“peak_thresh”

It controls how sensitive it is to finding peaks in the MUSIC pseudo spectrum. The function, pksfinder1.m was written by Chris Wingard and Anthony Kirincich. Previous to this, I used a histogram method to isolate what peaks are relevant in the MUSIC pseudo-spectrum by only using peaks above 60-80% of the spectrum.

The MUSIC algorithm used here starts with higher possible number of DOAs, set by “nmax” and sees if the corresponding MUSIC pseudo spectrum for that number of DOAs contains the same number of peaks. Then it continue to the next higher possible DOAs (nmax – 1), and does the same assessment.

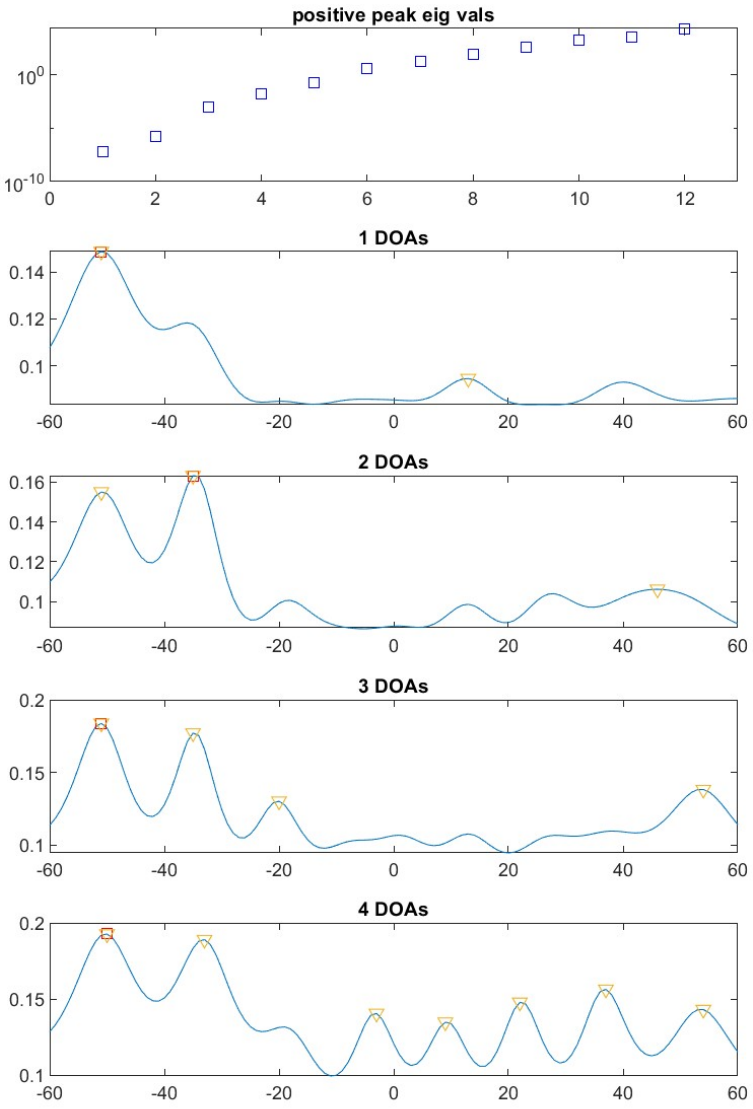
When the algorithm finds the same number of peaks in the MUSIC pseudo spectrum as the number of DOAs, it quits. If the number of DOAs is one, then if there are more than 1 peak, it will use the highest peak in the MUSIC pseudo-spectrum for that single DOA. This method is called MUSIC-highest by Kirincich et al. (2019)

Kirincich, A., B. Emery, L. Washburn, and P. Flament, 2019: Improving Surface Current Resolution Using Direction Finding Algorithms for Multiantenna High-Frequency Radars. *J. Atmos. Oceanic Technol.*, **36**, 1997–2014, https://doi.org/10.1175/JTECH-D-19-0029.1.

What follows are some examples of different thresholds use for two different sites.

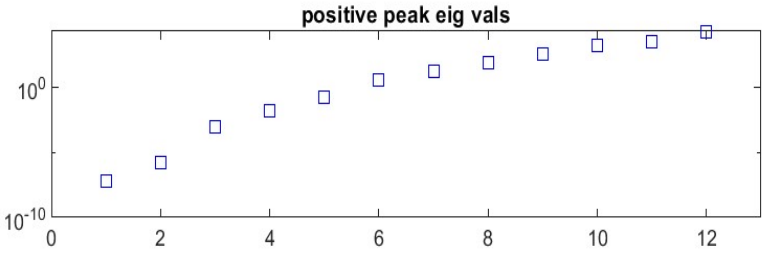
peak_thresh = 0.5

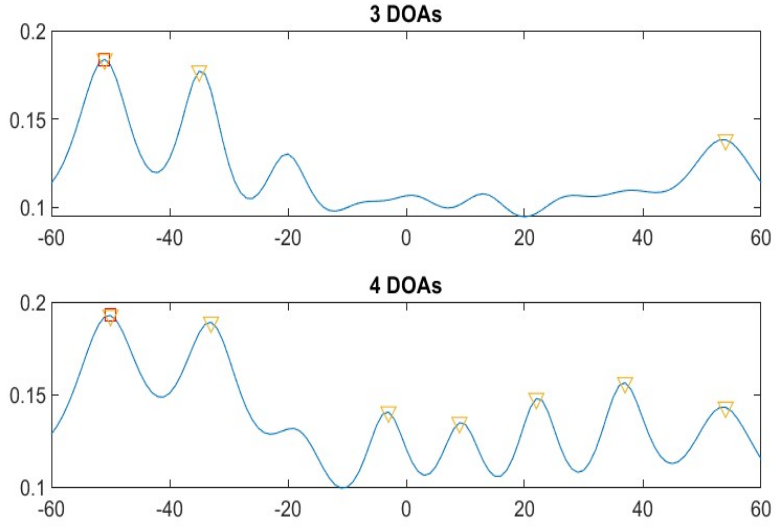
This threshold was quote low, and therefore more peaks (by the yellow triangles) than the number of DOAs are detected for each different MUSIC pseudo-spectrum. Therefore, the algorithm uses the 1 DOAs spectrum with the DOA at the maximum value (~-52 degrees in this figure).



peak_thresh = 1

Here we see the algorithm behaving differently, it finds a large number of peaks for the 4 DOA spectrum, but only 3 peaks for the 3 DOA spectrum. Therefore it will use the three DOA solution with angles at approx -52, -37 and +54 degrees.

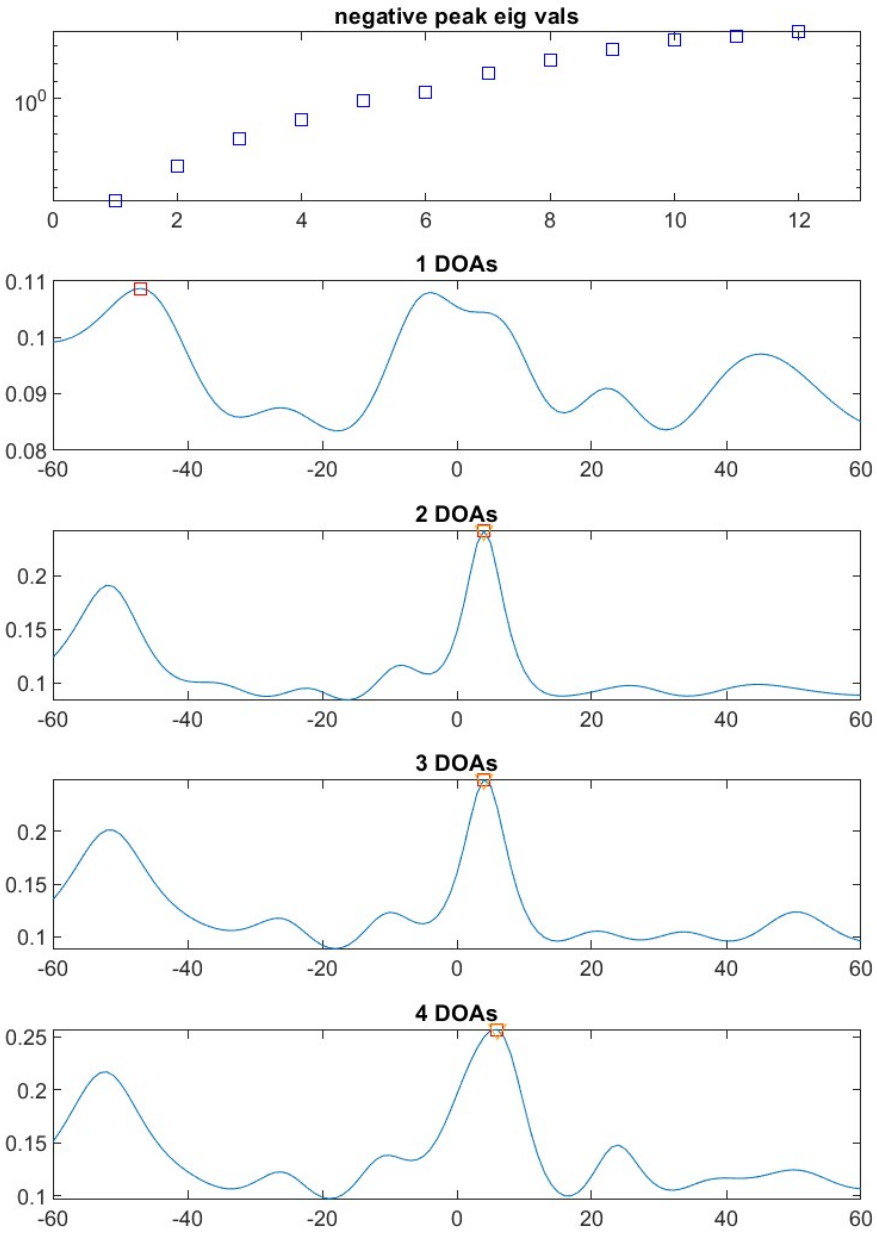




The threshold will need to be changed depending on site setup, number of antennas, antenna quality, signal quality, etc.

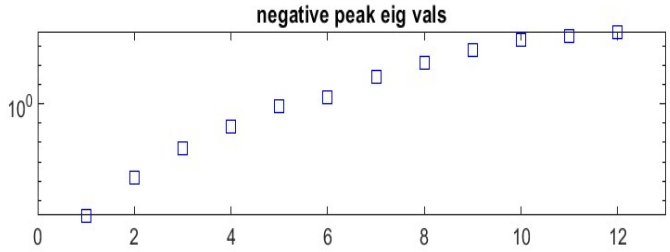
peak_thresh = 2

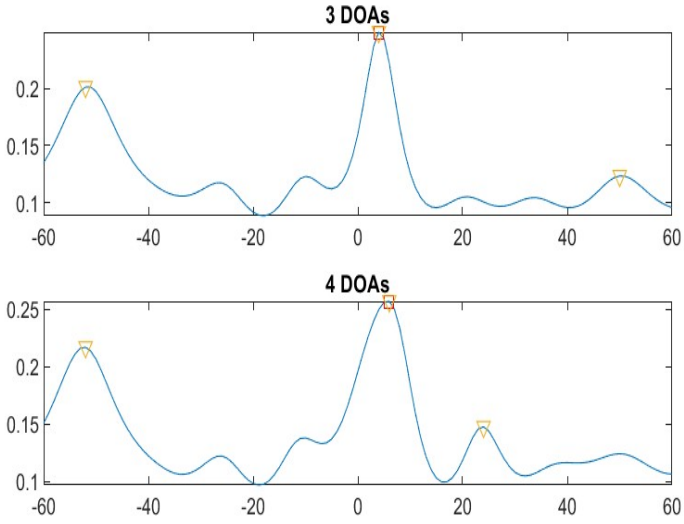
Here the threshold is too high and doesn't detect two peaks in the 2 DOA solution and therefore uses the largest peak from the 1 DOA solution.



peak_thresh = 1

Here I think it is slightly too low and detects 3 DOAs for the 3 DOA solution and therefore uses the three DOA solution.





peak_thresh = 1.5

Here it looks correct, detecting 2 strong peaks in the 2 DOA solution and therefore using those 2 DOAs for this frequency.