Propagation by Plate Tectonics and the Moon

The surprisingly strong affect of small quakes on the ionosphere and the moon as the force powering it.

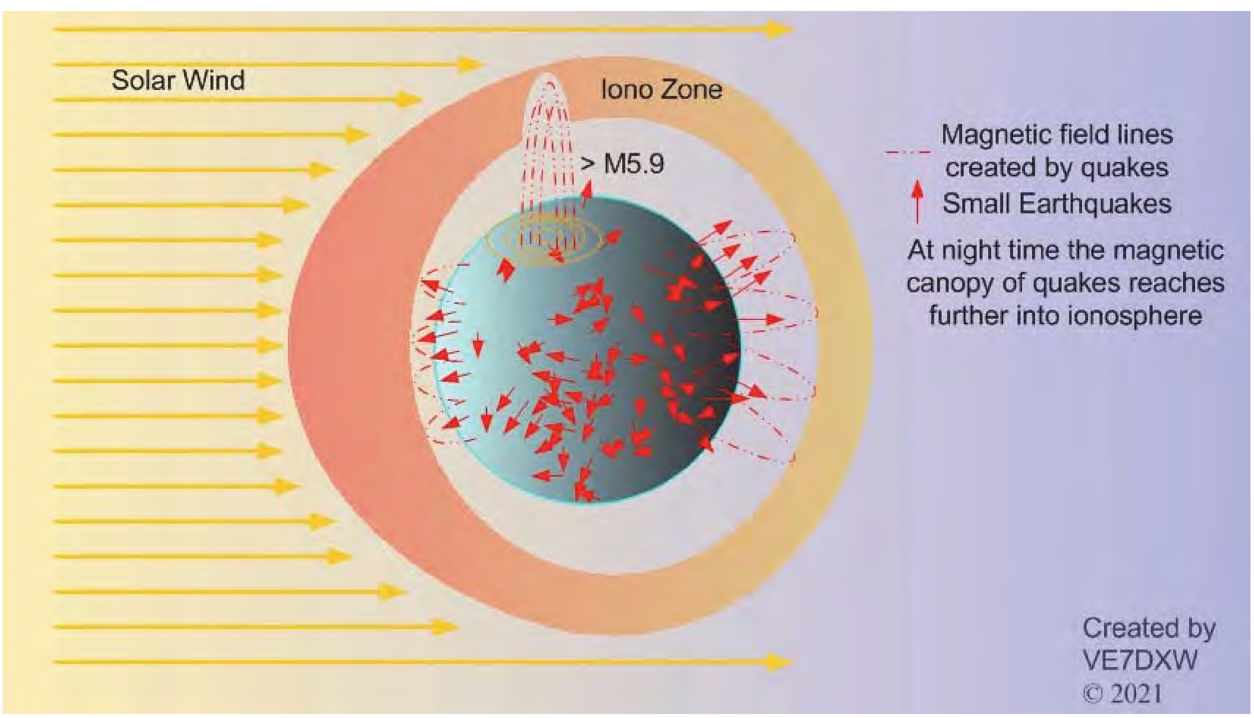
Goups.io user group: https://groups.io/g/MDSRadio

MDSR website: www.rf-seismograph.org

Alex Schwarz, VE7DXW
alexschwarz@telus.net

Earthquakes and the Moon vs. Propagation

A discovery that belongs to all Amateur radio operators
Propagation is very easily disturbed by solar particles. This is a well known fact, but what makes the depletion of the ionospheric layers worse are the earthquakes that are triggered by the solar storm at the same time. As the bow waves of the solar storms shake the magnetic field, the earth mantle also starts to vibrate and that increases the amount of quakes released; similar to a concrete vibrator that removes air bubbles. The RF-Seismograph data shows that in high solar wind conditions, the effects of the quakes on the ionosphere are amplified. Further, we found that the release of quakes measured by the USGS provides a constant stream of energy that varies with intensity. This energy has to be added into the models for propagation and, in general, for a better understanding of the D-Layer. Shortwave radio broadcast at such frequencies as the ones used by the digital modes between 80 m and 10 m are the only way to study the behavior of earthquakes on propagation at the moment.



The problem with the current models is that they are not in ISO values

We have developed a procedure that uses the Richter formula to convert the M Richter Scale numbers into GJ (Giga Joules $= 10^9$ J). This will make it easier to integrate the quake energy into the existing framework by using the ISO standard of physical energy in Joules.
Another value that is an outlier and prevents a general understanding is the Solar Flux index. It cannot be integrated into a general formula using ISO values either. There is another index, the "Thermosphere Climate Index" that represents the same natural phenomena and it is in ISO values. Unfortunately, there is very limited information on TCI. (If anyone has more info on this value, please contact us.)

The archives of data have been converted to videos – 10 s per day

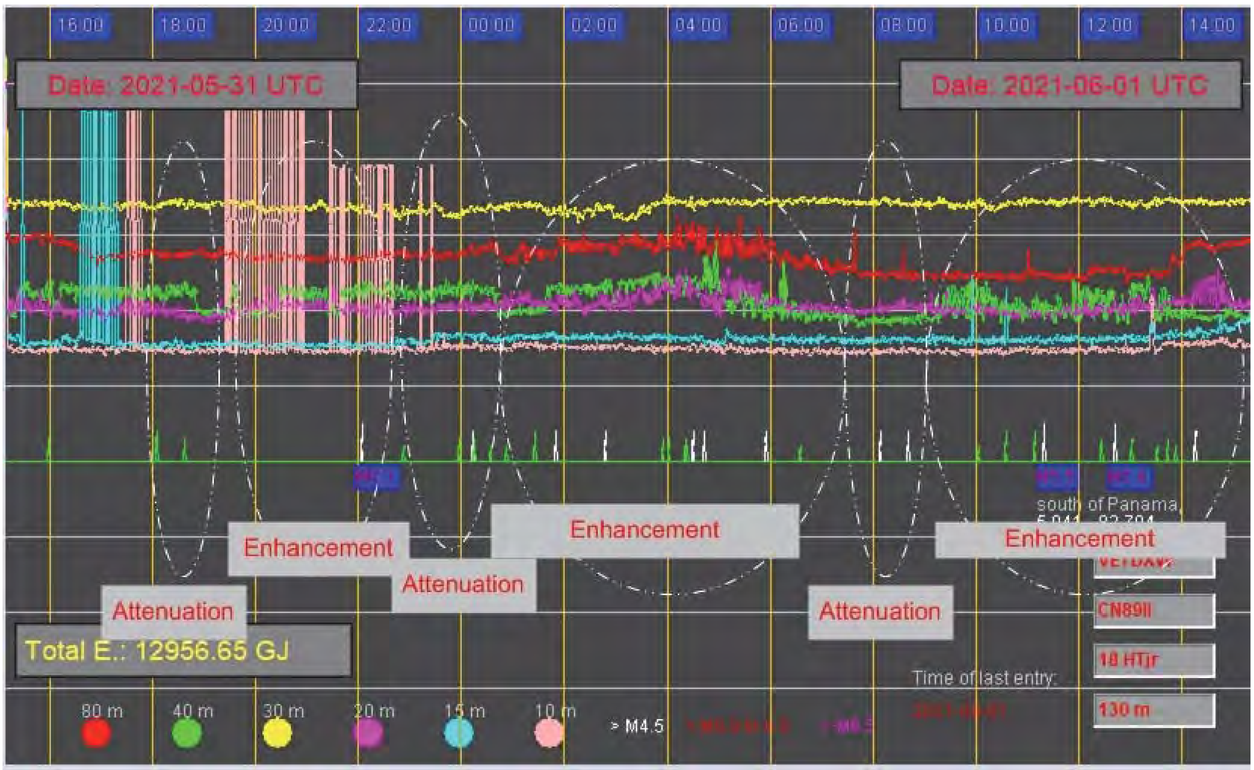
A lot of data has been accumulated by the RF-Seismograph research project as well as the daily propagation graphs. We have created videos out of the data and posted them on YouTube. Currently the data from July 2020 to April 2021 is available. Looking at the data makes one realize that there is no pattern to daily propagation. The solar flux and solar wind have a consistent day to night pattern; mostly visible on 80 m. The magnetic fields of the quakes are very dominant in the D-Layer and a measurable change would be expected because they attract each other. Propagation is changed by the creation of the gaps and rifts in the D-Layer, created by earthquakes, while the solar wind and flux are filling in the gaps. This creates a "lensing" effect that the radio waves use to bounce back and this effect can be measured by one RF-Seismograph on a global scale. Propagation below 30 m is generally created by quakes. Above the additional solar flux and solar wind energy are enhancing propagation, but earthquakes trigger these propagation windows too.

To view the videos, follow the link below:
https://www.youtube.com/channel/UCbDr9KOAbLaWIU6PbgNhl2g/videos
You can also find our YouTube channel at www.youtube.com : enter VE7DXW into the search box.

The recorded data is also available as daily CSV data files. If you are interested in studying the data, it can be uploaded to a SQL database using our RF-Viewer software that was developed to view and match the data that is recorded by the RF-Seismograph remotely without the need of setting up a RF-Seismograph. The RF-Viewer will run on Linux, Mac and Windows platforms, with the appropriate Java add-on software.
As a future project we want to correlate the WSPR propagation data with the USGS detected quakes.

Propagation changes by earthquakes detected with the RF-Seismograph

The shortwave propagation is globally defined by the Solar Flux, the solar wind and the day and night cycle. But when we start to measure propagation on a smaller scale – in the range of 1000 km^2 - the variances of earthquakes have to be taken into account. This is propagation that all shortwave radio operators have to deal with, when the solar flux is below 120. These conditions actually change several times a day, depending on how many earthquakes there are and where they are located. (Note: the graph below only displays quakes that are bigger then M2.0. If all the USGS detected quakes are shown, the earthquake line would be full of green spikes. The earth is constantly vibrating.) Propagation is constantly moving, like a tug-of-war, from enhanced to attenuation. When we assign attenuation and enhancement areas as we look at the daily measurement of the RF-Seismograph for propagation, we would get a picture that has areas of enhancement followed by attenuation, as per graph below:



Of course, the resulting propagation is not linear and quakes above M6.0 have, in general, an attenuating affect. As quakes cluster together, though, the resulting propagation is enhanced and if we have local minor quakes, within 2000 km of the RF-Seismograph (mostly green spikes) the RF-Seismograph either measures an enhancement or attenuation.

A description of the events recoded:

All bands attenuated from (thin line) after 07:30 UTC as the M4.6, 41 km NNE of Severo-Kurilâetmsk, Russia that struck at 2021-06-01 08:08 UTC was active, indicating a precursor of at least 30 min. The attenuation continued with the M4.7, 57 km W of Ishigaki , Japan at 2021-06-01 08:41 UTC and the attenuation stops at 09:15 UTC as the quake energy fades.

The resulting propagation is enhanced with the M2.59, 10 km SW of Leilani Estates, Hawaii that occurred at 10:03 UTC in the graph above. 40 m peaked as the quake was active and then attenuated somewhat with the M4.0, 13 km W of AshkÄsham, Afghanistan at 2021-06-01 10:35 UTC and the M4.4, 58 km NW of Yonakuni, Japan at 2021-06-01 11:08 UTC. The attenuation is actually caused by the precursor of the M5.5, south of Panama at 2021-06-01 that released at 11:20 UTC. The minor quakes working against the attenuation keeping the 40 m band open. The same effect can be seen again with the M3.1, 29 km ENE of Bridgeport, California at 2021-06-01 12:26 UTC. This time, the attenuating quake is the M5.4, 78 km SW of Atocha, Bolivia at 2021-06-01 12:42 UTC, attenuating while it is active. The 40 m band domes because there is too much energy to keep the propagation open, for 45 min, created by the M3.2 from Chickaloon, Alaska at 2021-06-01 13:02 UTC. The band recovers with a triple event of quakes from Alaska striking after 13:31 UTC

Installing the RF-Viewer on different operating systems

RF-Viewer on Windows

Download and install the Java Runtime on your PC from
www.java.com - it needs to be specific for your OS.
…then use this link for PC:
https://www.qsl.net/rf-seismograph/downloads/MDSR_SA.exe
It is a self-extracting file that you can drop on your desktop. It will contain additional files to make the SW work. When it is extracting, after double clicking it, it will ask you where to save it to (something like downloads folder or the MDSR folder, it does not matter where it is). Find the RF-Viewer.jar and double click it. This will launch the software. Once the SW is running, click the “GetRemoteD” button and, if you are connected to the internet, it will download the data and display the current RF-Seismograph data.

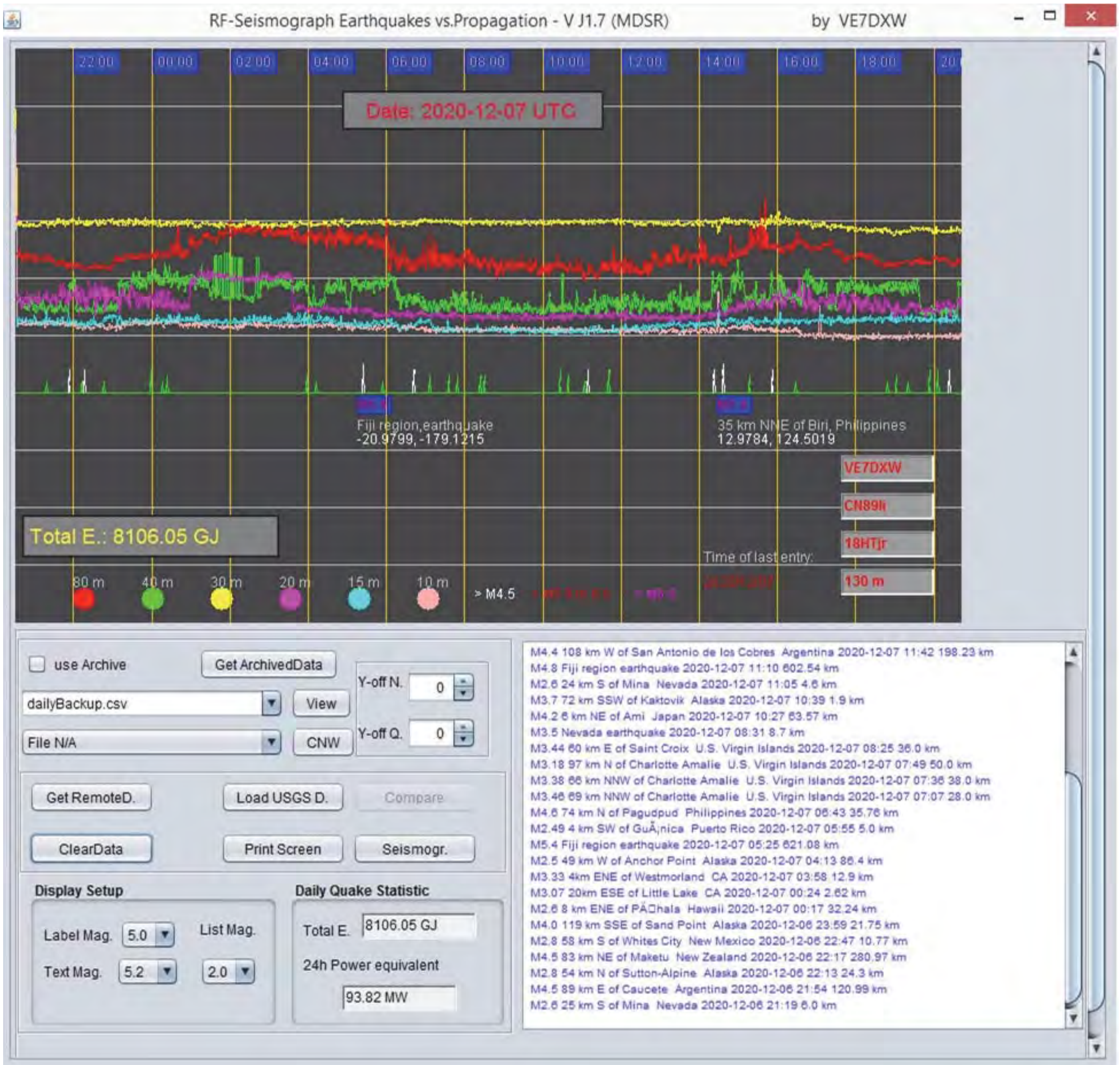
RF-Viewer on MAC

In order to make it work, you need to get Java installed from Java.com for Mac. In the OS software you have to set the .jar files to be opened by the Java RPI software that was just installed.
Here is the link to our tar file. Uncompress and then place the main folder on the desktop. Make sure there is also a Lib folder in this folder. The jar you want to execute is the RF-Viewer.jar.
http://www.qsl.net/rf-seismograph/downloads/MDSR_SA_Archive.tar
Here is the latest update; just replace this RF-Viewer.jar with the old one and re-launch the software.
http://www.qsl.net/rf-seismograph/downloads/RF-Viewer.jar

RF-Viewer and RF-Seismograph on Linux and Raspberry Pi

Follow **Wiki** on the MDSR IO user group; accessible without group membership
https://groups.io/g/MDSRadio/wiki

User interface of the RF-Viewer



Current data mode:

The RF-Viewer is designed to display the last 24 h of data that have been recorded by the RF-Seismograph, by pressing “Get Remote D”. It will query the current USGS data, by “Load USGS D” of quakes above M2.0. By pressing the “Compare” button, it will match the quakes recoded time with the noise recordings of the RF-Seismograph – this will take about 10 s to 20 s.

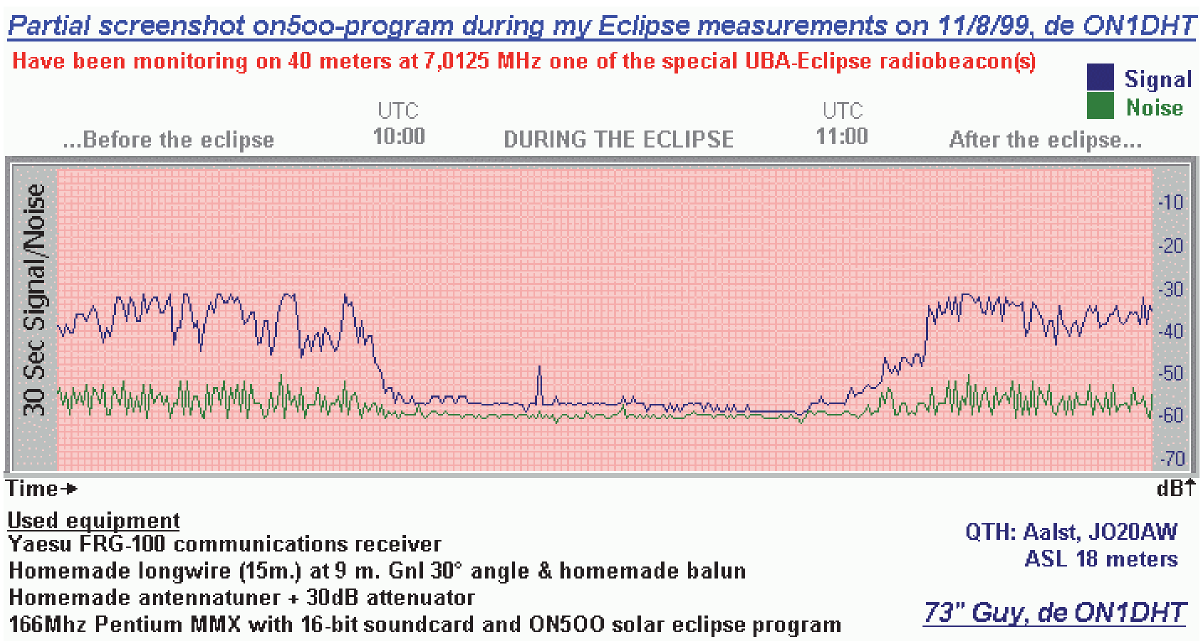
Archive mode

By selecting the “use Archive” box, the RF-Viewer can be used to display archived data back to July 2020 for now. The function of the selector box changes to allow the selection of the day of the recorded data. Note: the data selected will always bring the previous day as well as the quakes of the previous day. Press the "View" button to display on the screen and "compare" to match the quakes timing to the recoded noise and propagation. Note: The archive files have to be downloaded by pressing "get Archived Data" first.

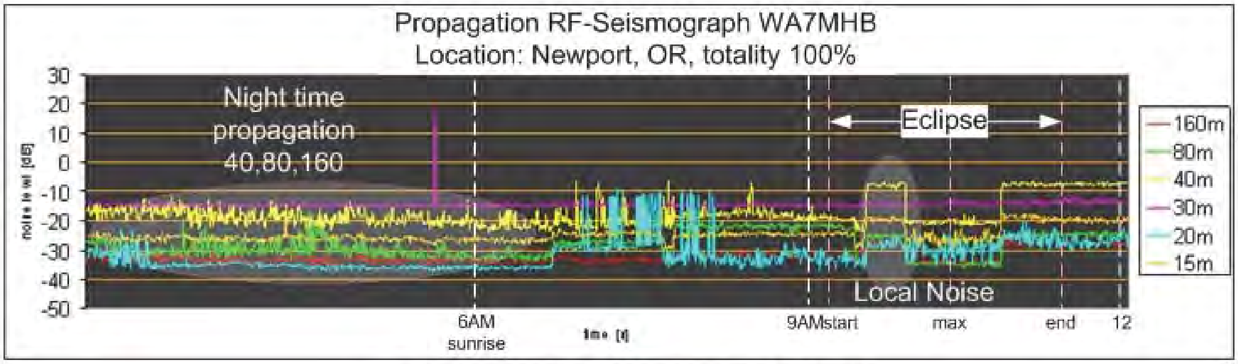
Creating Screen Shots of the Data:
By pressing the "Print Screen" button the a screen shot of the current graph will be saved to \\Users\<*computerName*>\MDSR_SA directory as RF_Viewer.png and in Archive mode the Call sign and date is added to keep file names distinct, to make it possible to have more than one person create images and share them.

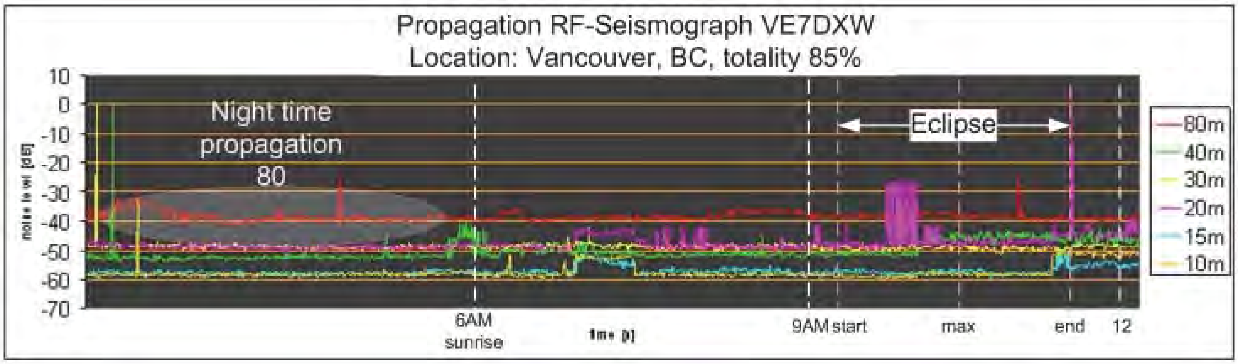
Conclusion

Our research has come full circle. When Guy Roels (ON6MU) started by measuring the effect of the moon blocking the solar radiation (graph below), on Aug. 11th in 1999, the resulting attenuation and dropout of the signal on 40 m was only partially caused by the small effect of the blocked solar radiation and mainly by the combined gravitational pull of the sun and the moon, which align in a straight line. The additional pull attacks water (tide), telluric currents and small earthquakes (if our data is correct) that blocked out the propagation during the eclipse.



Unfortunately, we were not able to repeat the measurement on Aug. 21th in 2017 during the solar eclipse in North America, due to high and unusual solar activity around the time of the quake that blocked out the lower part of the HF bands including 40 m, as per measurement below.





The discovery of the affect of small quakes on propagation was due to the development of the RF-Viewer that correlates USGS detected quakes with the current propagation as it is measured by the RF-Seismograph, in 2021.

This research and our conclusions are still very controversial and we can only hope that one of the Universities involved in Geo Science and Geo Physics will take up the RF-Seismograph project to enhance our understanding of earthquakes and their electromagnetic nature.

The connection to the moon that creates an enormous pressure shift on the continental plates by shifting water and magma in the crust, twice daily, will be a focal point of further analysis. If the new research that is suggesting that continental plates act like piezo eclectic generators is true, the bending caused by the tidal forces and the graphitational pull of the moon will also be visible on the RF-Seismograph. (see ref.; Electromagnetic anomalies that occur before an earthquake)

References

Thermosphere Climate Index:
https://spaceweatherarchive.com/2018/09/27/the-chill-of-solar-minimum/

Convert M values to Joules (J): http://convertalot.com/earthquake_power__calculator.html

Electromagnetic anomalies that occur before an earthquake:
https://phys.org/news/2021-05-electromagnetic-anomalies-earthquake.html

Ionospheric disturbances generated by different natural processes and by human activity in Earth plasma environment:
https://www.academia.edu/23674052/Ionospheric_disturbances_generated_by_different_natural_processes_and_by_human_activity_in_Earth_plasma_environment?email_work_card=thumbnail

Scientific American Oct. 2018: "Earthquakes in the Sky"
http://www.ep.sci.hokudai.ac.jp/~heki/pdf/Scientific_American_Vance2018.pdf

Earthquakes Canada: http://www.earthquakescanada.ca

U.S. Geological Survey: https://www.usgs.gov/

To view the videos follow the link below:
https://www.youtube.com/channel/UCbDr9KOAbLaWIU6PbgNhl2g/videos

Access to Study for 2017, 2018 (2019 is part of 2018):
http://www3.telus.net/public/bc237/MDSR/Matches-RF-Seismograph and Seismic data for 2017.pdf
http://www3.telus.net/public/bc237/MDSR/Earthquakes visible with RF-Seismograph 2018.pdf

Download and Install RF-Seismograph for Linux and Raspberry Pi:
https://groups.io/g/MDSRadio/wiki/home

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Also thanks to all the hams that were involved in Beta testing of the RF-Viewer.