Techincal Report

Worldwide SNR estimation of a network of receivers

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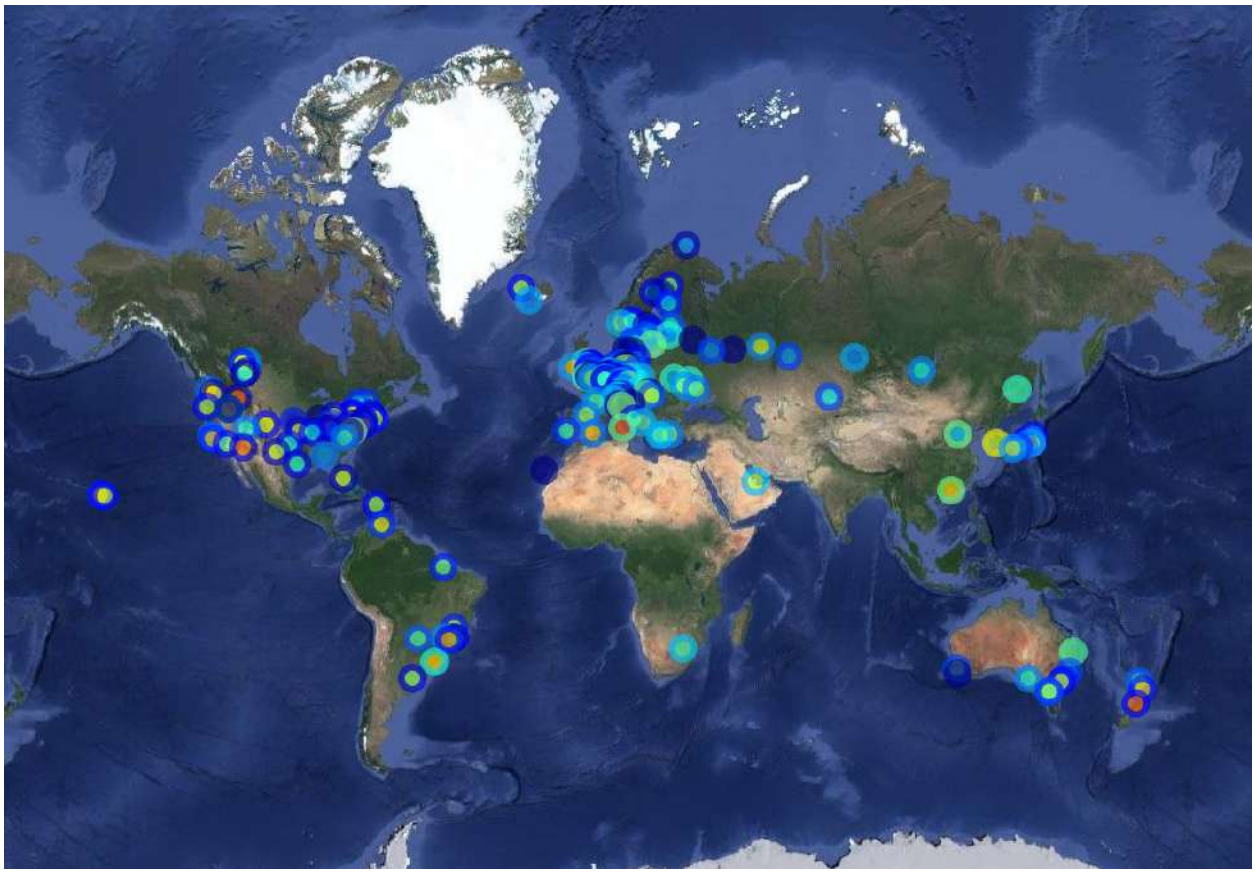
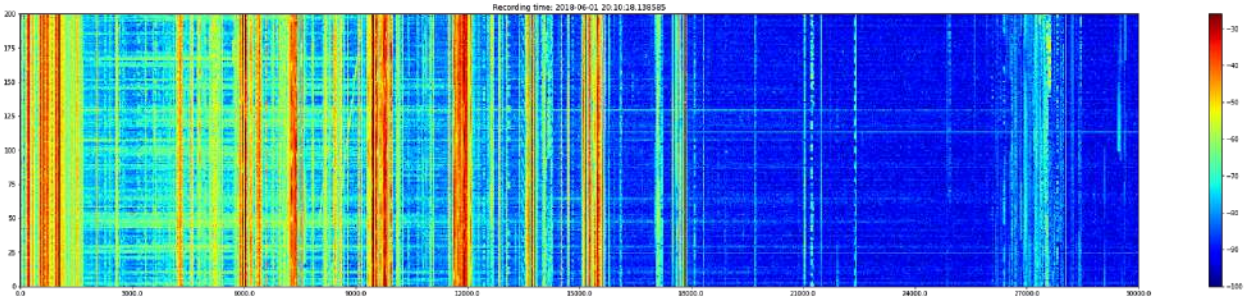


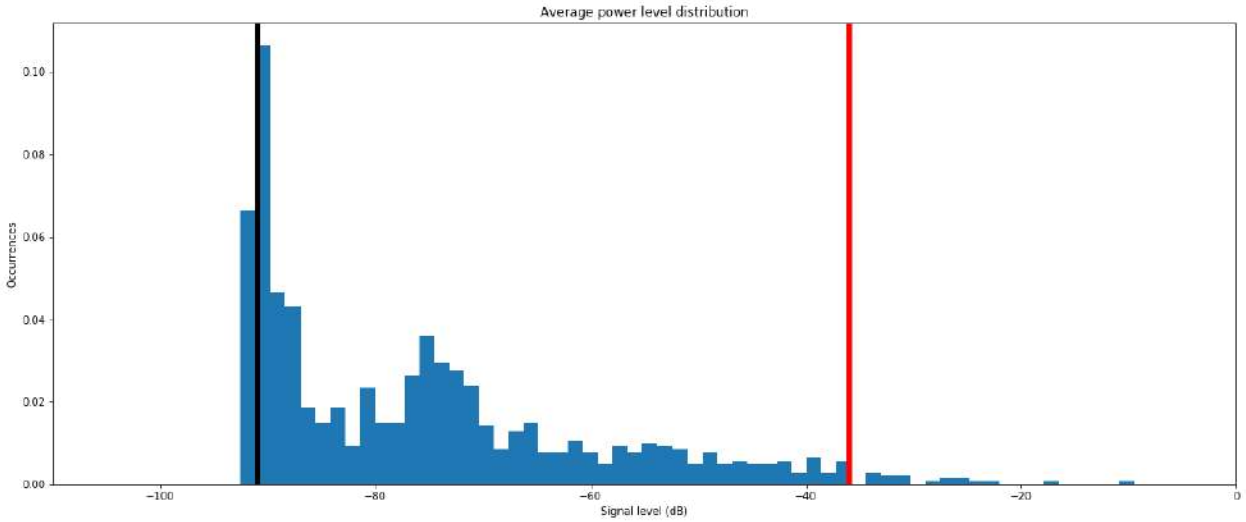
Summary:

Let's consider a whole band (0-30 MHz) waterfall:

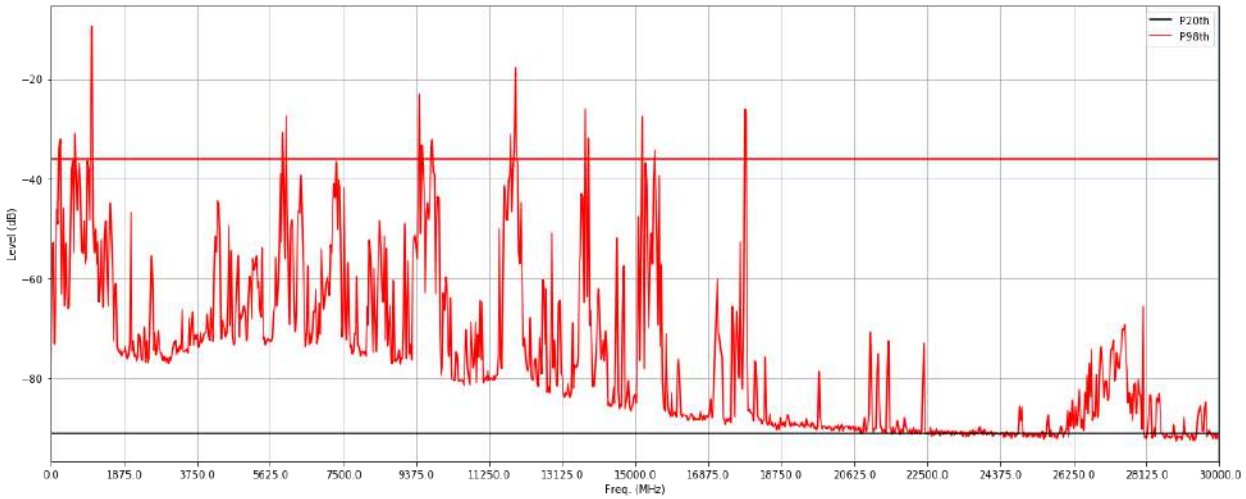


this has been recorded at 8PM local time in Sardinia, so that 10m are still a bit open. A you can see, there is some thunderstorm activity in the low HF. This waterfall is made of 200 samples (10s recording at 20fps) from each kiwiSDR. You can open the images on new tabs and view them at full resolution. The waterfall is composed of 1024 bins, so each bin covers a ~30 kHz narrow band.

Now, for each frequency, let's compute the median value (as suggested by Chavdar LZ1AQ) to filter out spike noise (lightning etc) and extract the whole-band power level distribution:

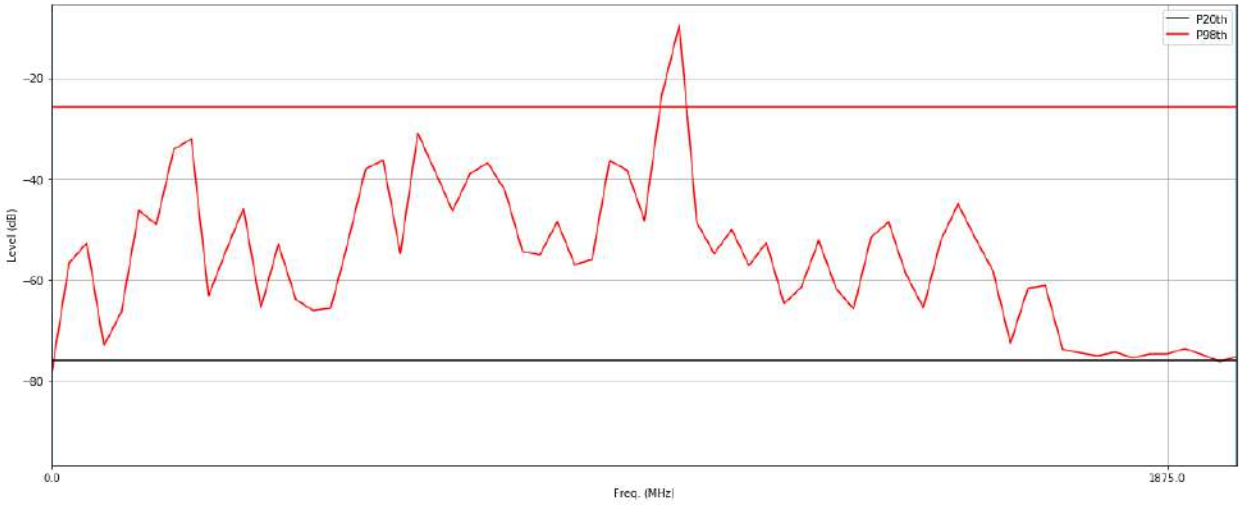


Now consider the 5th (black) and the 98th percentile (red). Then we assume that black and red lines are decent estimates of the background noise and of the highest signals on the band, respectively.



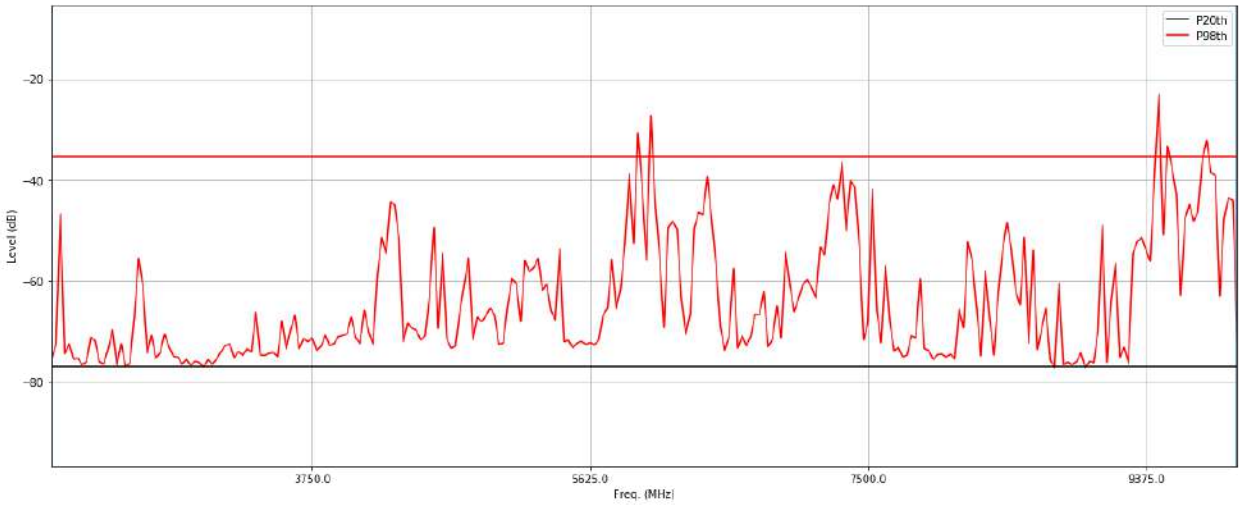
Plotting these estimates over the spectrum plot confirms this idea, roughly, since there are variations over different bands.

This is an all band calculation, but we can do more... This is what happens on 0-2MHz:

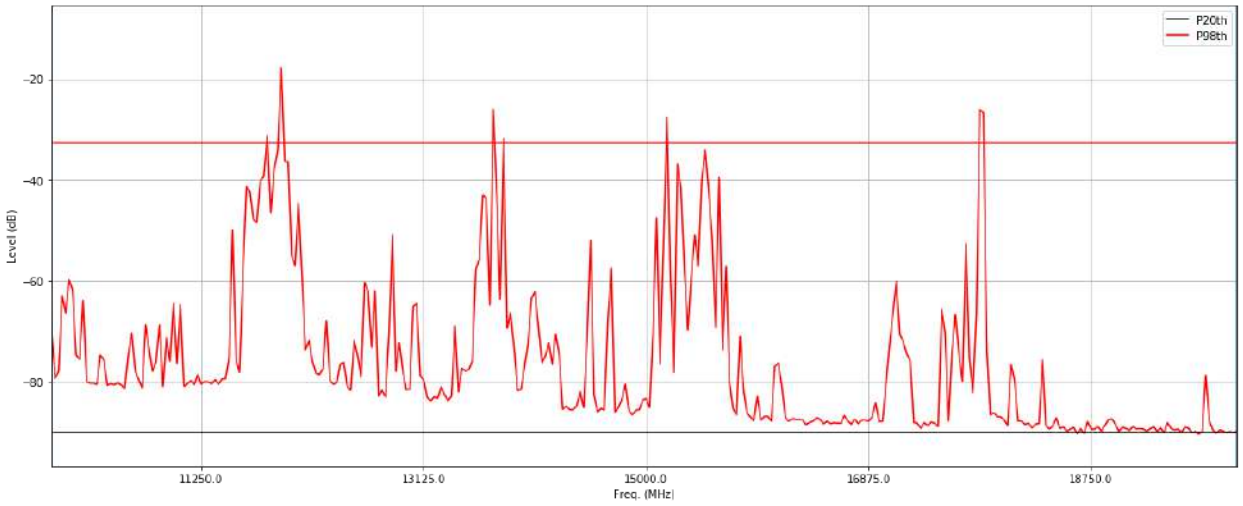


Sure, more bins would be welcome, but even zooming further, would show just a filled MW band with broadcasts every 9/10 kHz, so let's say this is enough for now.

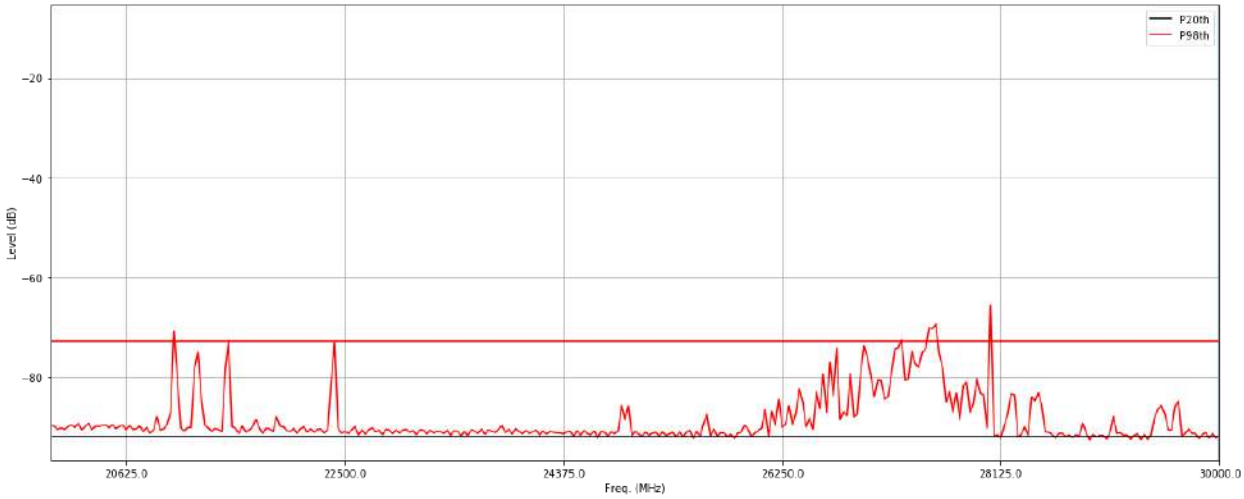
Then we have low HF bands (2-10 MHz):



then 10-20MHz:

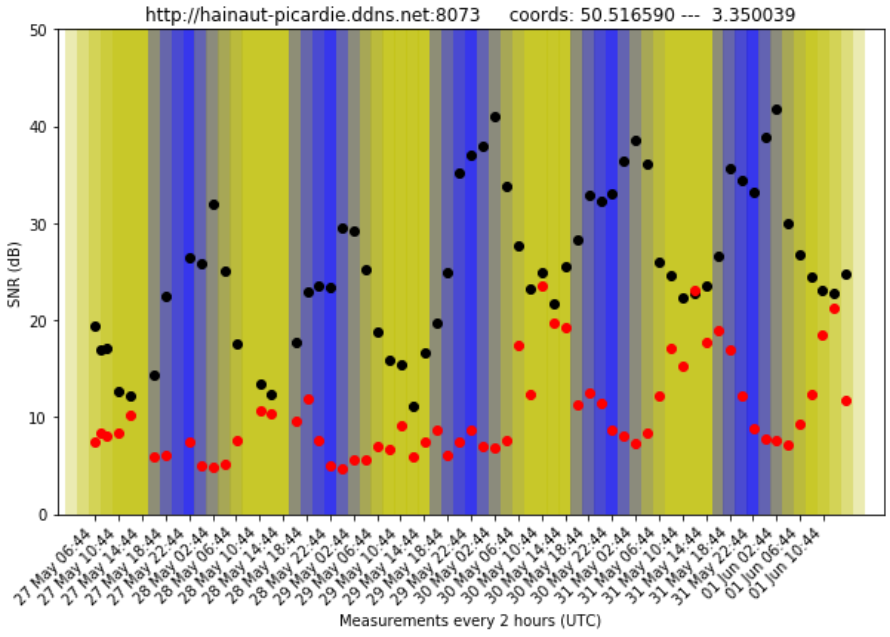


and from 20 to 30MHz:



So I think this band segmentation is a decent approximation to an octave split as suggested by Leif Asbrink / SM5BSZ.

As you can see, the noise floor and the peaks are extracted quite well, considering this is not intended to be a scientific work (for now), but it serves to give a rough idea of how a particular SDR is performing on a band and how it compares to the others nearby.



In the above graph, we can see nearly one week of accumulated data for just two bands (0-15, black dots and 15-30 MHz red dots) then everybody told me: “Two bands are not enough!” and the new multiband approach is slowly going online. The blue/yellow overlay is a rough estimate of daytime nighttime given the GPS of each receiver.

I think the history is a really valuable tool (you can open in new tab each small figure and get the full resolution!). You can understand medium term propagation trends over one week for now.

Future work

Leif’s idea of computing correlations between all pairs of SDR is very nice. I could create a dynamic graph of how propagation works geographically (using just the best receivers!)

A remote idea could be to use multiple receivers (since the audio streams are gps-tagged) to create a meta receiver exploiting interferometry... If only all SDRs were easily connectable with LINRAD... there is now a Python tool to extract the gps-tagged stream and a Christoph Mayer is doing very nice geolocalization of radars at the moment http://hcab14.blogspot.com/.

I wrote the Python tool to save the waterfalls, and I'm planning to detect lightning strikes positions.