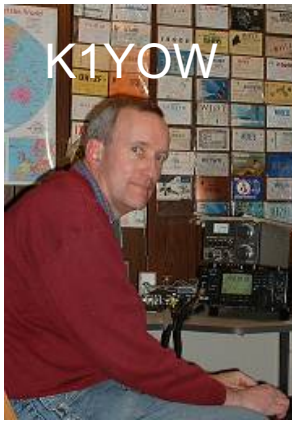


Upper Level Lows and Six Meter 50 Mhz Es: A Citizen Science Investigation

Joseph A. Dzekevich, K1YOW@ARRL.NET

Presented by Phil Erickson, W1PJE@ARRL.NET

Outline

I. Introduction

II. What Started This Investigation?

III. Sporadic E (Es)

IV. Es and 6M Low Pressure Observations using Amateur Radio

V. Conclusions

K1YOW

- Joe Dzekevich, FN42, Harvard, MA, USA
- Retired Reliability Engineering Fellow
- Licensed in 1962
- Station is modest: TS-950SG or IC-746-PRO, 100W, into a 7 band OCF dipole
- Interests: Propagation (Es, F2, Geomagnetic Storms, PCA, Tropo Ducts, Gray Line, Auroras), Astronomy, Science
- Used CRPL Predictions way back in the 60's.
- Email: K1YOW@ARRL.NET

W1PJE

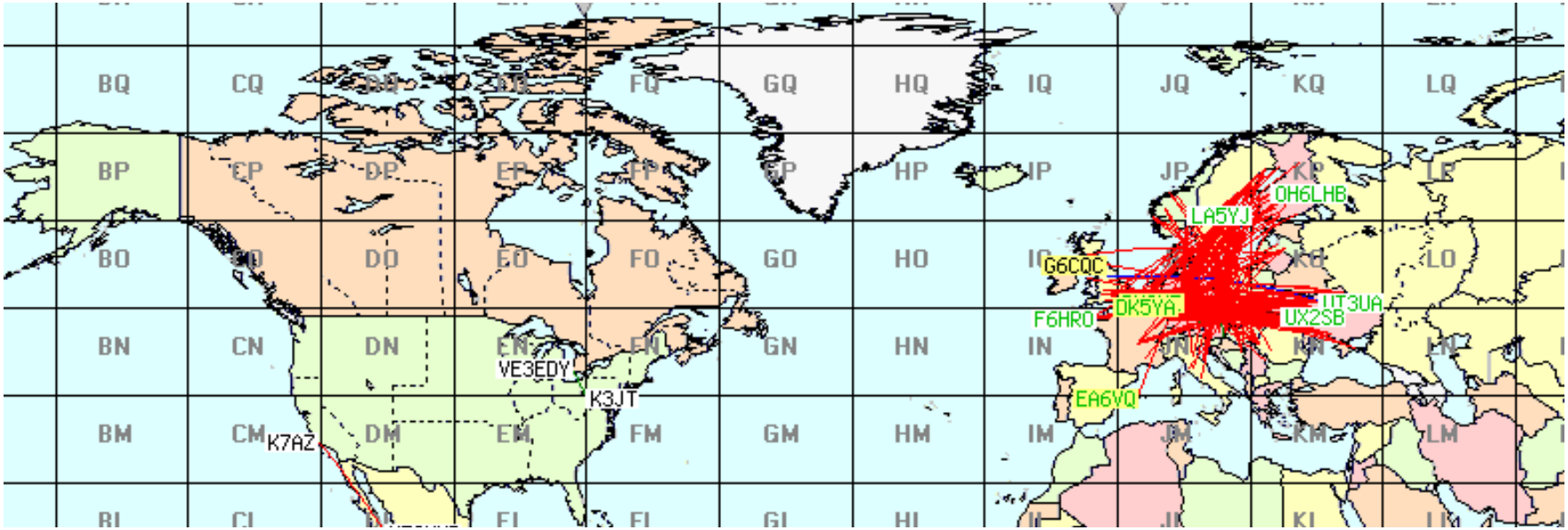
- Dr. Philip J. Erickson, FN42, Westford, MA, USA
- Assistant Director, MIT Haystack Observatory
- Ionospheric / Radio Scientist (Licensed 2016)
- Nashoba Valley Amateur Radio Club (NVARC)
- Forging links between radio amateurs and professional ionospheric researchers
- Email: W1PJE@ARRL.NET

MIT HAYSTACK OBSERVATORY

NVARC Nashoba Valley Amateur Radio Club


MIT Haystack Observatory Complex
Westford, Massachusetts
Established 1956
Haystack Observatory
Radio Astronomy
Atmospheric Science
Space Surveillance
Radio Science
Education and Public Outreach
Millstone Hill
Observatory
Millstone Hill Radar
Firepond Optical
Facility

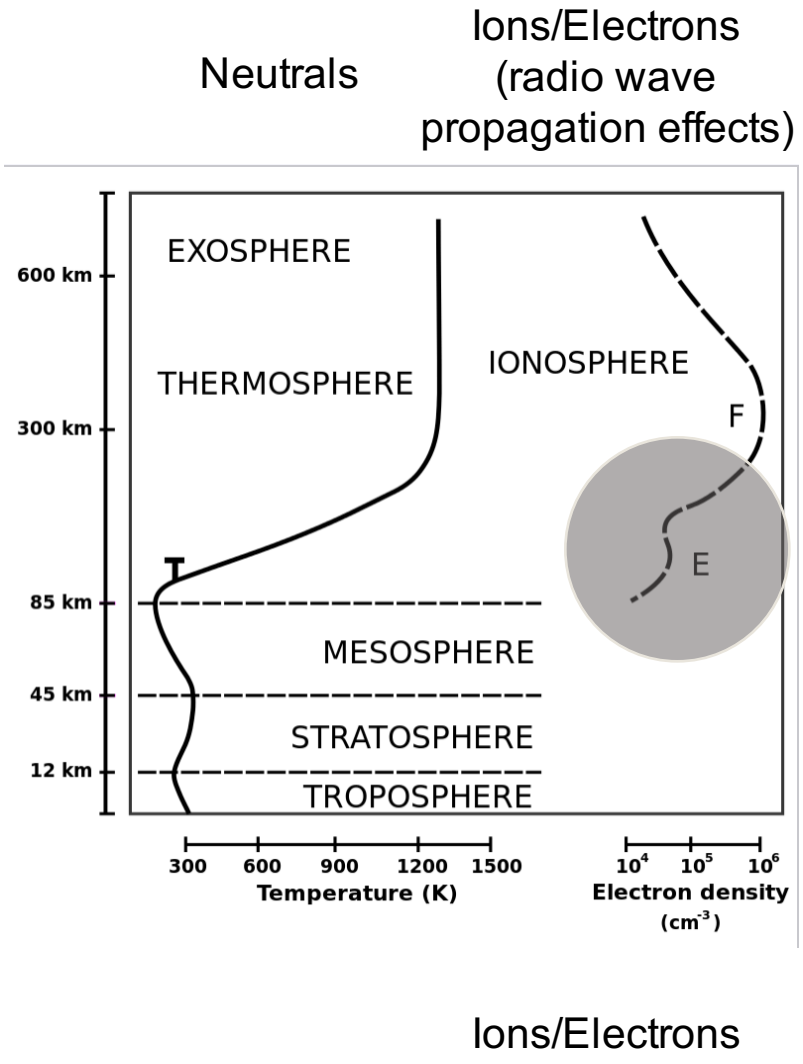
What Started This Investigation?



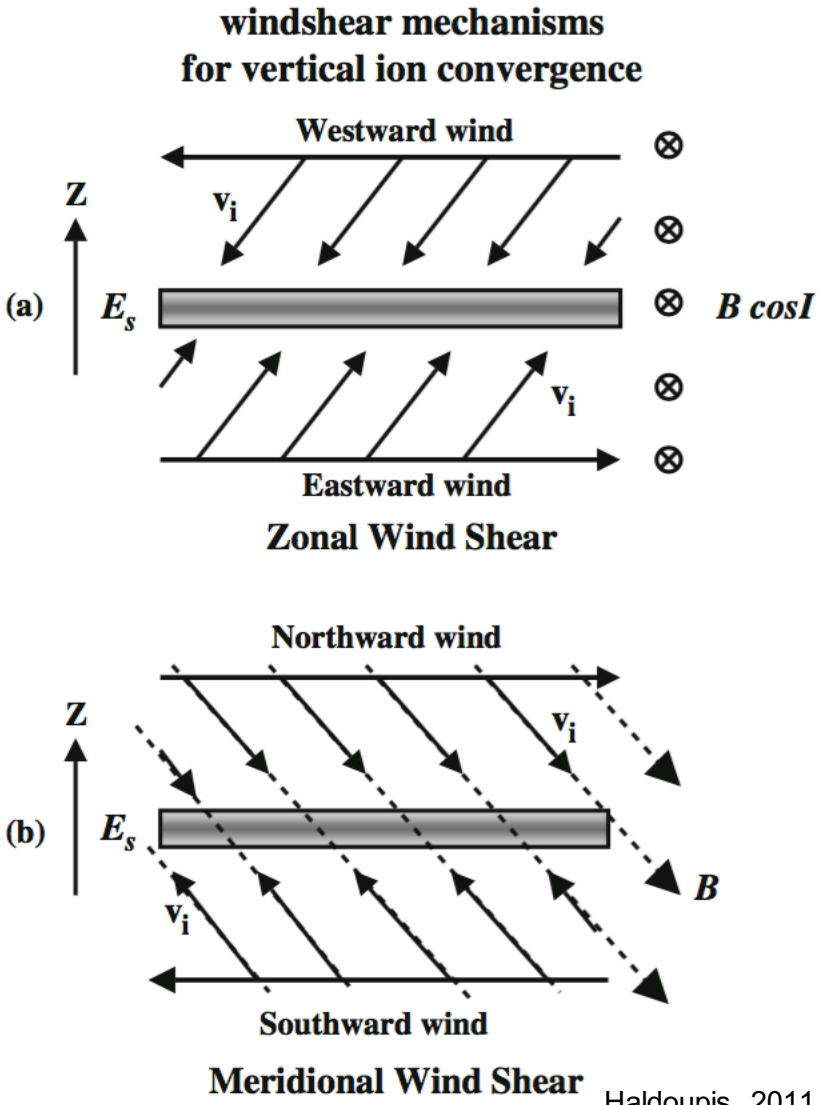
Typical 6M Day for the Spring of 2016
European 6M Es, NA – Nothing!
What then are the causes of Es?

Sporadic E (Es)

- Sporadic E layers are phenomena of the ionospheric E region.
- The Es layers appear mainly at daytime in mid latitudes in the summer hemisphere.
- Sporadic E layers = enhanced electron density compared to the background ionization.
- They occur between 90 and 120 km altitude with a thickness of usually 0.5 – 5.0 km and a horizontal extent of 10 – 1000 km.



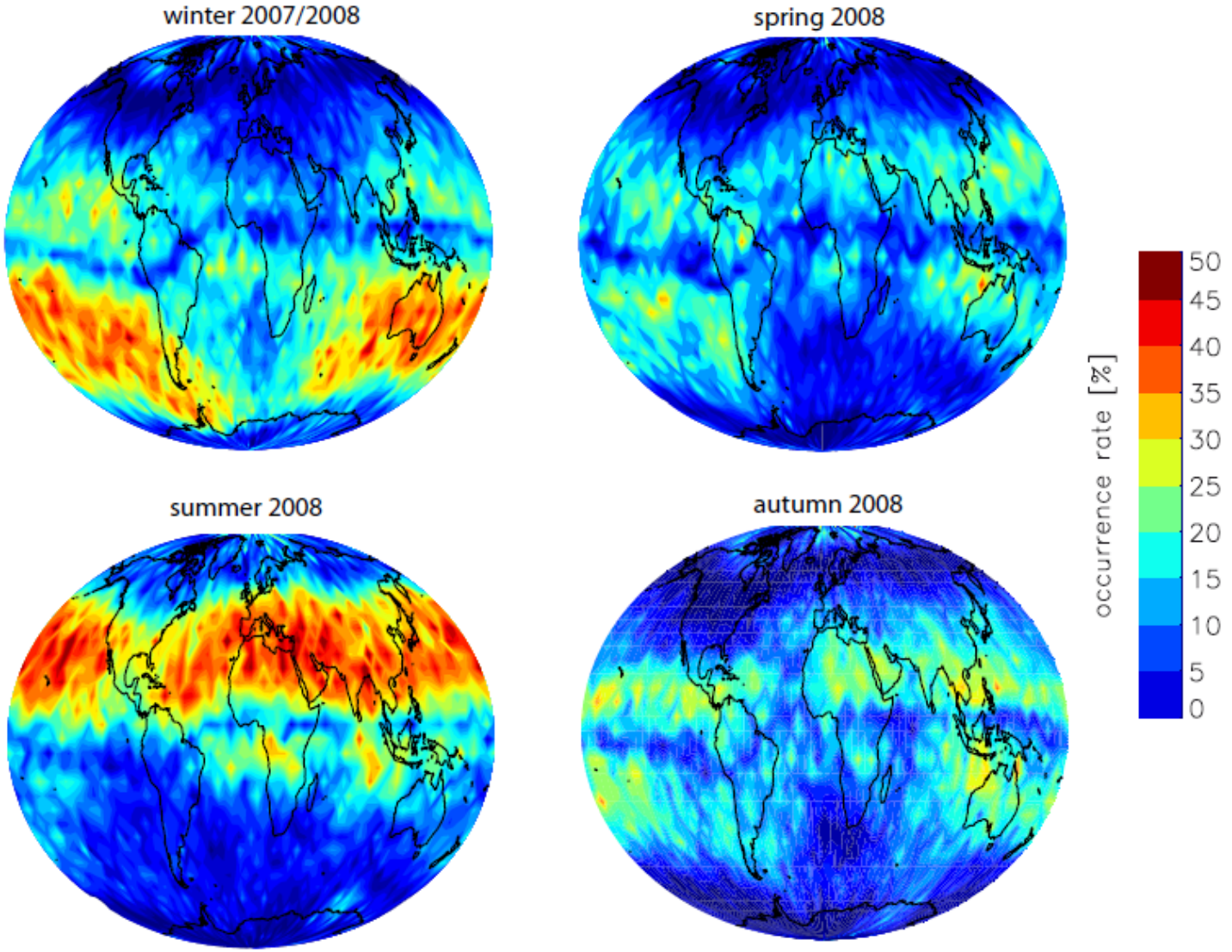
Sporadic E: Related to Neutral Wind



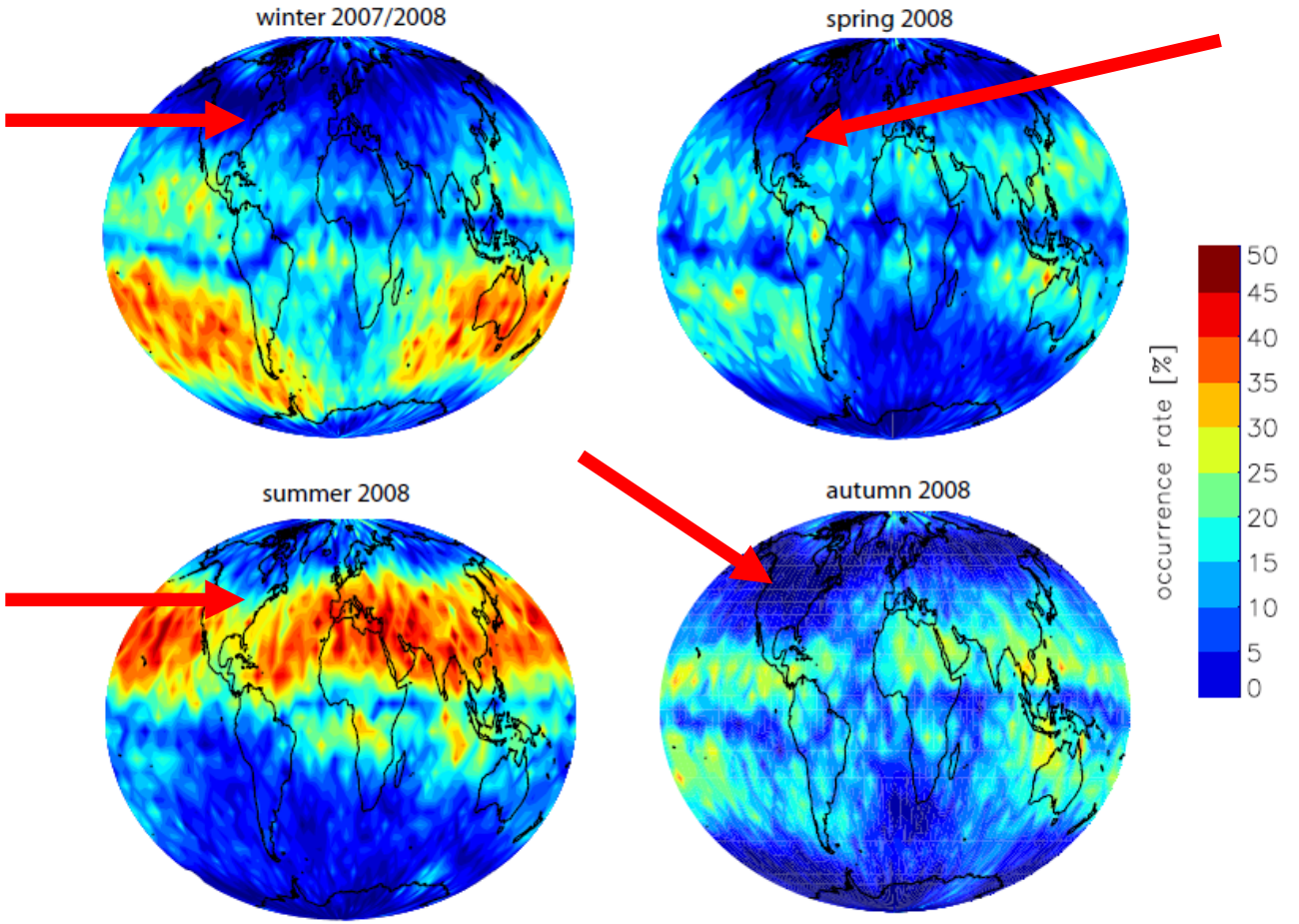
Haldoupis, 2011

- Neutral winds at 100 km altitude can have strong shears
- Meteoric dust input (Fe+, Mg+, K+): winds can pile up ions into thin layers
- Electrons follow = sporadic E: source of skip
- Depends critically on neutral wind patterns (variable) – SpE most often seen in summer

Global Es: Red/Yellow = Es Areas



North America is Not an Es Hot Spot!



What Else is Going On?

- If then North America is not an Es hot spot, then why do we see good Es at times?
- Amateurs over the years have also noticed that Es openings seem to happen near upper level TROPOSPHERIC (neutral atmosphere) disturbances, as well as the regular Es openings.

K1YOW's Hypothesis

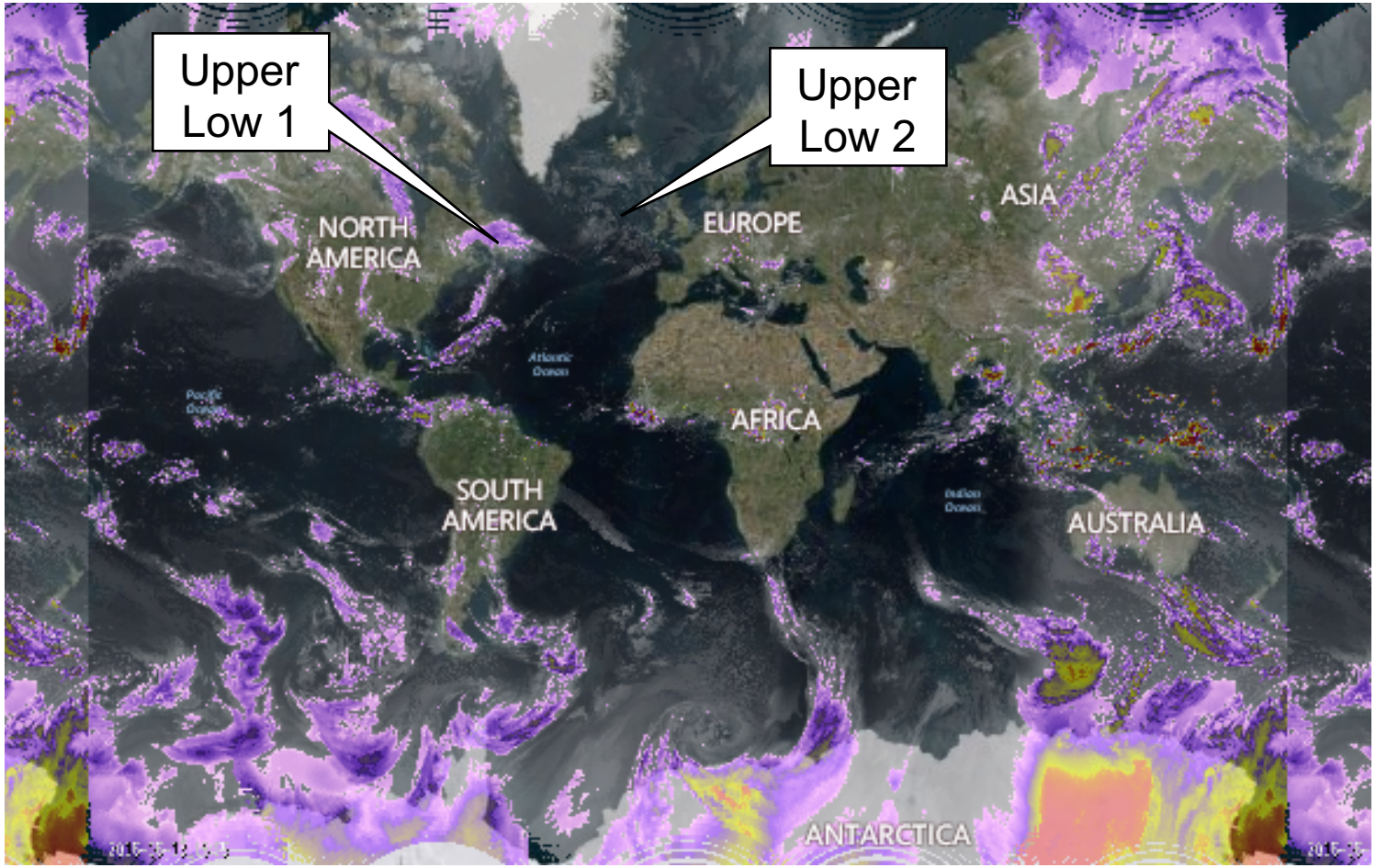
- The hypothesis to be tested is: besides the normal random Es, Es openings are enhanced by strong neutral atmospheric disturbances like hurricanes and upper level low pressure systems at mid latitudes.
- Cause: lower atmosphere low pressure systems may be affecting upper level tidal wind shear.
- Upper atmosphere wind shears: active research area in the professional community.
- Can we see this effect using Amateur Radio?

June 13 2016

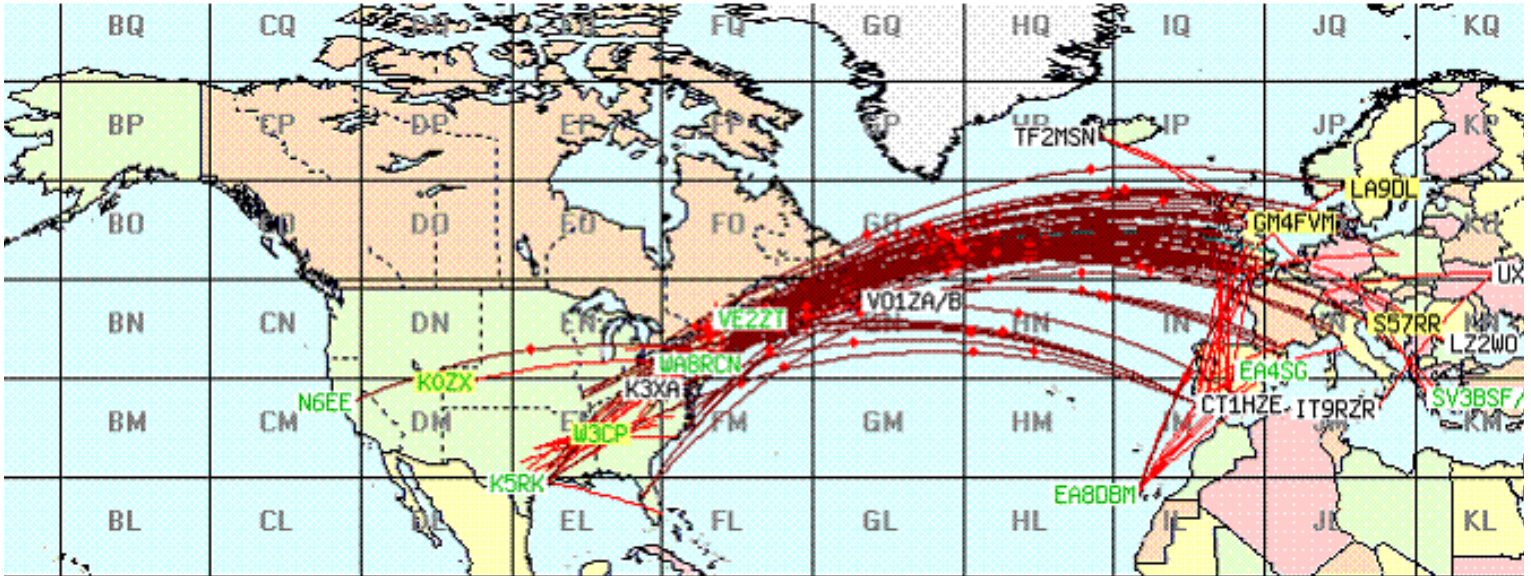
Two Upper Level Lows during 50 Mhz
Trans-Atlantic Es Double Hop

Note: Views are surface level winds just to make things easier to see. Viewing high level winds make things very hard to see what is going on.

June 13, 2016 – Two Atlantic Storms

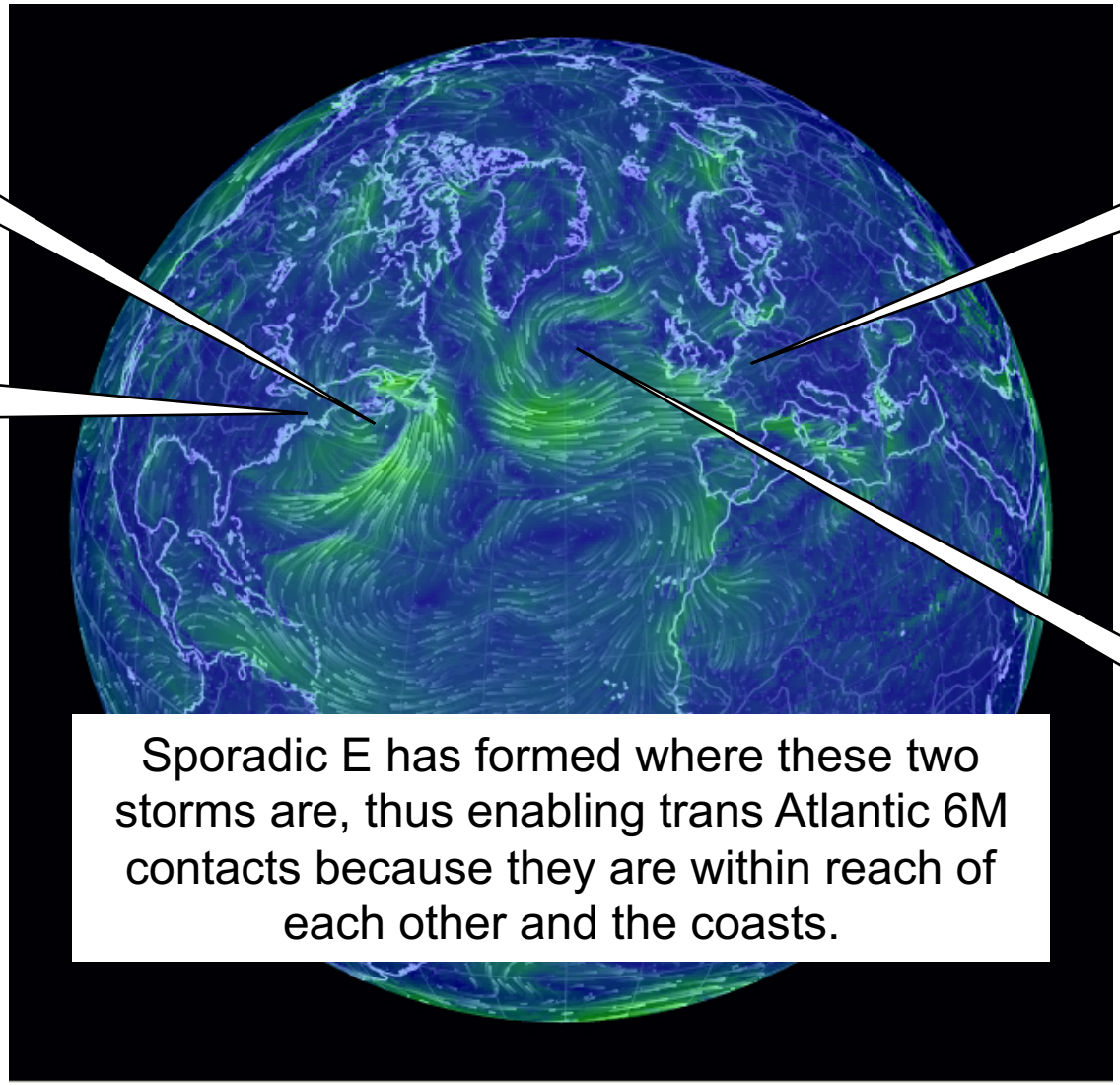


June 13, 2016 6 Meter Double Hop Trans Atlantic Es DX Map



The VHF Gods Were Smiling on us this Day!

June 13, 2016 – Another View



Sporadic E has formed where these two storms are, thus enabling trans Atlantic 6M contacts because they are within reach of each other and the coasts.

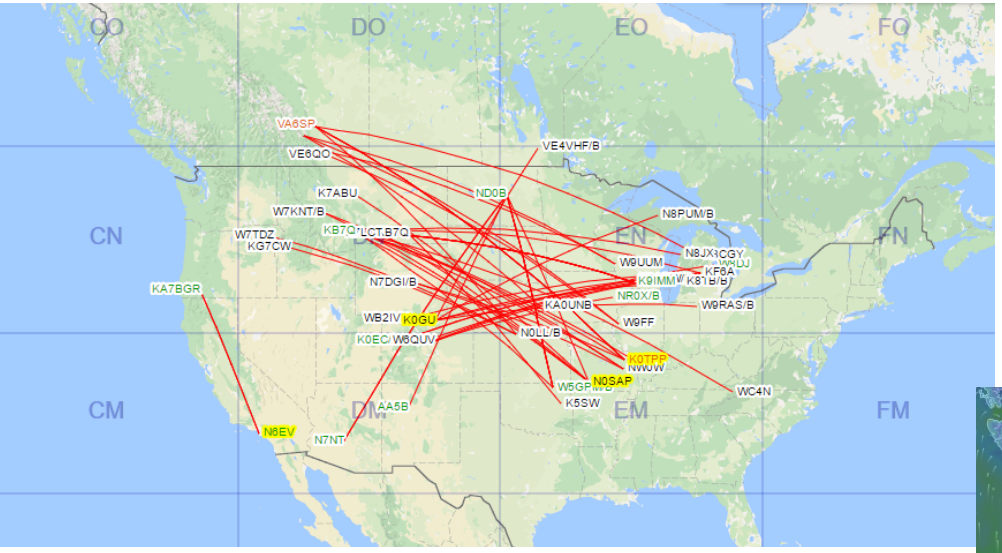
K1YOW on 6M in FN42 worked:

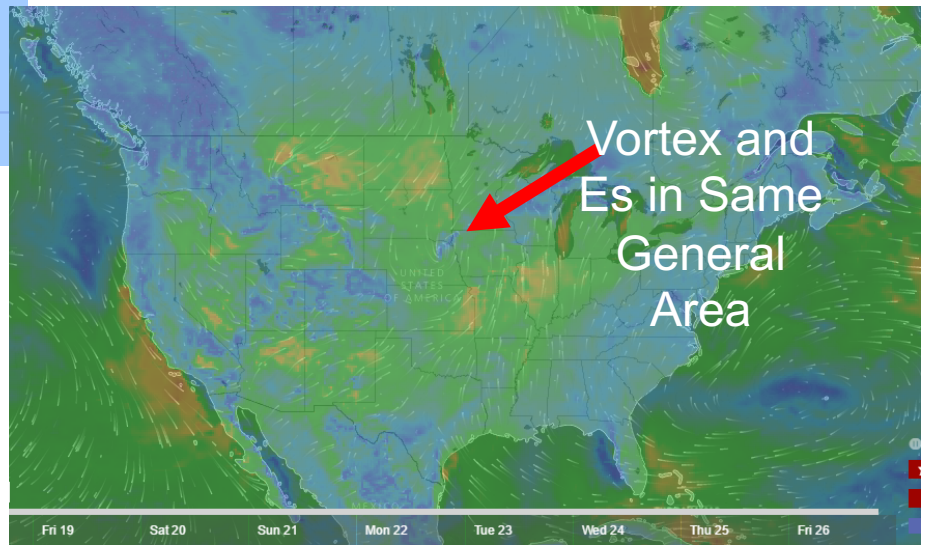
- EA7AH in IM67 on CW
- G4RRA in IO80 on CW
- EI4DQ in IO51 on CW
- One day earlier (VHF contest) I worked 35 stations in 2.5 hours in the 1,2,3,4,5,7,8,9 and 0 call districts on 6M. I did not call a single CQ.
- All using 100W and a 7 band Buckmaster OCF horizontal dipole strung in some white pines 1.5 stories up.
- So: We small guns do have a chance under good conditions

(W1PJE: other examples exist but omitted here for time)

Happening again in 2017..

05/17/2017 21:32 GMT 6M





K1YOW Ham Radio
Citizen Science Conclusions

- Es is not random – just many variables – still cant predict it – yet!
- Upper level low pressure systems are likely affecting high level tidal wind shears, forming Es via T-Storms, Hurricanes, Strong Fronts.
- It is looking like we can use Amateur Radio to see and document these occurrences.
- North America is not the best Es spot in the world.
- Hams should not pray for hurricanes and storms just so they can work 6M DX!!!

Still In Mourning

Reference Links

- http://www.dxmaps.com/spots/map.php
- http://www.accuweather.com/en/world/satellite
- https://earth.nullschool.net/
- https://www.windyty.com/?42.753,-71.584,4
- http://gfzpublic.gfz-potsdam.de/pubman/item/escidoc:23022:5/component/escidoc:23021/1009.pdf
- **A statistical analysis on the relationship between thunderstorms and Sporadic E Layer over Rome** V. BartaP1,2P, UC. ScottoUP3P, M. PietrellaUP3P, V. Sgrigna P4, G. SátoriP2P, L. Conti 5
- F-Region Propagation and the Equatorial Ionospheric Anaomaly, Jim Kennedy, K6MIO/KH6, QEX Issue No. 299 November/December 2016