Kitchener, Georgian Bay, Orillia, Ottawa, Montreal, and others.

Our proposal for an NVIS ‘event’:

- Frequencies +/- QRM
  - Phone:

    3.700-3.750

    5.357 (note: USB for 60M, vfo tuning)

    7.06-7.07

- Identifier:

  CQ NVIS Ontario “call sign”

Other resources and thoughts

- Ohio sponsored an NVIS event on April 23 earlier this year. Generally the same goals as we have. Try antennas, modes and frequencies to become more effective at communicating locally with HF. The plan is to do it next year as well. (search Stan Broadway N8BHL on arrl.org)

- http://www.ngdc.noaa.gov/stp/IONO/rt-iono/realtime/AL945_foF2.png
- www.arrl.org/**nvis**
- http://www.sws.bom.gov.au/HF_Systems/6/5
- en.wikipedia.org/wiki/Near_vertical_incidence_skywave
- http://www.w8ji.com/nvis_n_v_i_s_antenna.htm
- https://ve3xr.wordpress.com/ (Peel Amateur Radio Club Site)