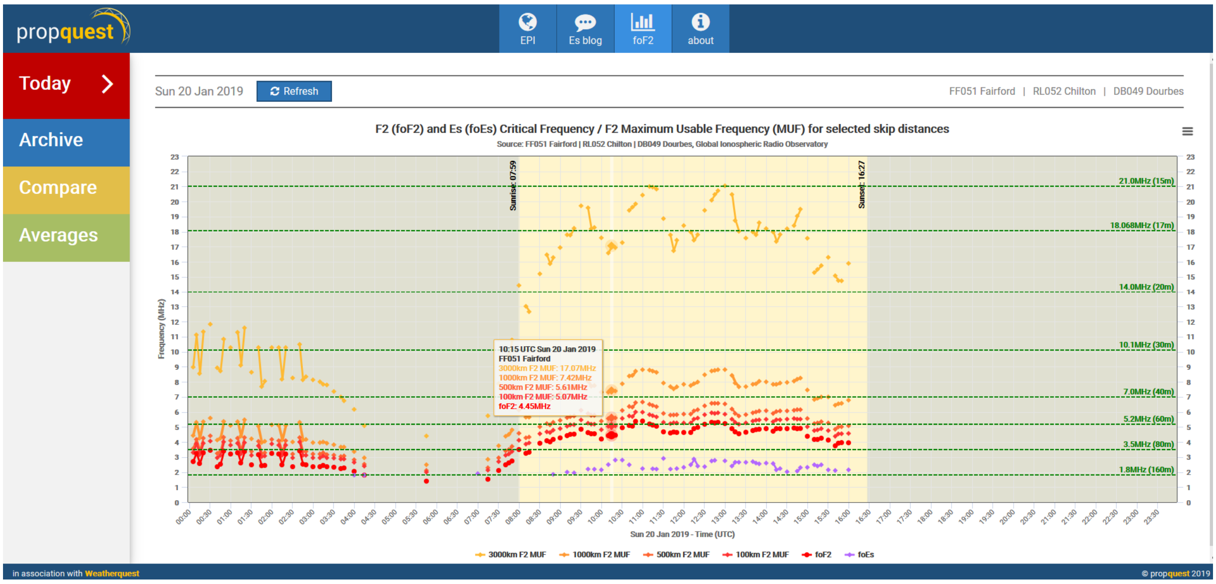
Monitoring short range propagation.

More often than not, in the Amateur radio Hobby, we are looking to see when the space weather is going to help us make distant (DX) contacts. There are however times when long skip distances are not what we want!

Living in the South of Germany and chasing SOTA activators, bands “going long” is bad news for me as the majority of high scoring activations take place in the Alpine regions and often the bands being used (20m & 40m most often) mean that my signals after bouncing off the f-layer in the ionosphere come back down way past where the station I would like to contact is. There is of course ground-wave contact and NVIS contact possibilities for those stations that are very close to me and if the station is operating on VHF (6 metres and up) a direct contact may be possible, however as luck would have it, the majority of the stations I want to contact are past the Ground wave distance and are not operating on VHF.

Now I cannot change physics. Skip distances are what they are, but they do CHANGE and being able to monitor this and understand when a contact might be possible is very valuable for my SOTA chasing and also for other facets of the hobby such as emergency communications and local nets.

So, what is possible? Well without tens of thousands of dollars of equipment you can’t do anything yourself however there are publicly run Ionosondes (Ionosphere sounding) stations around the world and their data can help. In Western Europe we are lucky to have an amateur run website that takes the data from three western Europe Ionosondes and present the data on the web. This website is called PropQuest and can be found at: http://www.propquest.co.uk/graphs.php. For those living in other parts of the world, you will need to find a local equivalent.



The valuable data that this site provides is the readings every 15 minutes for the frequency for Fof2 (aka Critical frequency) and the MUF (maximum usable frequency) for 100, 500, 1000

& 3000km signal paths. Fof2/CF is relevant to Near vertical Incidence Skywave (NVIS) where you are trying to get your RF signal to bounce back down very close (in propagation terms) to where you are transmitting it up from, to get local contacts on HF. The closer the CF is to the band you are transmitting on the more perpendicular your signals will come back down to the Earth.

The MUF Maximum Usable Frequencies for different distances are what the name infers – the Maximum frequency you can use to get that distance – use any higher frequency and you're not going to be heard.

What is very interesting is that the MUF increases the longer the path is as the angle of reflection becomes shallower and shallower. For predicting short-range communications this fact is very useful and from the real-time values provided from the Ionosondes we can therefore predict which band within a frequency range is likely to give good communications into an area at a particular distance – in all directions so effectively in a doughnut like ring around your QTH.

Ignoring obstructions (mountains etc.) the distance away that stations can be heard (first Hop) is on a scale related to increasing frequencies going outwards from your station.

Some really close-in contacts (ignoring ground wave) may be made by operating below the Critical (Fof2) frequency by using NVIS propagation (with D-layer signal absorption however this is better after dusk and before dawn rather and is less effective during the day especially on 160 & 80m), after that the F2 MUF frequency for 100km defines the maximum frequency that a signal will be bounced back to the earth (first hop) and hit the earth at 100km away from the station. As operating frequency rises that "first point of contact" goes outwards, further and further away from your station. Some "checkpoints" on the scale are given by the 500km, 1000km and 3000km MUF readings from Propquest.

So taking the following frequencies from Propquest as examples:
Fof2 4.375 MHz
MUF F2 100km 4.99 MHz
MUF F2 500km 5.55MHz
MUF F2 1000km 7.4MHz
MUF F2 3000km 17.29MHz

We can interpret this data to say...
to contact stations up to 100km away, via skip I need to use a frequency of less than 4.99MHz (hence 160m or 80m bands)
to contact stations up to 500km away, via skip I need to use a frequency of less than 5.55MHz (hence 160, 80 or 60m bands)
to contact stations up to 1000km away, via skip I need to use a frequency of less than 7.4MHz (hence 160,80,60 or 40m bands)
to contact stations up to 3000km away, via skip I need to use a frequency of less than 17.29MHz (hence 160,80,60,40,30 or 20m bands).

Signal strength drops for the lower of the bands in the brackets as the distance the signal needs to travel increases as multiple hops can be needed and the D-layer absorption has a greater attenuation impact. Hence the highest frequency band (lowest wavelength) shown in the brackets will be the best choice for contacts in the distance range chosen.

One can also extrapolate between the check points to calculate an approximate "Best Band" for e.g. a station at 2000 km away from your QTH. Be aware though that the scale is non-linear.

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