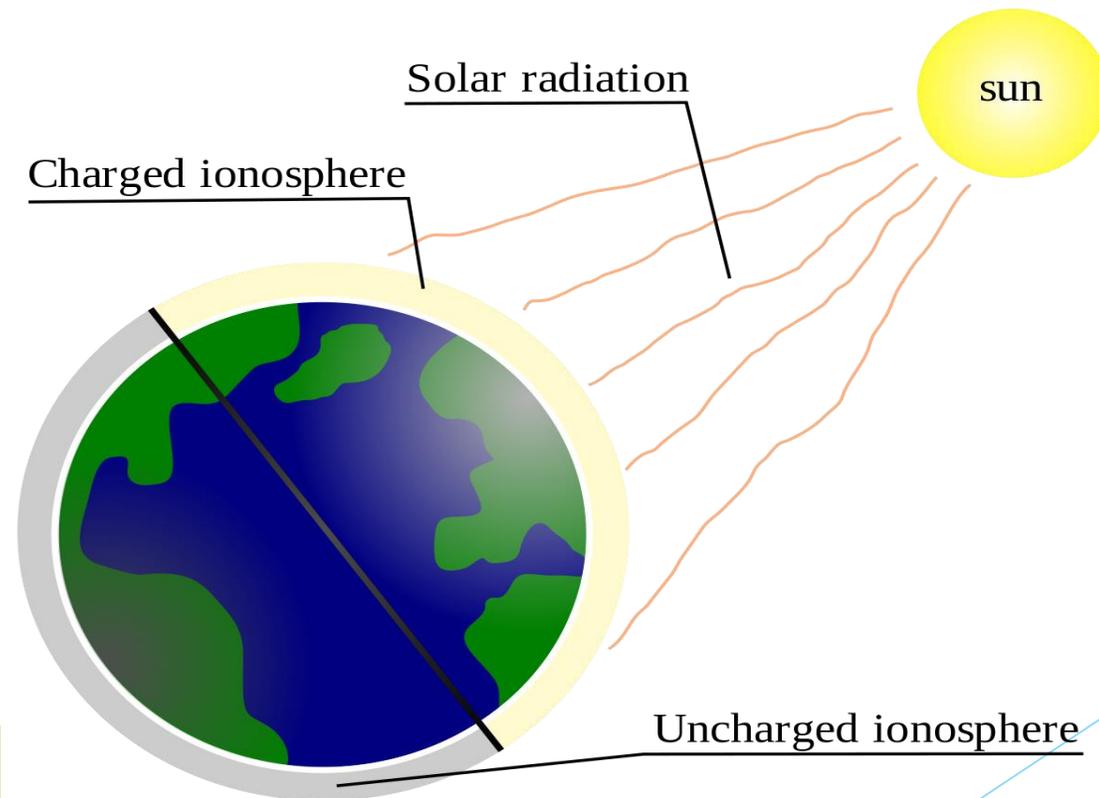


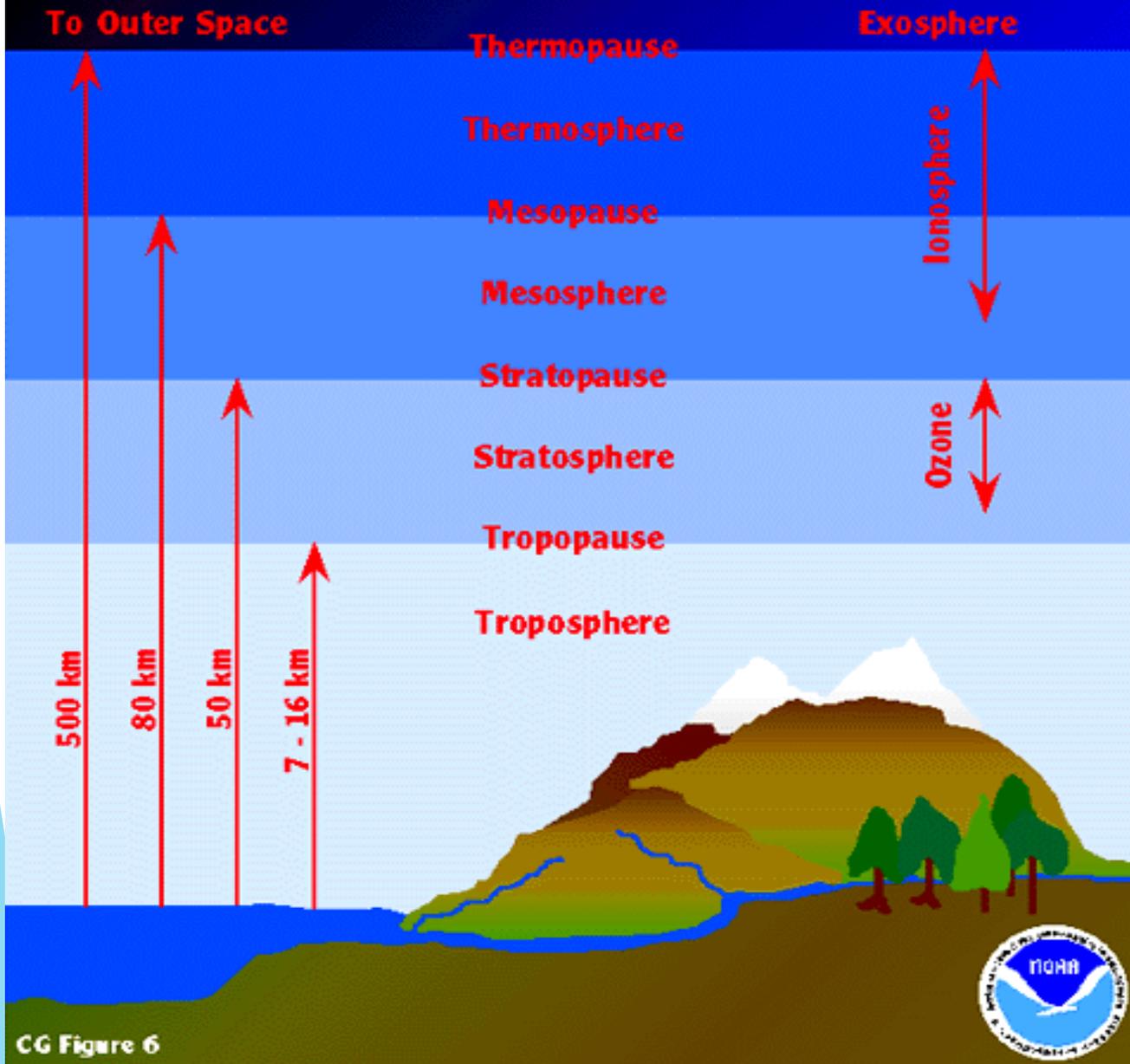
# THE BVARC CONSORTIUM

## THE IONOSPHERE AND ITS AFFECT ON RADIO WAVES



W1YRC Bob and K1GND Jim

# The Layers of the Atmosphere

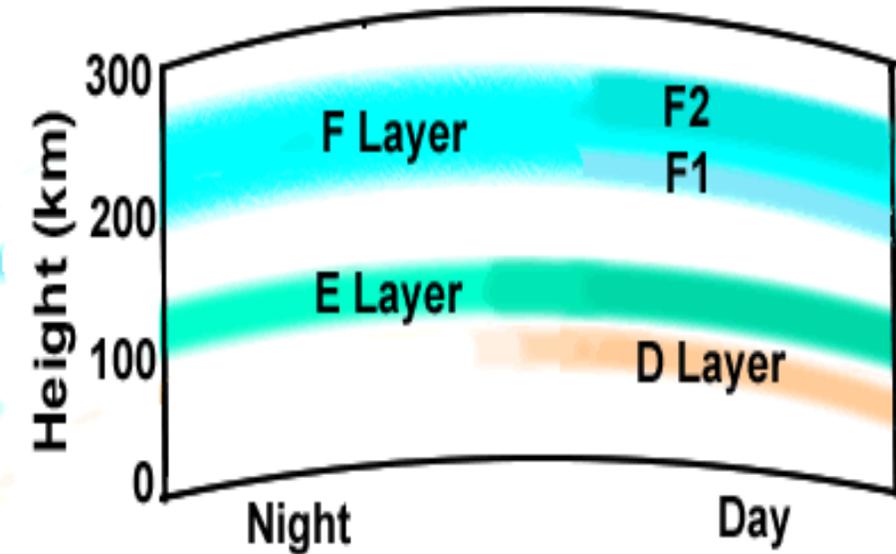


The ionosphere is an electrified atmosphere ranging from 40 to 400 miles above the earth.

You are able to see it sometimes as the Northern Lights. It is charged by the sun and it affects radio waves that strike it.



The D layer is 40 miles up and is the **daylight** layer. It almost disappears at night. The D layer absorbs radio waves between 1 MHz to 7 MHz . These are long waves. All others pass through.



The E layer is also a **daylight** layer and is very erratic. Patches of ionization may cause some surprising reflections on signals in both HF and VHF ranges. The E layer is usually 70 miles above the earth.

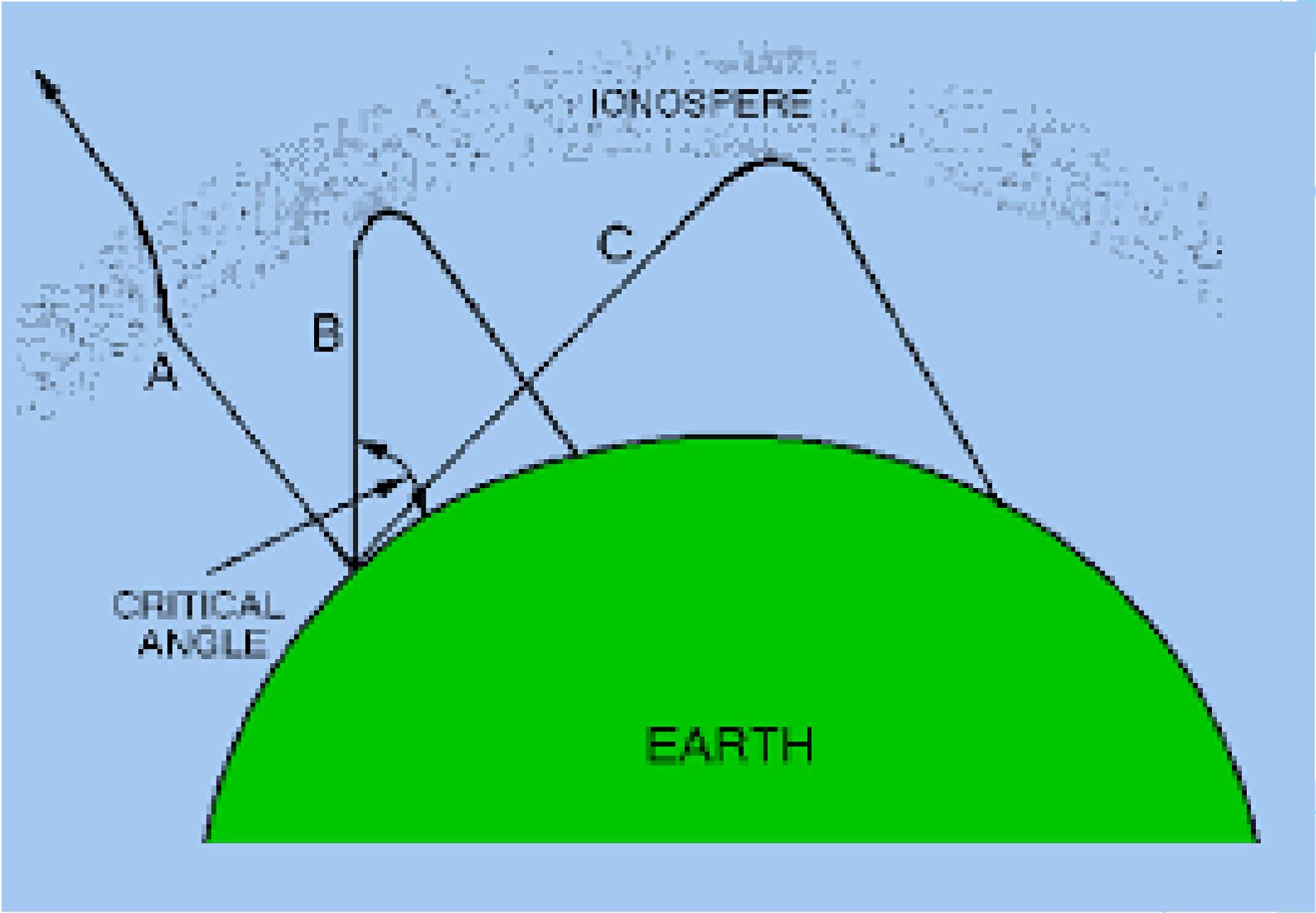
The F1 layer is around 150 miles above earth.

The F2 layer is around 250 miles high. F2 is strongest during summer months.

At night time F1 and F2 combine to be just the F layer and settles in at 180 miles above earth and bends waves between 1 and 15 MHz back to earth.

# Absorption



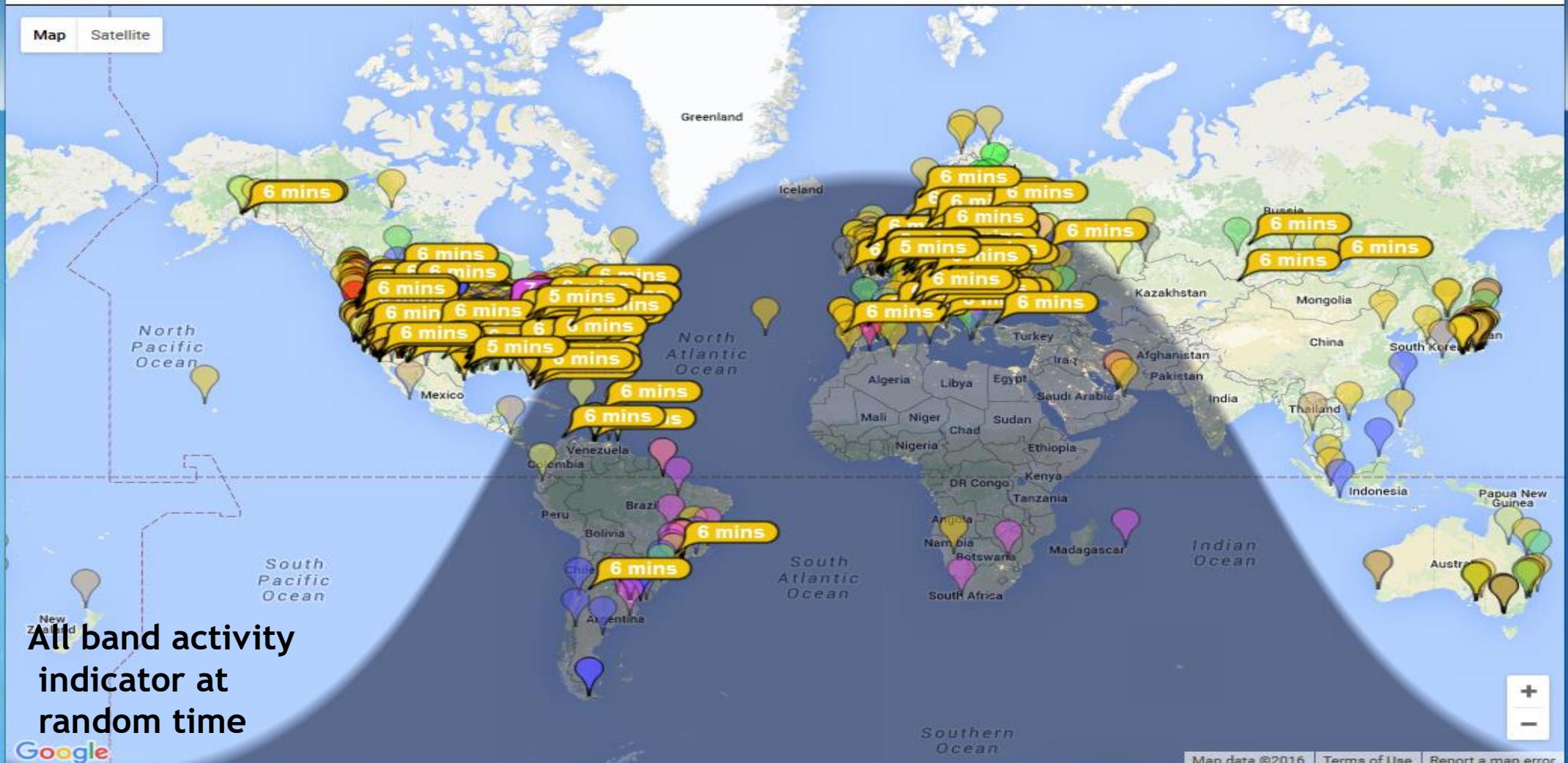


On all bands, show signals, sent/rcvd by the callsign K8JTK using all modes over the last 15 minutes

Display options Permalink

Monitoring K8JTK (last heard 5 mins ago). Automatic refresh in 5 minutes. 144 reception reports for K8JTK are shown as times (show logbook).

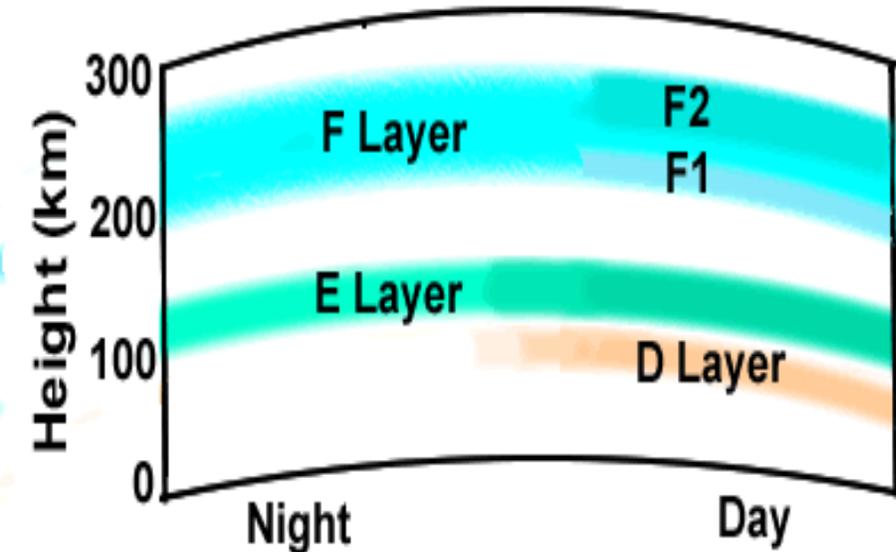
There are 1010 active monitors: 558 on 20m, 106 on 40m, 66 on 30m, 49 on 17m, 47 on 15m, 34 on 6m, 33 on 80m, 11 on unknown, 5 on 10m, 3 on 2200m, 2 on 23cm, 2 on 11m, 2 on 2m, 1 on vlf, 1 on 160m. Legend



All band activity indicator at random time



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At night time F1 and F2 combine to be just the F layer and settles in at 180 miles above earth and bends waves between 1 and 15 MHz back to earth.

# Summing it up

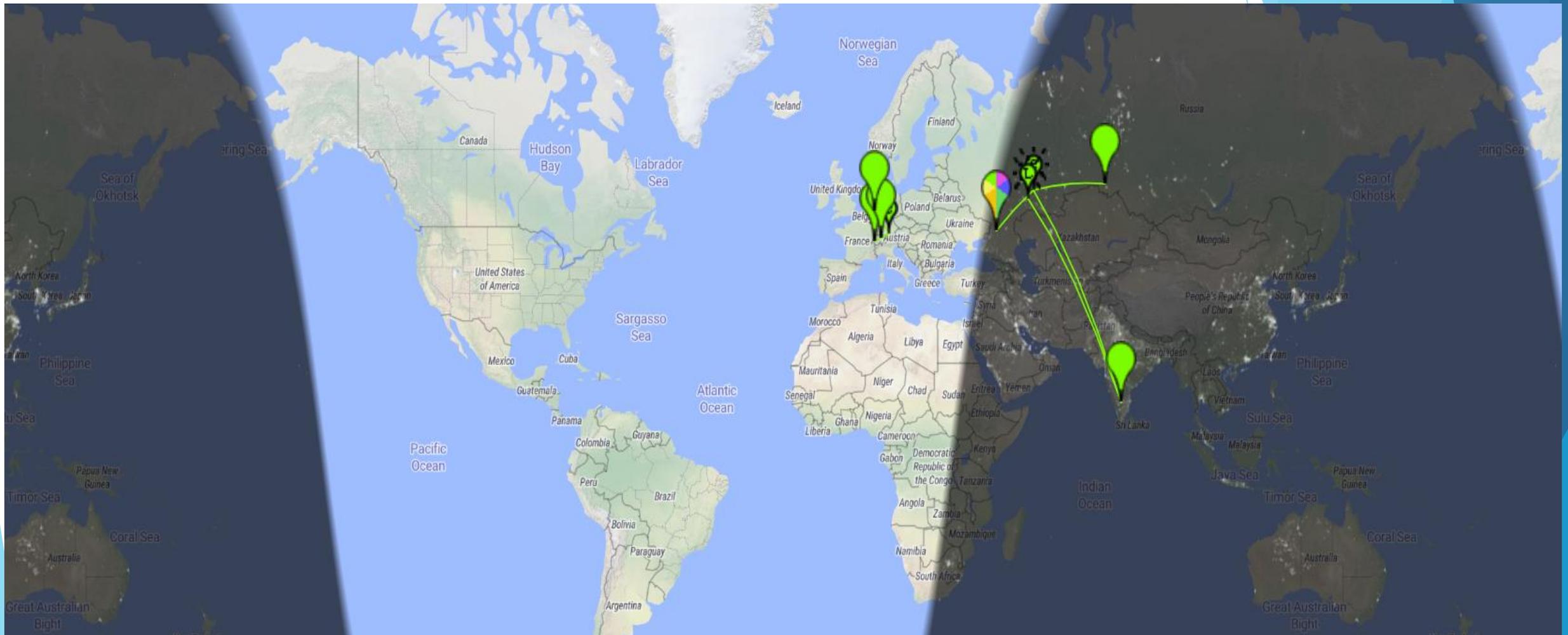
<u>Layer</u>	<u>Distance</u>
D	25-55 miles
E	55-90 miles
F	90-250 miles
F1	90-150 miles
F2	250 miles

*all distances are miles out from earth*

# Propagation Summary by Band

## 1.8-2.0 MHz (160 meters) Top Band.

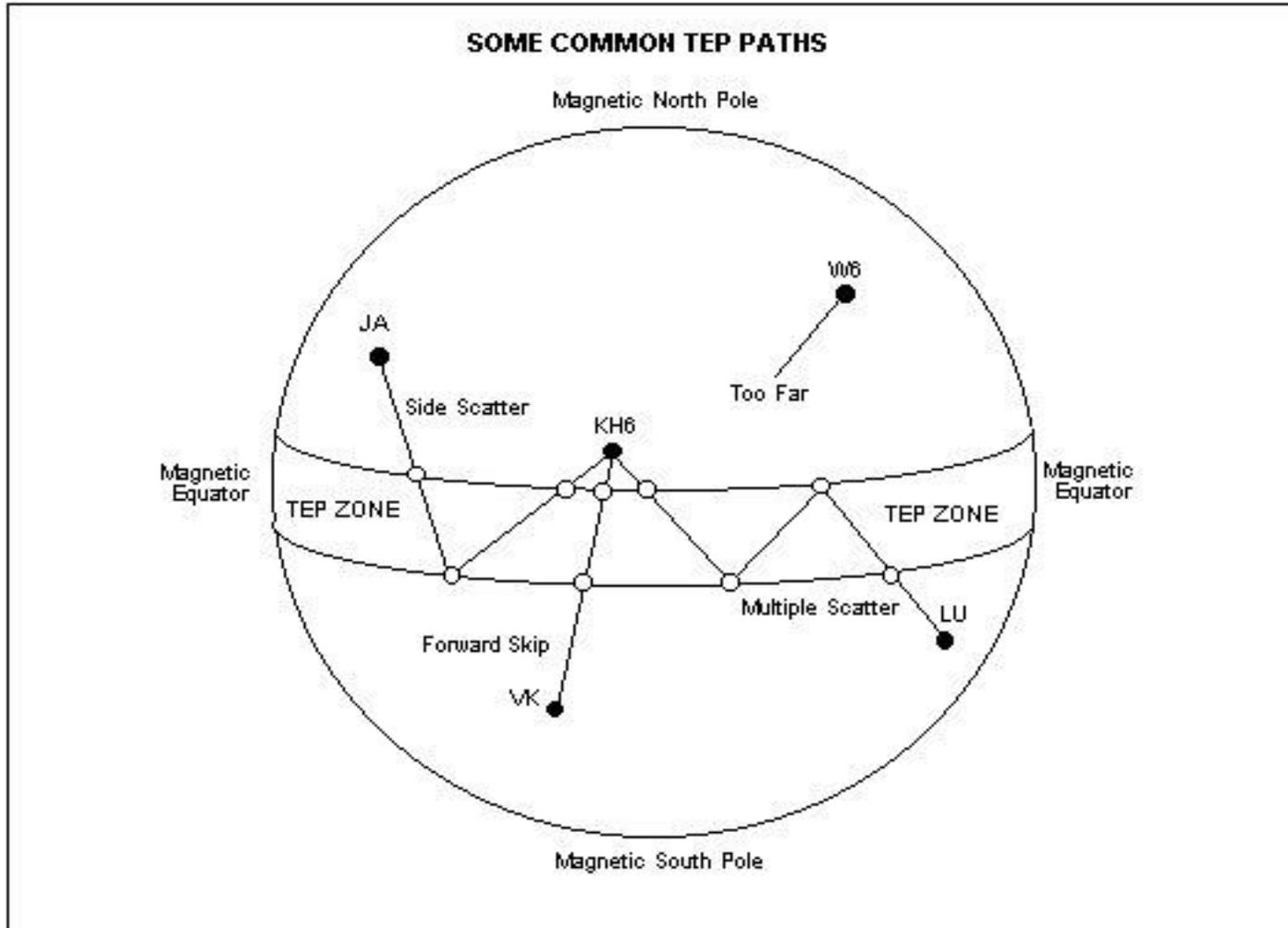
Top Band suffers from daytime D layer absorption. Daytime communication is limited to ground-wave coverage and a single E hop out to about 900 miles for well equipped stations running legal limit power. At night the D layer disappears and worldwide communication becomes possible via the F2 layer.



## HIGH FREQUENCY (HF) BANDS (3-30 MHz)

A wide variety of propagation modes are useful on the HF bands. The lowest 2 bands in this range share many daytime characteristics with 160 meters. The transition between bands primarily useful at night or during the day appears around 10 MHz . Most long distance contacts are made via F2 layer skip. Above 21 MHz, more exotic propagation, including TE, sporadic E, aurora and meteor scatter begins to be practical.

# Trans-equatorial Propagation



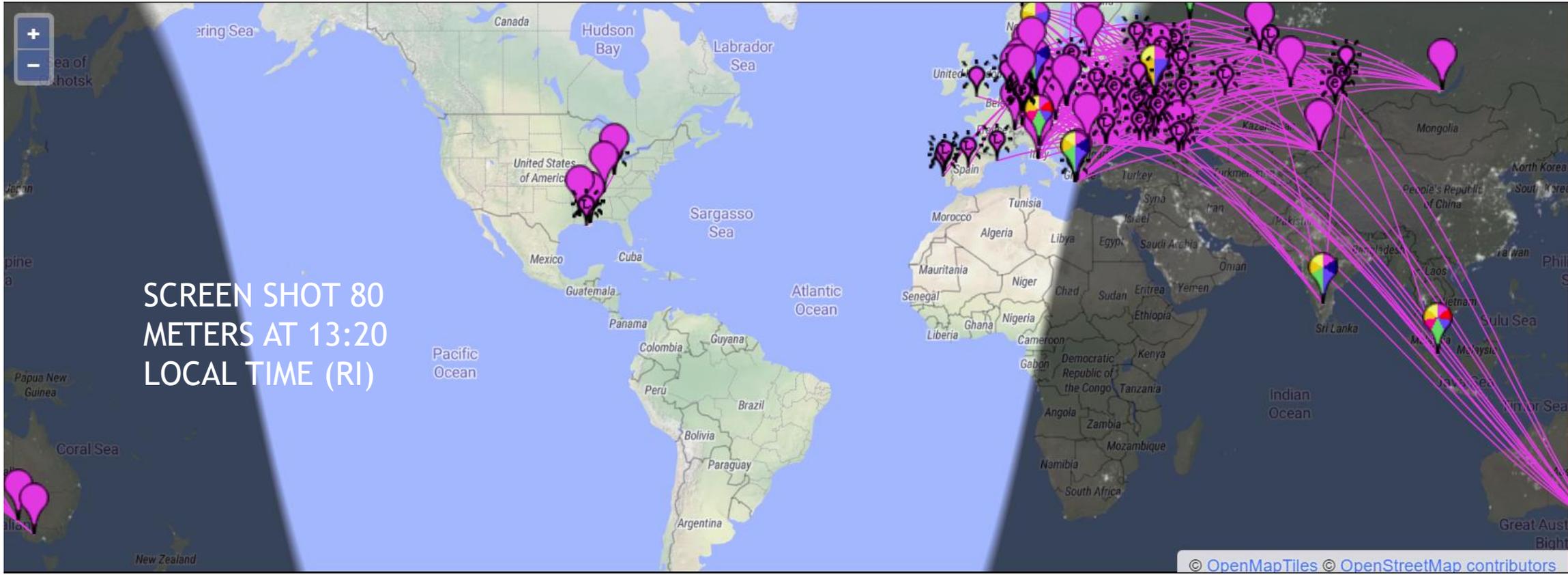
Propagation between two mid latitude points at approximately the same distance north and south of the magnetic equator.

**3.5-4.0 MHz**  
**(80 meters for the lower end,**  
**75 meters for the higher end)**

The lowest HF band is similar to 160 meters in many respects. Daytime absorption is significant ,but not quite as extreme as at 1.8 MHz . As at 1.8 MHz , atmospheric noise is a nuisance, making winter the most attractive season for the 80/75 Meter DXer.

On 80m, show signals sent/rcvd by anyone using FT8 over the last 15 minutes Go!

[Display options](#) [Permalink](#)  
Automatic refresh in 5 minutes. Large markers are monitors. [Display all reports](#).  
There are 47 active FT8 monitors on 80m. [Show all FT8 on all bands](#). [Show all on all bands](#). [Legend](#)



SCREEN SHOT 80 METERS AT 13:20 LOCAL TIME (RI)

## Propagation Summary by Band (cont.)

### 5.3-5.4 MHz (60 meters)

The distance covered during daytime propagation will fall in between that achievable on the 80 meter and 40 meter bands. At night, worldwide propagation is possible in spite of the relatively low power limit. Signal strengths will typically be higher than on 80 meters but not as high as on 40 meters.

## Propagation Summary by Band (Cont.)

### 7.0-7.3 MHz (40 meters)

The popular 40 meter band has a clearly defined skip zone during the day due to insufficient ionization to **refract** high angles. D layer absorption is not as severe as on the lower bands, so short-distance skip via the E and F layers is approximately 500 miles. At night, reliable worldwide communication via F2 is common on the 40 meter band. ( cont. )

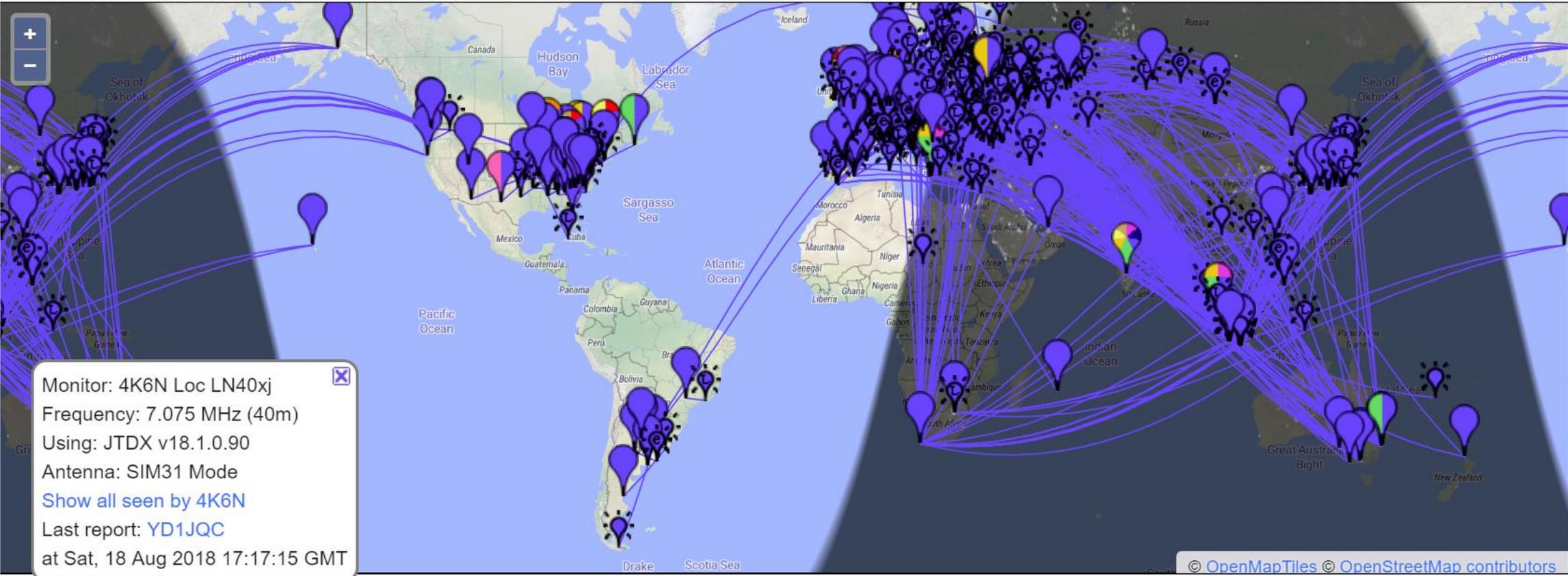
## Propagation Summary, by Band (cont.)

### 40 meters continued

Atmospheric noise is much less troublesome than on 160 and 80 meters, and 40 meter DX signals are often of sufficient strength to override even high-level summer static. For these reasons, 40 meters is the lowest frequency band considered reliable for DX communications in all seasons. Even during the lowest point in the solar cycle, 40 meters may be open for worldwide DX throughout the night.

On 40m, show signals sent/rcvd by anyone using all modes over the last 15 minutes Go!

[Display options](#) [Permalink](#)  
Automatic refresh in 5 minutes. Large markers are monitors. [Display all reports.](#)  
There are **455 active monitors** on 40m. [Show all on all bands.](#) [Legend](#)



[System statistics](#). Comments, problems etc to [Philip Gladstone](#). [Online discussion](#) of problems/issues. Reception records: 4,220,531 40m

## Propagation Summary by Band ( cont. )

### 14.0-14.35 MHz (20 meters)

The 20 meter band is traditionally regarded as the amateur's primary long haul DX favorite. Regardless of the 11-year solar cycle, 20 meters can be depended on for at least a few hours of world-wide F2 propagation during the day. During solar-maximum periods, 20 meters will often stay open to distant locations throughout the night. Skip distance is usually appreciable and is always present to some degree. Daytime E layer propagation may be detected along very short paths. Atmospheric noise is not a serious consideration, even in the summer. Because of its popularity, 20 meters tends to be very congested during the daylight hours.

On 20m, show signals sent/rcvd by anyone using all modes over the last 15 minutes Go!

[Display options](#) [Permalink](#)

Automatic refresh in 5 minutes. Large markers are monitors. [Display all reports.](#)

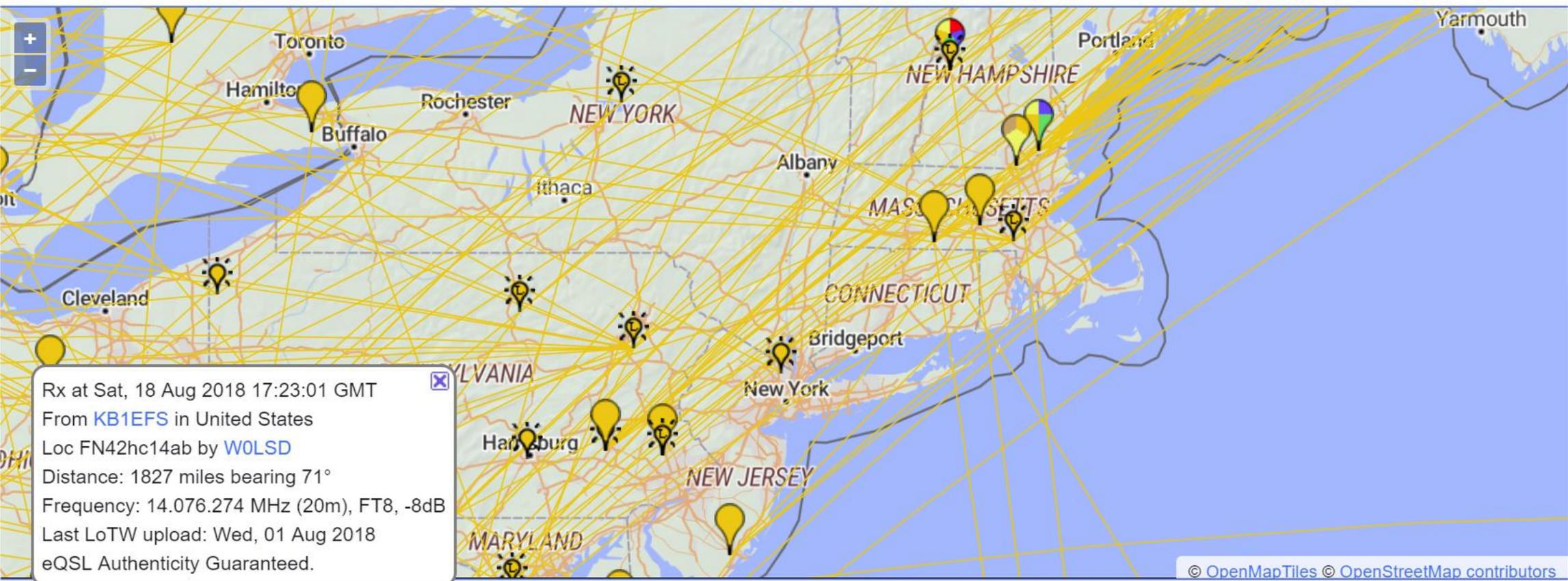
There are **1216 active monitors** on 20m. [Show all on all bands.](#) [Legend](#)



[System statistics.](#) Comments, problems etc to [Philip Gladstone.](#) [Online discussion](#) of problems/issues. Reception records: 4,220,604 (19)

On 20m, show signals sent/rcvd by anyone using FT8 over the last 15 minutes Go!

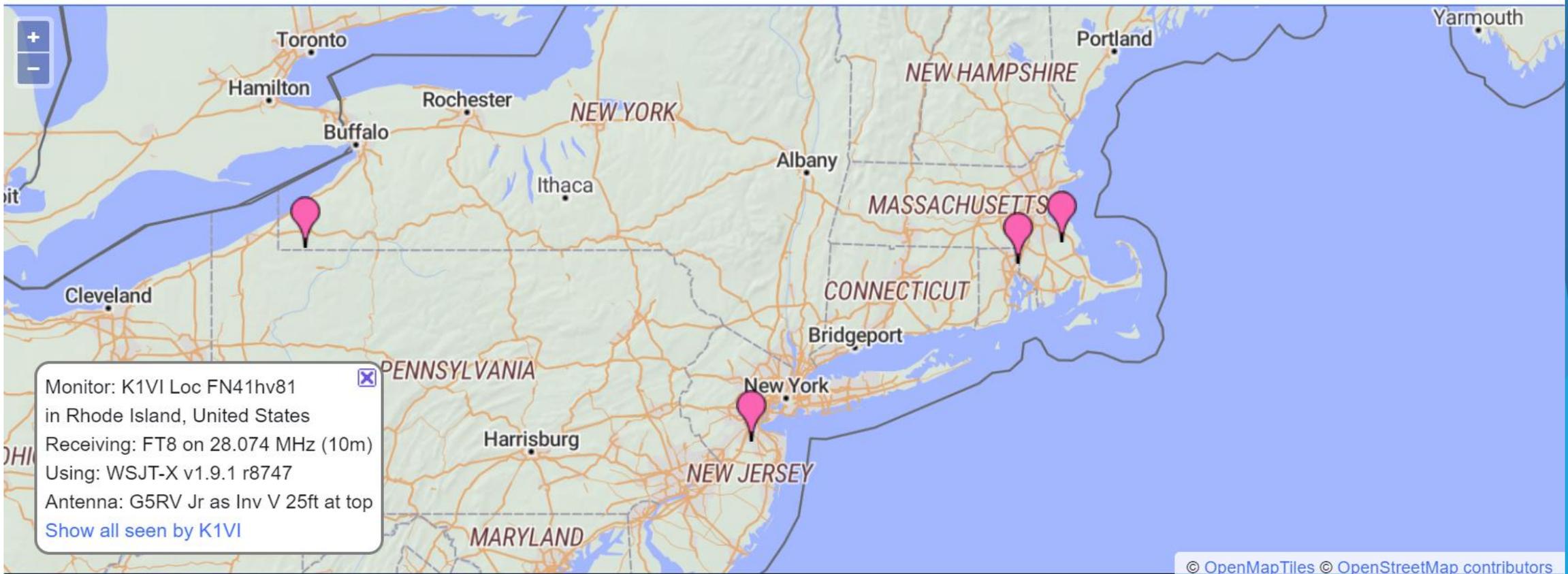
[Display options](#)  
Automatic refresh in 5 minutes. Large markers are monitors. [Display all reports.](#)  
There are **1123 active FT8 monitors** on 20m. [Show all FT8 on all bands.](#) [Show all on all bands.](#) [Legend](#)



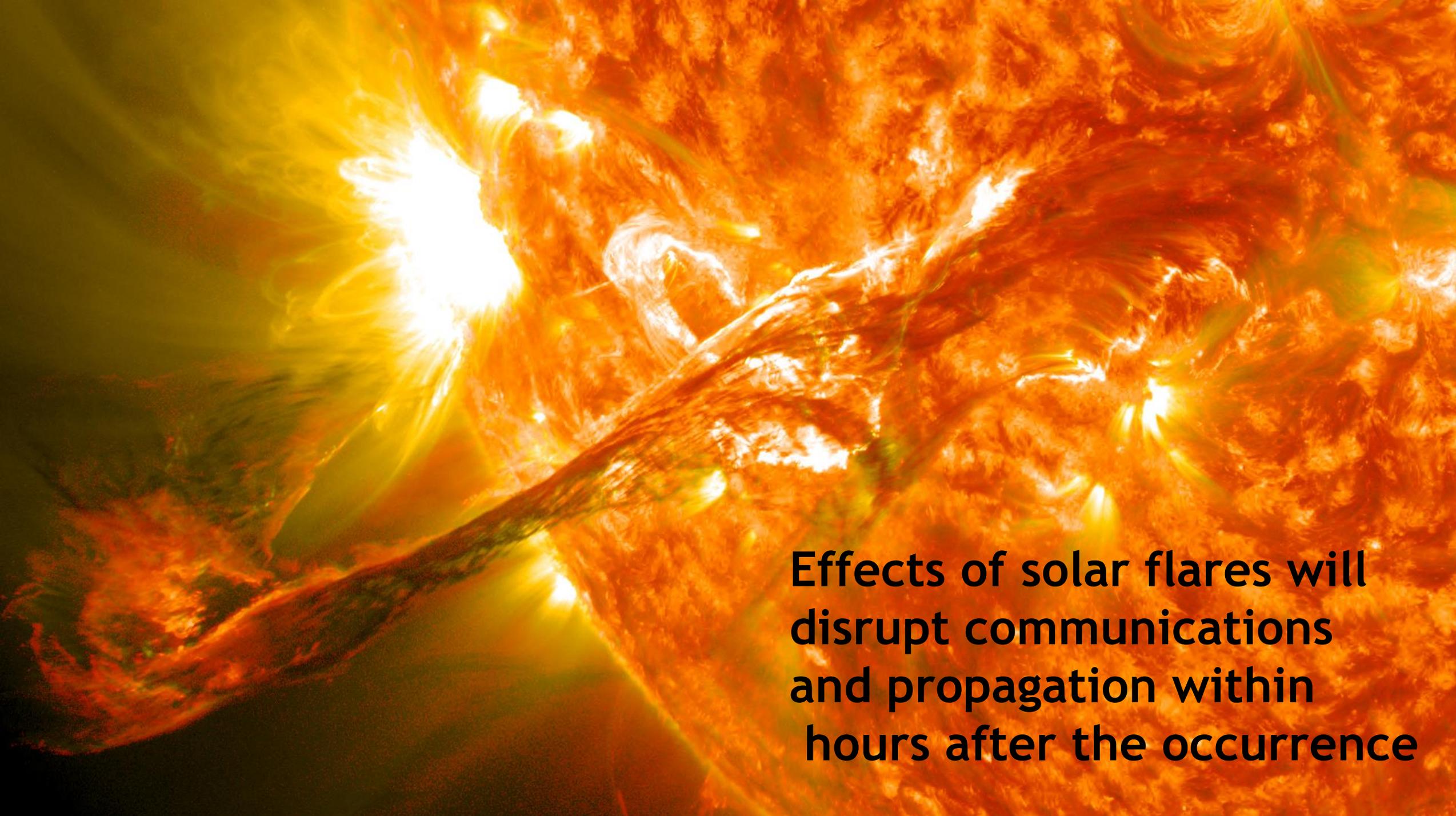
On 10m, show signals sent/rcvd by the callsign k1gnd using FT8 over the last 24 hours Go!

[Display options](#) [Permalink](#)

Monitoring K1GND (last heard 14 hrs ago). Automatic refresh in 5 minutes. K1GND statistics: 294 reports, 17 countries last 24 hours; 3929 reports, 69 countries last week  
There are 185 active FT8 monitors on 10m. [Show all FT8 on all bands.](#) [Show all on all bands.](#) [Legend](#)



[System statistics.](#) Comments, problems etc to [Philip Gladstone.](#) [Online discussion](#) of problems/issues. Reception records: 4,220,652,000



**Effects of solar flares will  
disrupt communications  
and propagation within  
hours after the occurrence**



# US Amateur Radio Bands

## US AMATEUR POWER LIMITS

FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

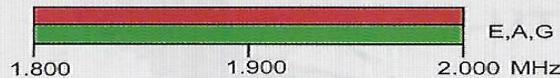
Effective Date  
March 5, 2012

Published by:  
**ARRL** The national association for  
**AMATEUR RADIO**  
www.arrl.org  
225 Main Street, Newington, CT USA 06111-1494

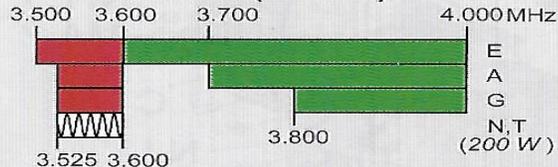


### 160 Meters (1.8 MHz)

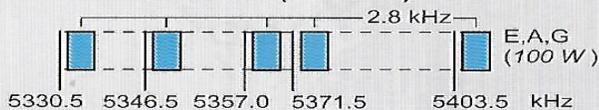
Avoid interference to radiolocation operations from 1.900 to 2.000 MHz



### 80 Meters (3.5 MHz)

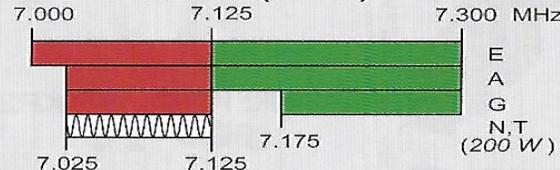


### 60 Meters (5.3 MHz)



General, Advanced, and Amateur Extra licensees may operate on these five channels on a secondary basis with a maximum effective radiated output of 100 W PEP. Permitted operating modes include upper sideband voice (USB), CW, RTTY, PSK31 and other digital modes such as FACTOR III as defined by the FCC Report and Order of November 18, 2011. USB is limited to 2.8 kHz centered on 5332, 5348, 5358.5, 5373 and 5405 kHz. CW and digital emissions must be centered 1.5 kHz above the channel frequencies indicated above. Only one signal at a time is permitted on any channel.

### 40 Meters (7 MHz)



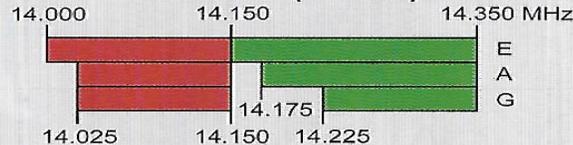
Phone and Image modes are permitted between 7.075 and 7.100 MHz for FCC licensed stations in ITU Regions 1 and 3 and by FCC licensed stations in ITU Region 2 West of 130 degrees West longitude or South of 20 degrees North latitude. See Sections 97.305(c) and 97.307(f)(11). Novice and Technician licensees outside ITU Region 2 may use CW only between 7.025 and 7.075 MHz and between 7.100 and 7.125 MHz. 7.200 to 7.300 MHz is not available outside ITU Region 2. See Section 97.301(e). These exemptions do not apply to stations in the continental US.

### 30 Meters (10.1 MHz)

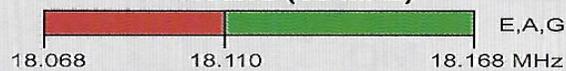
Avoid interference to fixed services outside the US.



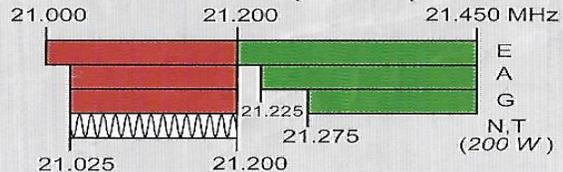
### 20 Meters (14 MHz)



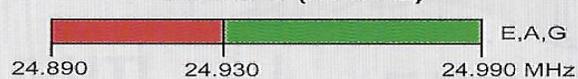
### 17 Meters (18 MHz)



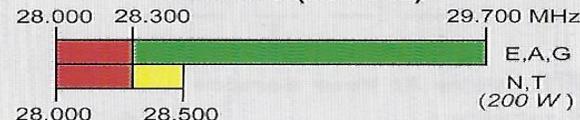
### 15 Meters (21 MHz)



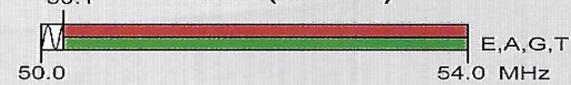
### 12 Meters (24 MHz)



### 10 Meters (28 MHz)



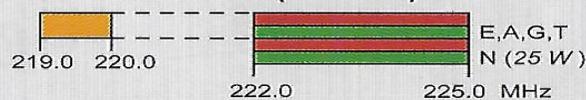
### 6 Meters (50 MHz)



### 2 Meters (144 MHz)



### 1.25 Meters (222 MHz)



\*Geographical and power restrictions may apply to all bands above 420 MHz. See *The ARRL Operating Manual* for information about your area.

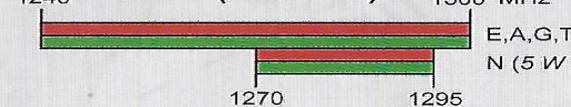
### 70 cm (420 MHz)\*



### 33 cm (902 MHz)\*



### 23 cm (1240 MHz)\*



All licensees except Novices are authorized all modes on the following frequencies:

2300-2310 MHz	10.0-10.5 GHz *	122.25-123.0 GHz
2390-2450 MHz	24.0-24.25 GHz	134-141 GHz
3300-3500 MHz	47.0-47.2 GHz	241-250 GHz
5650-5925 MHz	76.0-81.0 GHz	All above 275 GHz

\* No pulse emissions

## KEY

**Note:**  
CW operation is permitted throughout all amateur bands.  
MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.  
Test transmissions are authorized above 51 MHz, except for 219-220 MHz

- = RTTY and data
- = phone and image
- = CW only
- = SSB phone
- = USB phone, CW, RTTY, and data
- = Fixed digital message forwarding systems only

- E = Amateur Extra
- A = Advanced
- G = General
- T = Technician
- N = Novice

See *ARRLWeb* at [www.arrl.org](http://www.arrl.org) for detailed band plans.

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