M3.9 Solar Flare Radio Noise Observed using KiwiSDRs and WsprDaemon Noise Estimates

An M3.9 solar flare around 1911 UTC on 7 May 2021, Figure 1, produced a burst of radio frequency noise, manifest on the earth's surface in the upper HF band, Figure 2, shown here from the observatory of Thomas Ashcraft[1]. The time of this flare was such that its effect was centred over North America, Figure 3.

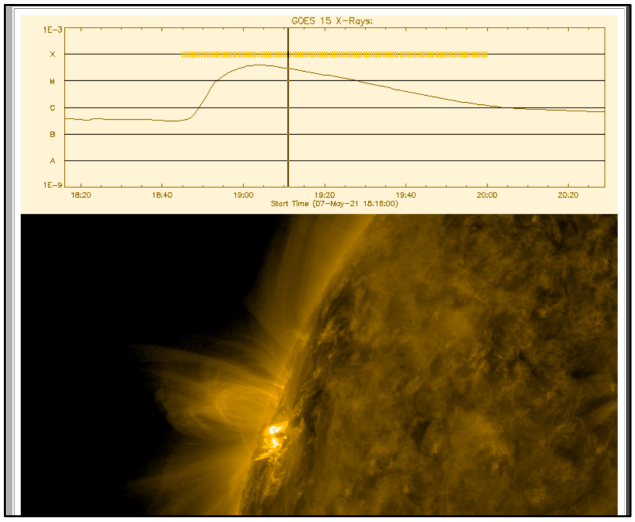

Figure 1. 7 May M3.9 solar flare X-Ray flux time-series from GOES-15 satellite with an image from NASA's Solar Dynamics Observatory[2].

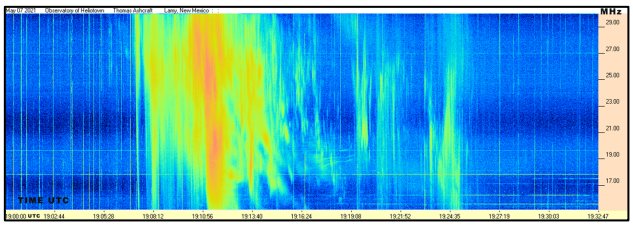

Figure 2. Dynamic spectrum showing rise in noise level over 16–30 MHz centred around 1911 UTC on 7 May 2021 from Thomas Ashcraft[3].

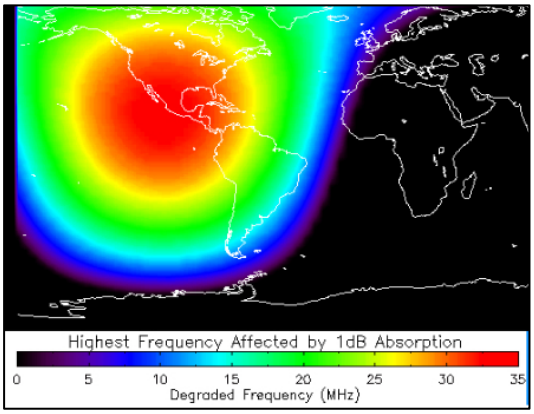

Figure 3. Map showing highest frequency affected by 1 dB absorption[4], a proxy for the likely area to experience the solar radio burst.

Given the number of North America stations using KiwiSDRs and reporting noise estimates with WsprDaemon, can we see a signature akin to that in Figure 2 in the WsprDaemon noise data?

Using 15 m band noise data as an example Figure 4 shows the answer to be yes. But the figure also illustrates many issues for quantifying space weather at amateur stations, including:

- Calibration, including components ahead of the KiwiSDR antenna socket, e.g. preamplifier, splitter.
- Accounting for azimuth and elevation antenna response in the direction of the sun as the source.
- Masking effect of local noise levels.

More can be done with this data to address the issues outlined above. The resulting analysis framework could be applied to future solar noise bursts, where different affected areas, different azimuths and elevation angles may help refine initial receiving site characterisations.

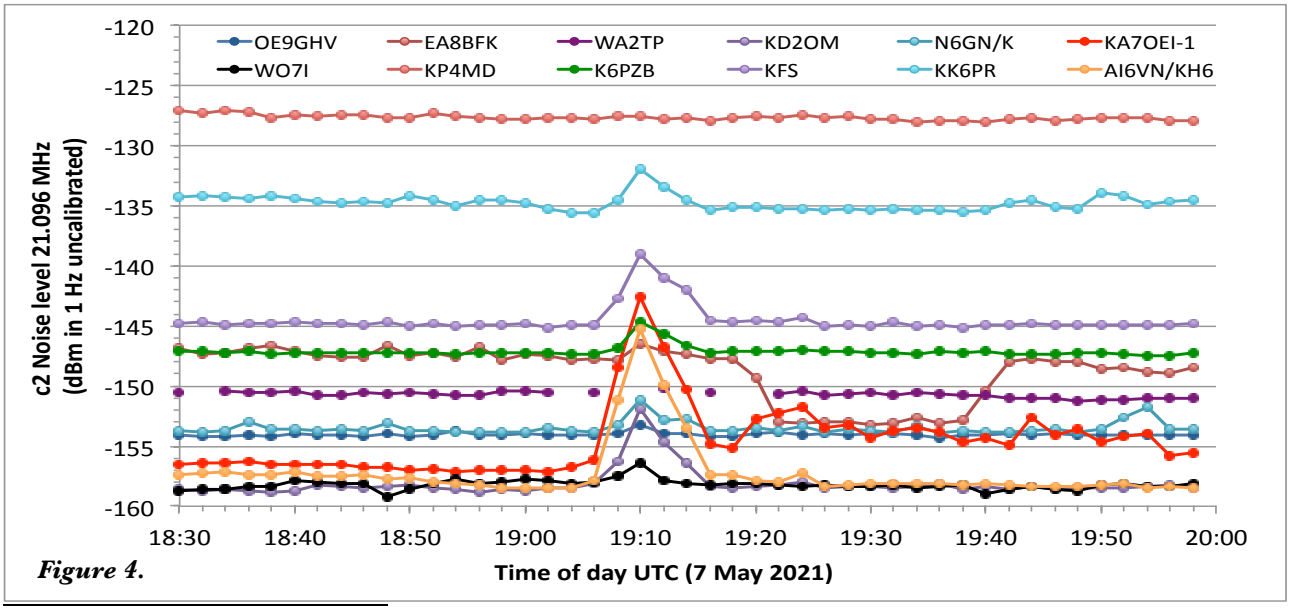

Figure 4.

[1] www.heliotown.com

[2] tinyurl.com/yzhj4dmr

[3] spaceweather.com/images2021/07may21/dynamicspectrum.png

[4] spaceweather.com/images2021/07may21/blckoutmap.jpg