WSPR Analysis

For fans of WSPR, here are a few python routines for performing analyses of received spots.

- wspr2Rx.py
- wsprRx_by_band_and_call.py
- wsprRx_by_freq_and_call.py
- wsprRx_by_freq_and_grid.py
- wsprRx_print_allspots_by_freq.py
- wsprRx_snr_by_band_callsignplot.py
- wsprRx_snr_by_band_geoplot.py
- wsprRx_sort_by_us.py
- wsprRx_sort_by_uszone(0-9).py

Examples of each routine are included below.

My analysis setup consists of a windows machine with Anaconda / Spyder.

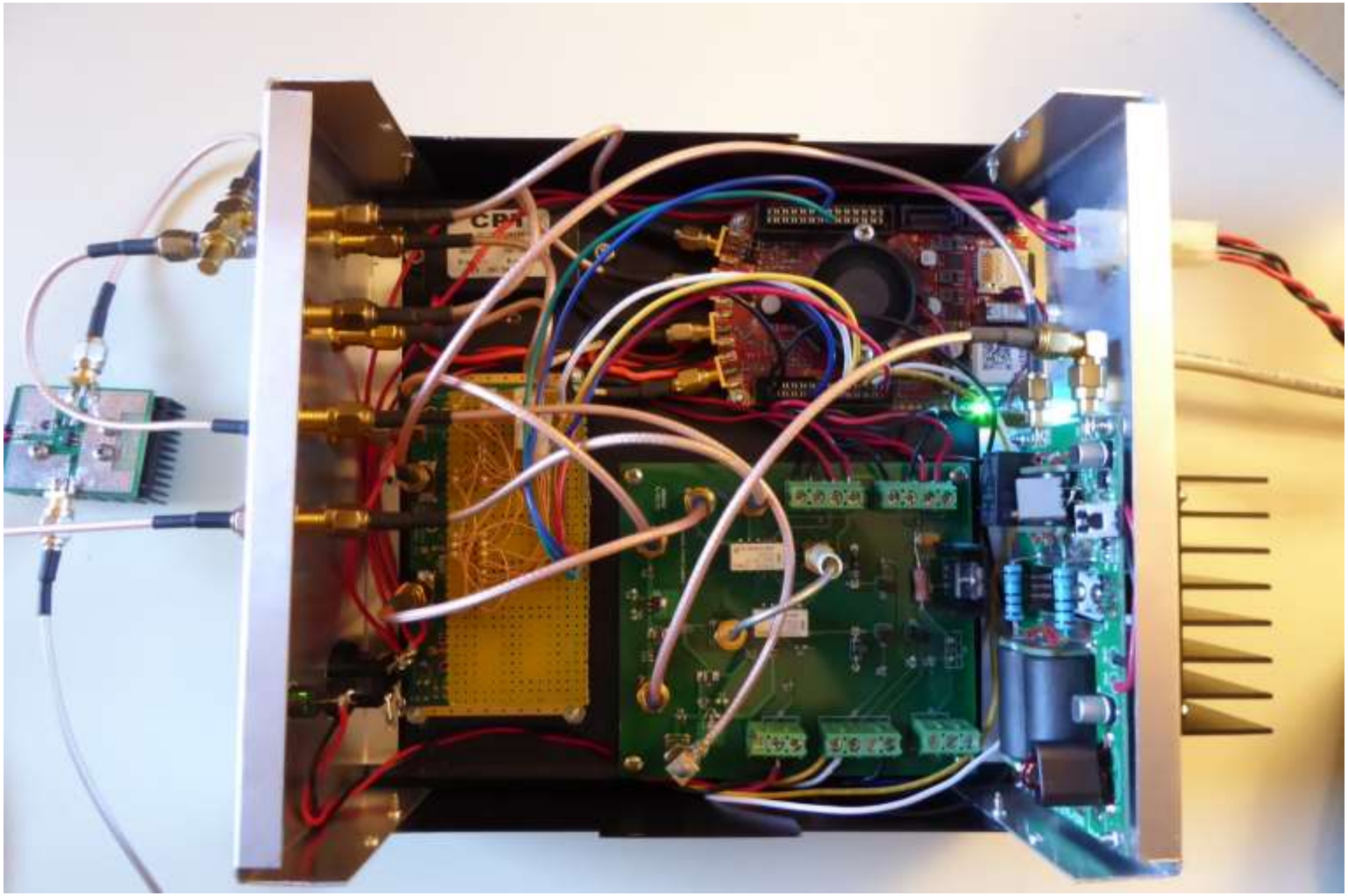
My WSPR transceiver is a homebrew SDR rig based on a 14b Red Pitaya board and WSJT-X / piHPSDR running on a Raspberry Pi.

The file to be examined is copied from the Raspberry Pi to the windows machine. The ALL_WSPR.TXT file format consists of 17 fields (WSJT-X).

Additional packages must first be installed to enable the database and plotting functions.

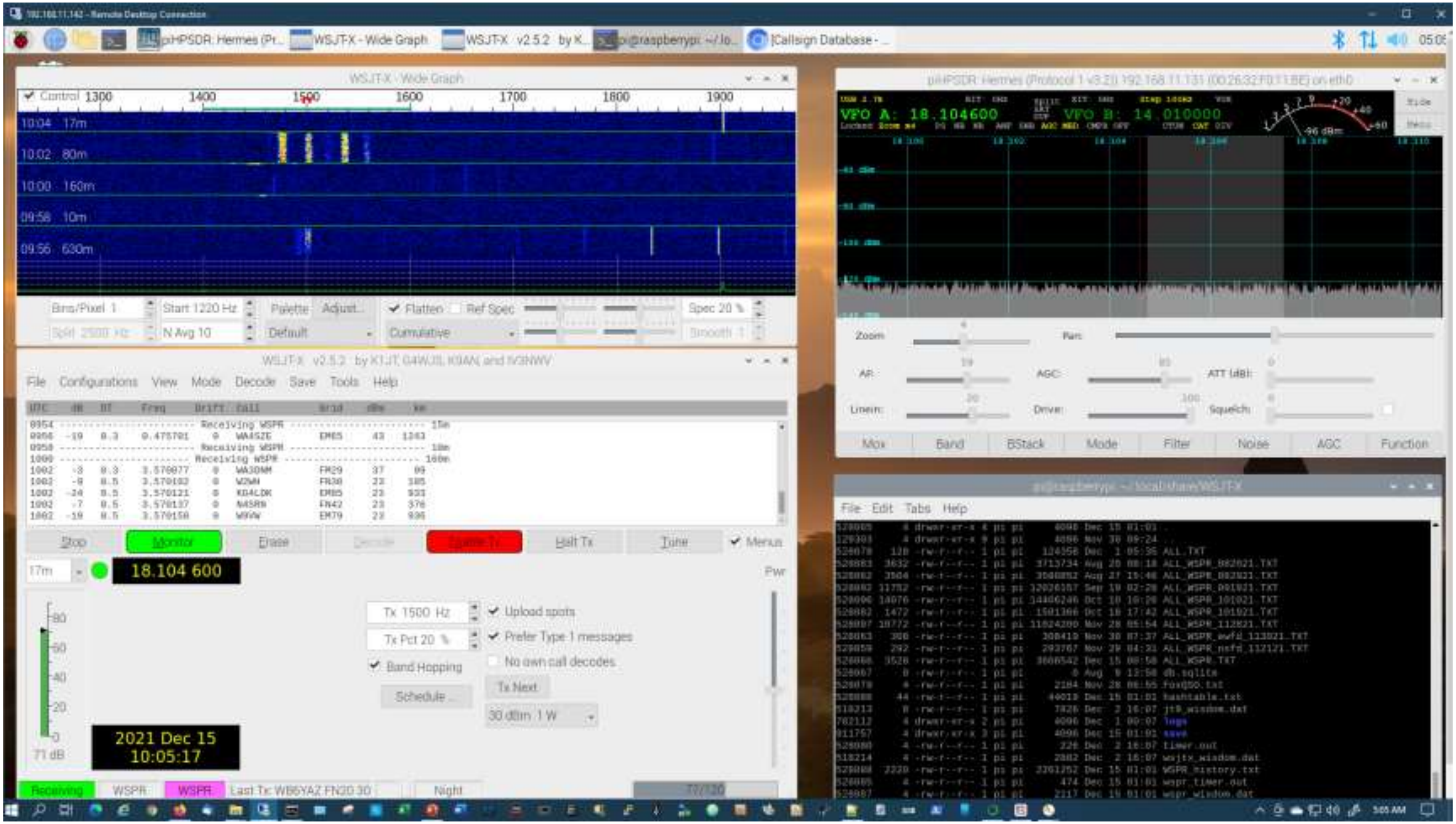
1. pandas
2. geopandas
3. matplotlib
4. shapely
5. pyhamtools

WSPR Analysis



Red-Pitaya SDR QRP Transceiver

WSPR Analysis



WSJT-X - Wide Graph

10:04	17m
10:02	80m
10:00	160m
09:58	10m
09:56	630m

☑ Control 1300 1400 1500 1600 1700 1800 1900

Bins/Pixel 1 · Start 1220 Hz · Palette · Adjust... · ☑ Flatten · □ Ref Spec · Spec 20 % · Split 2500 Hz · N Avg 10 · Default · Cumulative · Smooth 1

WSJT-X v2.5.2 by K1JT, G4WJS, K9AN, and IV3NWV

File Configurations View Mode Decode Save Tools Help

```
UTC   dB   DT      Freq    Drift  Call        Grid    dBm    km
0954 ---------------------- Receiving WSPR ---------------------- 15m
0956  -19  0.3   0.475701    0    WA4SZE      EM65     43   1263
0958 ---------------------- Receiving WSPR ---------------------- 10m
1000 ---------------------- Receiving WSPR ---------------------- 160m
1002   -3  0.3   3.570077    0    WA3DNM      FM29     37     89
1002   -9  0.5   3.570102    0    W2WN        FN30     23    185
1002  -24  0.5   3.570121    0    KD4LDK      EM85     23    933
1002   -7  0.5   3.570137    0    N4SRN       FN42     23    376
1002  -19  0.5   3.570158    0    W9VW        EM79     23    936
```

17m · 18.104 600

2021 Dec 15 10:05:17

71 dB

Tx 1500 Hz · Tx Pct 20 % · ☑ Band Hopping · Schedule ... · ☑ Upload spots · ☑ Prefer Type 1 messages · □ No own call decodes · Tx Next · 30 dBm 1 W · ☑ Menus · Pwr

Receiving · WSPR · WSPR · Last Tx: WB6YAZ FN20 30 · Night · 77/120

piHPSDR Hermes (Protocol 1 v3.2) 192.168.11.131 (00:26:32:F0:11:BE) on eth0

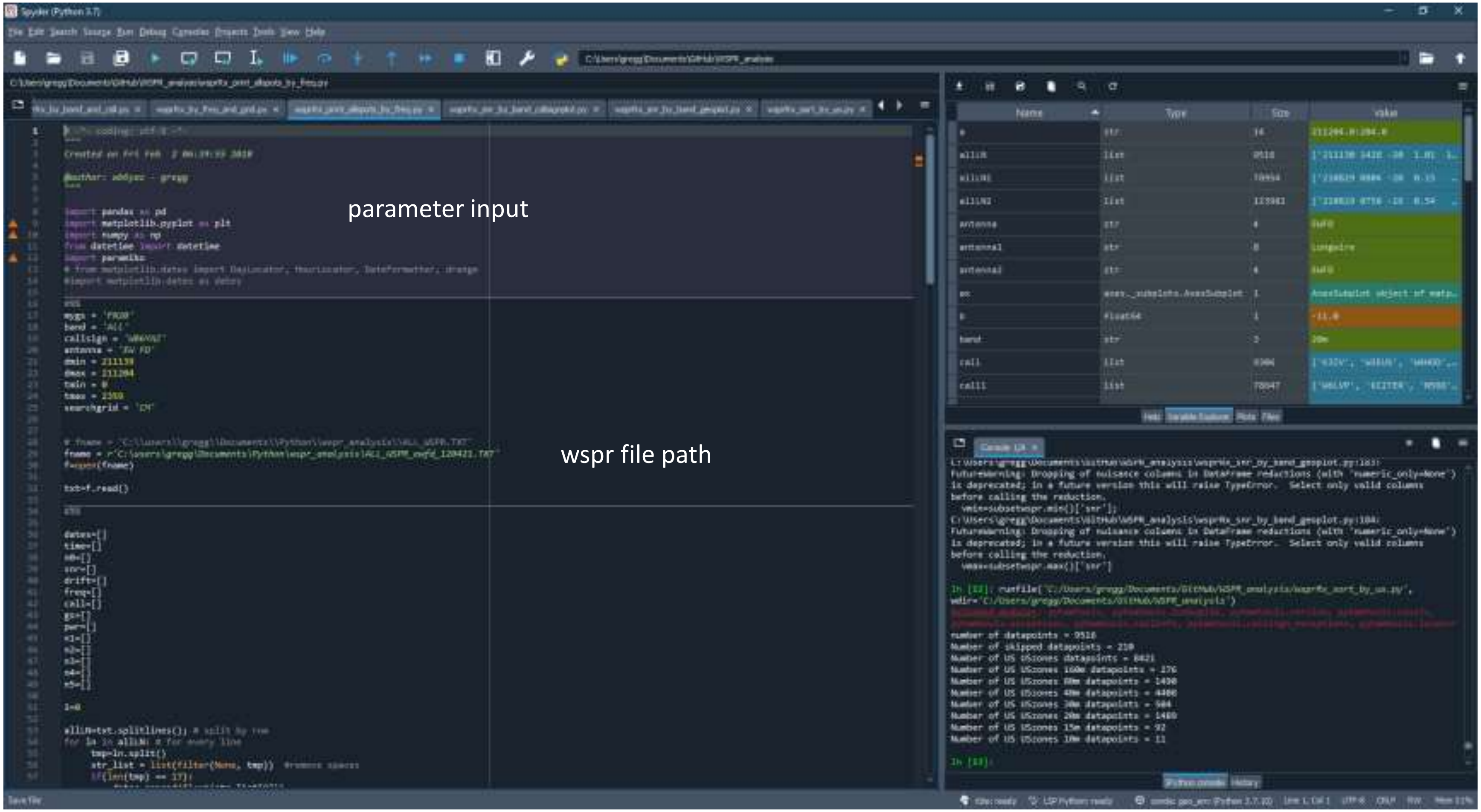
VFO A: 18.104600 · VFO B: 14.010000 · Step 100Hz · -96 dBm

Zoom · Pan · AF · AGC · ATT (dB) · Linein · Drive · Squelch

```
528085     4 drwxr-xr-x 4 pi pi     4096 Dec 15 01:01 .
129303     4 drwxr-xr-x 9 pi pi     4096 Nov 30 09:24 ..
528078   128 -rw-r--r-- 1 pi pi   124358 Dec  1 05:35 ALL.TXT
528083  3632 -rw-r--r-- 1 pi pi  3713734 Aug 20 08:18 ALL_WSPR_082021.TXT
528082  3504 -rw-r--r-- 1 pi pi  3080852 Aug 27 15:46 ALL_WSPR_082821.TXT
528082 11752 -rw-r--r-- 1 pi pi 12026187 Sep 19 02:28 ALL_WSPR_091921.TXT
528086 14076 -rw-r--r-- 1 pi pi 14406246 Oct 10 10:28 ALL_WSPR_101021.TXT
528082  1472 -rw-r--r-- 1 pi pi  1501366 Oct 18 17:42 ALL_WSPR_101921.TXT
528087 10772 -rw-r--r-- 1 pi pi 11024200 Nov 28 05:54 ALL_WSPR_112821.TXT
528063   300 -rw-r--r-- 1 pi pi   308419 Nov 30 07:37 ALL_WSPR_ewfd_113021.TXT
528059   292 -rw-r--r-- 1 pi pi   293767 Nov 29 04:31 ALL_WSPR_nsfd_112121.TXT
528066  3528 -rw-r--r-- 1 pi pi  3606542 Dec 15 00:58 ALL_WSPR.TXT
528067     0 -rw-r--r-- 1 pi pi        0 Aug  9 12:58 db.sqlite
528078     4 -rw-r--r-- 1 pi pi     2184 Nov 28 06:55 foxQSO.txt
528088    44 -rw-r--r-- 1 pi pi    44013 Dec 15 01:01 hashtable.txt
518213     8 -rw-r--r-- 1 pi pi     7826 Dec  2 16:07 jt9_wisdom.dat
782112     4 drwxr-xr-x 2 pi pi     4096 Dec  1 00:07 logs
811757     4 drwxr-xr-x 3 pi pi     4096 Dec 15 01:01 save
528080     4 -rw-r--r-- 1 pi pi      226 Dec  2 16:07 timer.out
518214     4 -rw-r--r-- 1 pi pi     2882 Dec  2 16:07 wsjtx_wisdom.dat
528088  2220 -rw-r--r-- 1 pi pi  2261252 Dec 15 01:01 WSPR_history.txt
528085     4 -rw-r--r-- 1 pi pi      474 Dec 15 01:01 wspr_timer.out
528087     4 -rw-r--r-- 1 pi pi     2117 Dec 15 01:01 wspr_wisdom.dat
```

Red-Pitaya SDR QRP Transceiver

WSPR Analysis



Spyder (Python 3.7)
File Edit Search Source Run Debug Consoles Projects Tools View Help
C:\Users\gregg\Documents\GitHub\WSPR_analysis
C:\Users\gregg\Documents\GitHub\WSPR_analysis\wsprRx_print_allspots_by_freq.py
Help Variable Explorer Plots Files
Console 1/A
IPython console History
Save File
Kite: ready LSP Python: ready conda: geo_env (Python 3.7.10) Line 1, Col 1 UTF-8 CRLF RW Mem 11%

parameter input

wspr file path

```
# -*- coding: utf-8 -*-
"""
Created on Fri Feb  2 06:29:33 2018

@author: wb6yaz - gregg
"""

import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
from datetime import datetime
import paramiko
# from matplotlib.dates import DayLocator, HourLocator, DateFormatter, drange
#import matplotlib.dates as dates

#%%
mygs = 'FR20'
band = 'ALL'
callsign = 'WB6YAZ'
antenna = '3W FD'
dmin = 211139
dmax = 211204
tmin = 0
tmax = 2359
searchgrid = 'CM'


# fname = 'C:\\users\\gregg\\Documents\\Python\\wspr_analysis\\ALL_WSPR.TXT'
fname = r'C:\users\gregg\Documents\Python\wspr_analysis\ALL_WSPR_wsfd_120421.TXT'
f=open(fname)

txt=f.read()

#%%

dates=[]
time=[]
db=[]
snr=[]
drift=[]
freq=[]
call=[]
gs=[]
pwr=[]
x1=[]
x2=[]
x3=[]
x4=[]
x5=[]

i=0

allLN=txt.splitlines(); # split by row
for ln in allLN: # for every line
    tmp=ln.split()
    str_list = list(filter(None, tmp))  #remove spaces
    if(len(tmp) == 17):
```

Name	Type	Size	Value
a	str	16	211204.0:204.0
allLN	list	9516	['211130 1426 -20 1.81 1...
allLN1	list	78954	['210829 0004 -20 0.13 ...
allLN2	list	123981	['210829 0756 -23 0.54 ...
antenna	str	4	3WFD
antenna1	str	8	Longwire
antenna2	str	4	3WFD
ax	axes._subplots.AxesSubplot	1	AxesSubplot object of matp...
b	float64	1	-11.0
band	str	3	20m
call	list	8306	['KJ2V', 'W1EUS', 'WA4QD', ...
call1	list	78047	['W6LVP', 'KI1TER', 'N7BB', ...

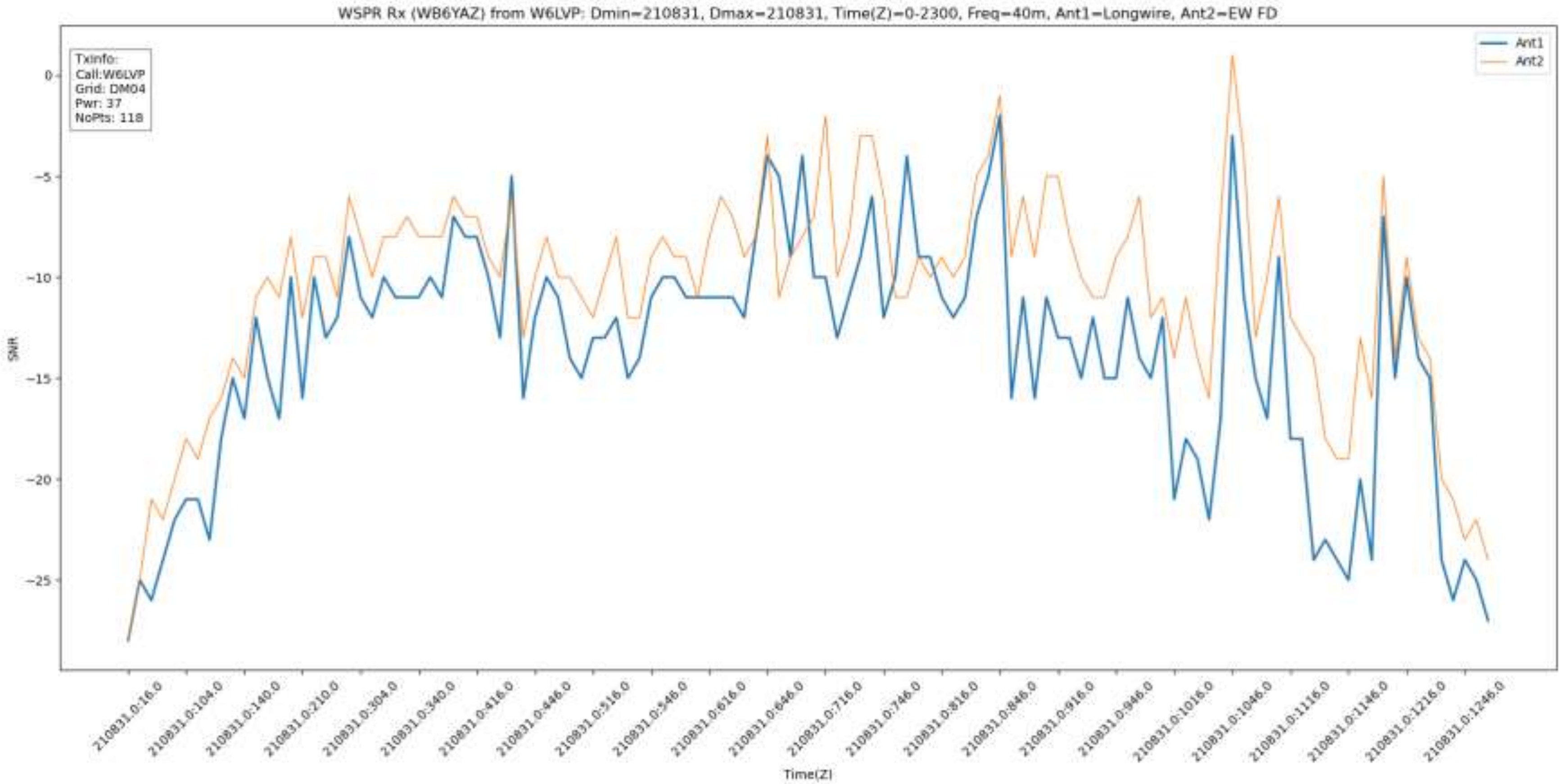
```
C:\Users\gregg\Documents\GitHub\WSPR_analysis\wsprRx_snr_by_band_geoplot.py:183:
FutureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None')
is deprecated; in a future version this will raise TypeError.  Select only valid columns
before calling the reduction.
  vmin=subsetwspr.min()['snr'];
C:\Users\gregg\Documents\GitHub\WSPR_analysis\wsprRx_snr_by_band_geoplot.py:184:
FutureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None')
is deprecated; in a future version this will raise TypeError.  Select only valid columns
before calling the reduction.
  vmax=subsetwspr.max()['snr']

In [12]: runfile('C:/Users/gregg/Documents/GitHub/WSPR_analysis/wsprRx_sort_by_us.py',
wdir='C:/Users/gregg/Documents/GitHub/WSPR_analysis')
[illegible]
number of datapoints = 9516
Number of skipped datapoints = 210
Number of US USzones datapoints = 8421
Number of US USzones 160m datapoints = 176
Number of US USzones 80m datapoints = 1490
Number of US USzones 40m datapoints = 4406
Number of US USzones 30m datapoints = 984
Number of US USzones 20m datapoints = 1469
Number of US USzones 15m datapoints = 92
Number of US USzones 10m datapoints = 11

In [13]:
```

Spyder Console

G. Daugherty (WB6YAZ)

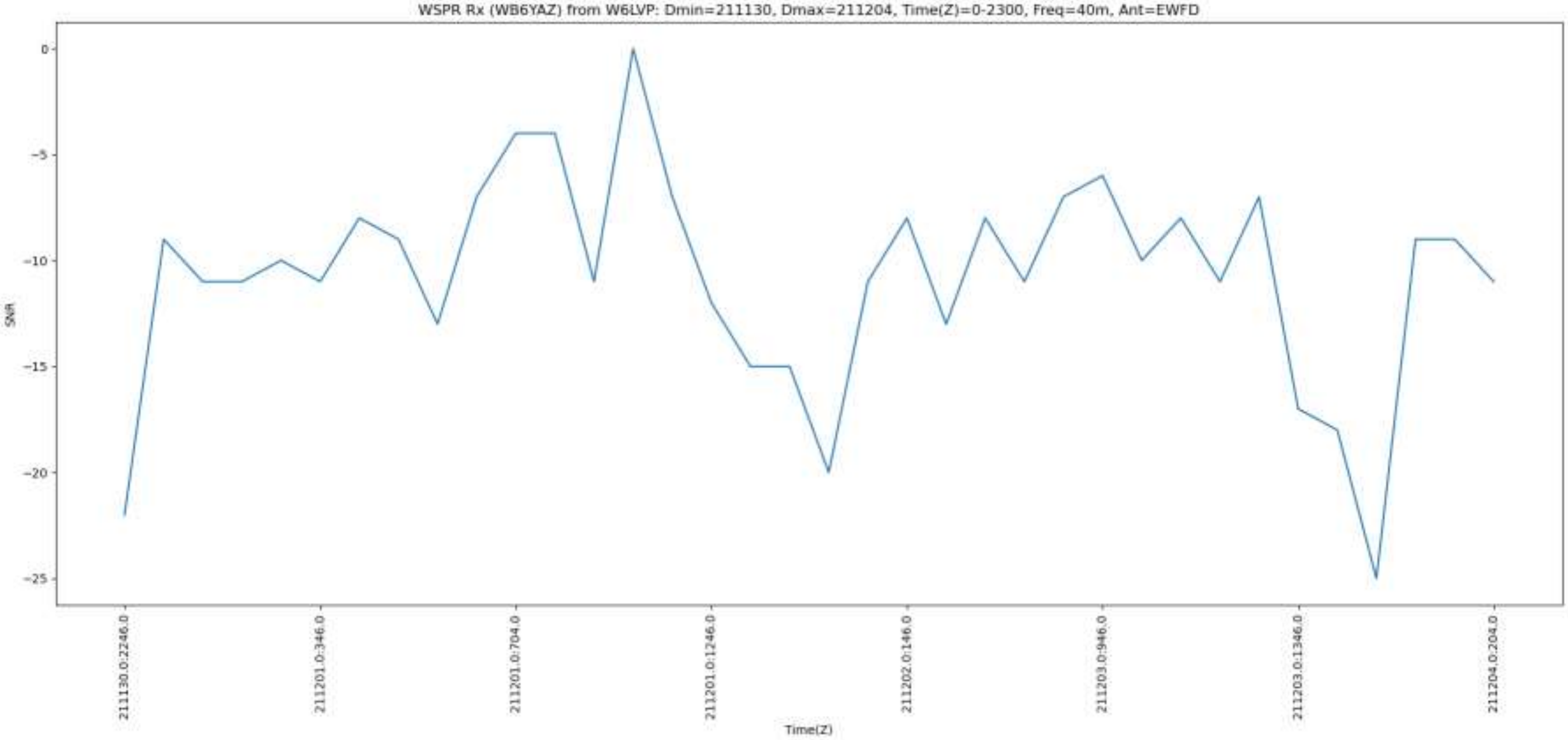
12/15/21

WSPR Analysis



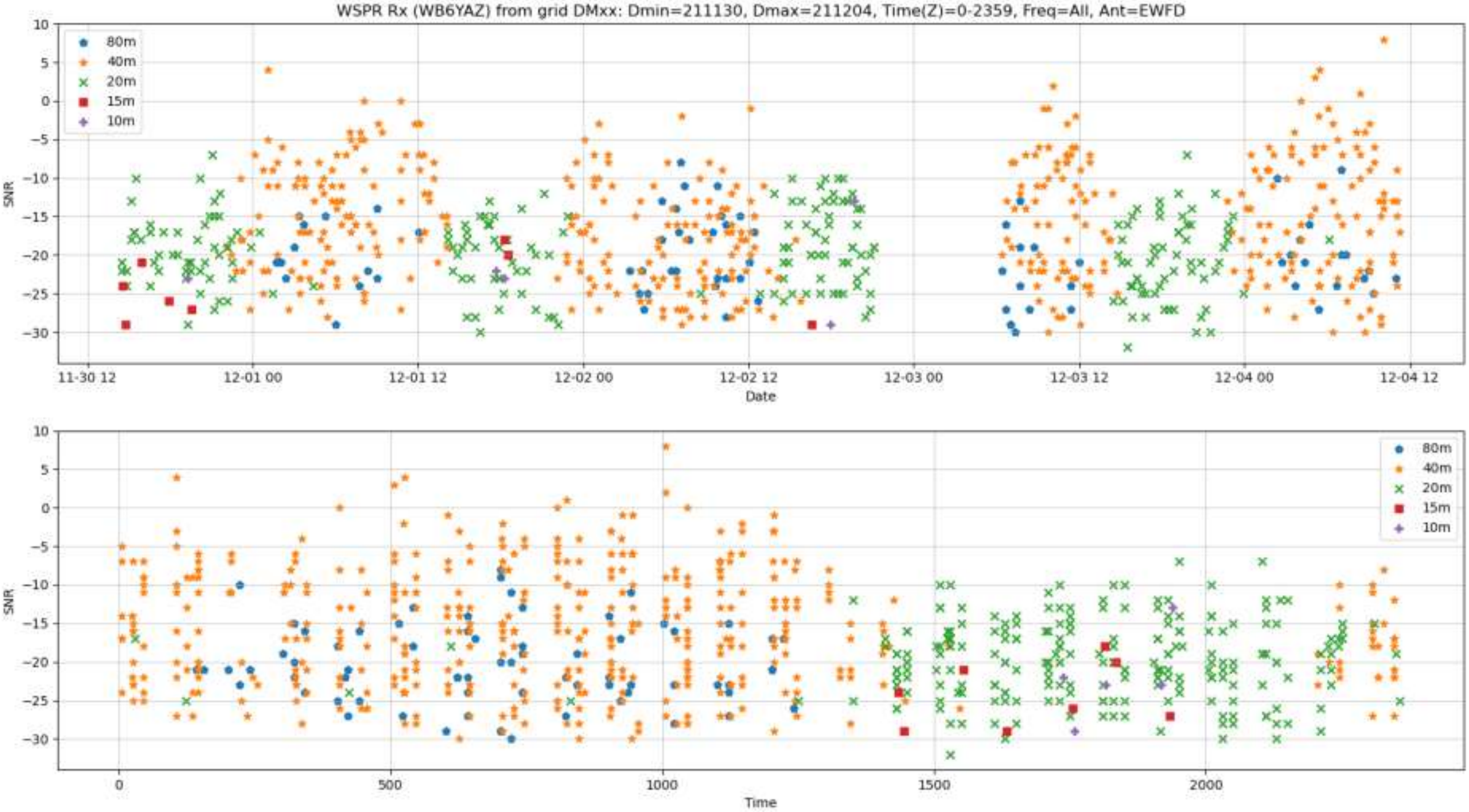
wspr2Rx.py

WSPR Analysis



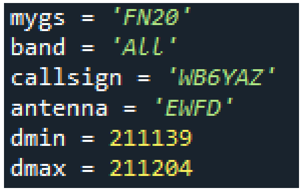
wsprRx_by_band_and_call.py

WSPR Analysis

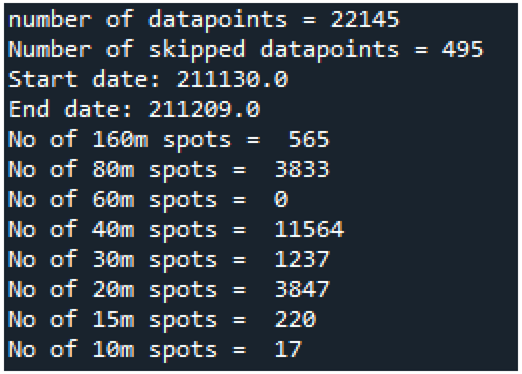


wsprRx_by_freq_and_grid.py

WSPR Analysis



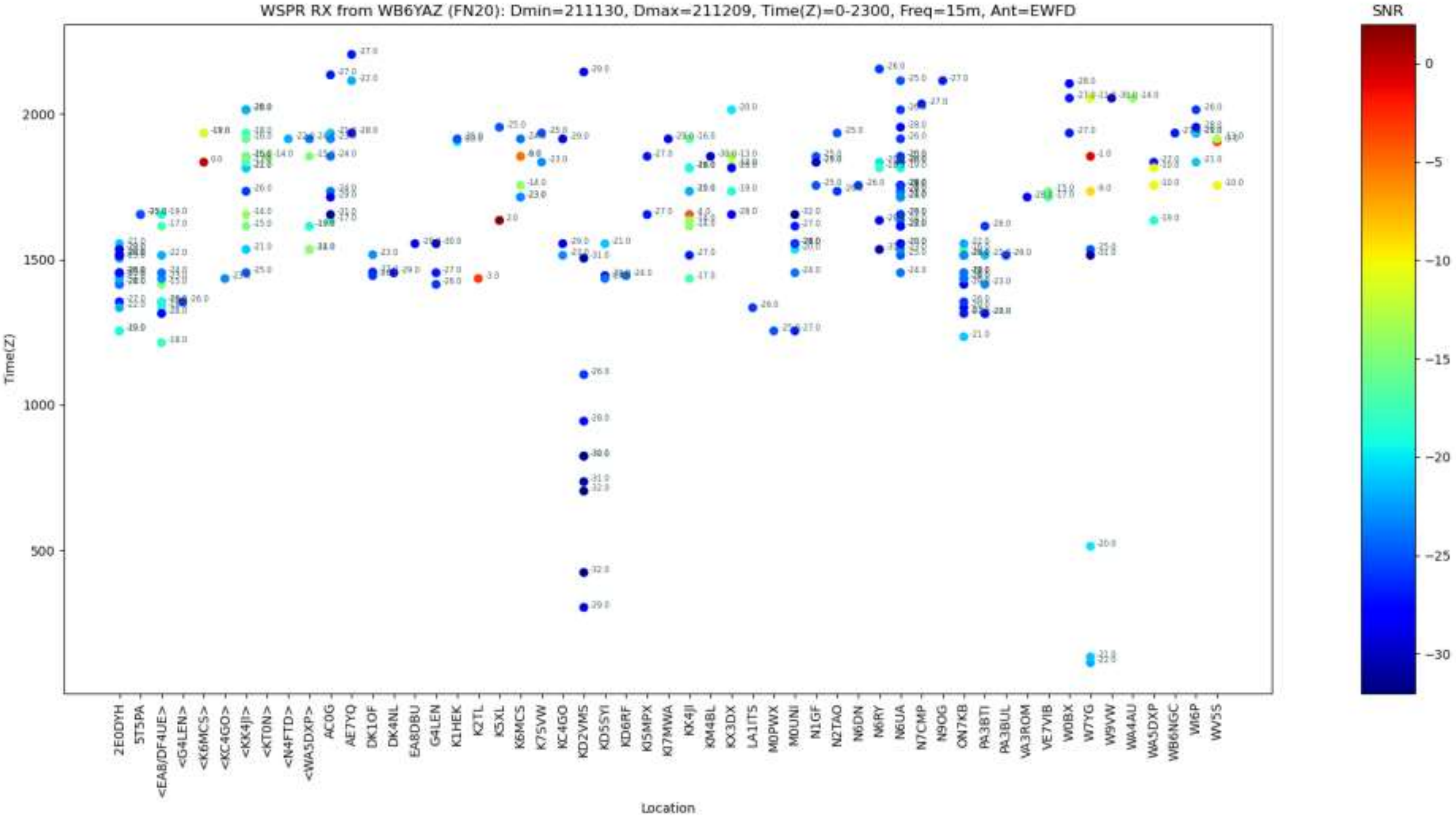
```
mygs = 'FN20'
band = 'ALL'
callsign = 'WB6YAZ'
antenna = 'EWFD'
dmin = 211139
dmax = 211204
```



```
number of datapoints = 22145
Number of skipped datapoints = 495
Start date: 211130.0
End date: 211209.0
No of 160m spots =  565
No of 80m spots =  3833
No of 60m spots =  0
No of 40m spots =  11564
No of 30m spots =  1237
No of 20m spots =  3847
No of 15m spots =  220
No of 10m spots =  17
```

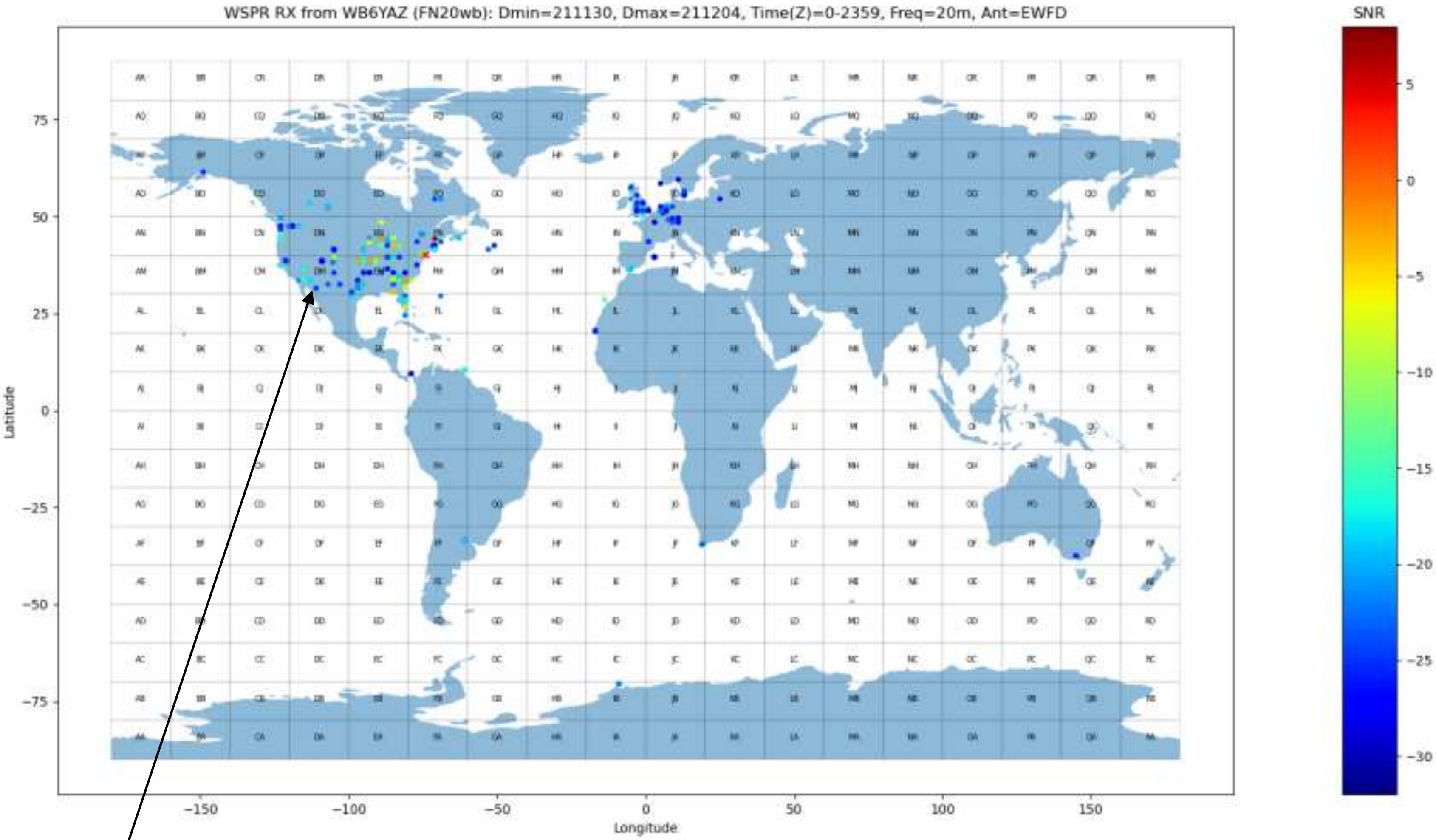
wsprRx_print_allspots_by_freq.py

WSPR Analysis



wsprRx_snr_by_band_callsignplot.py

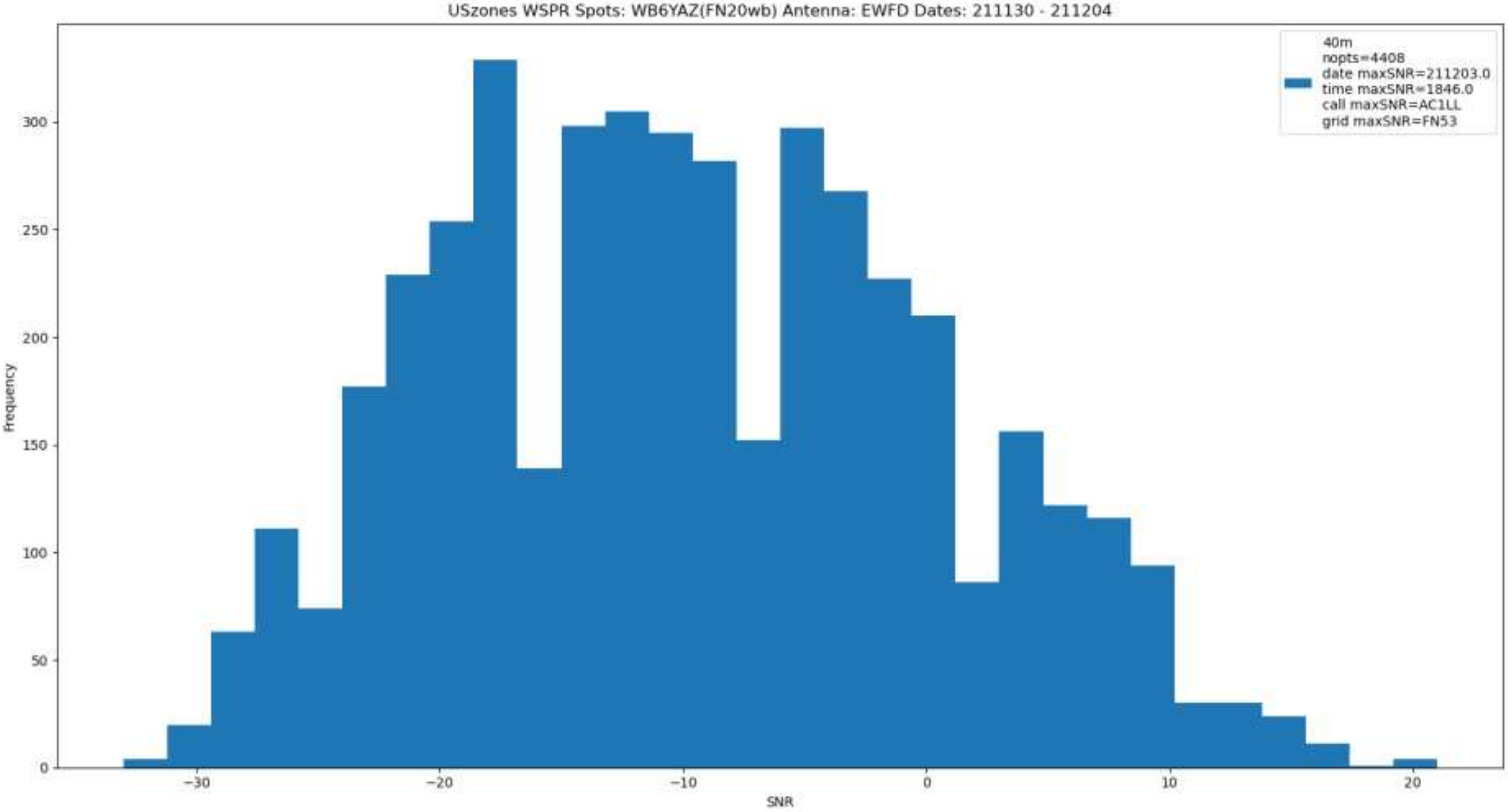
WSPR Analysis


WSPR RX from WB6YAZ (FN20wb): Dmin=211130, Dmax=211204, Time(Z)=0-2359, Freq=20m, Ant=EWFD
Latitude
75
50
25
0
−25
−50
−75
Longitude
−150
−100
−50
0
50
100
150
SNR
5
0
−5
−10
−15
−20
−25
−30

wsprRx_snr_by_band_geoplot.py

Clicking on point displays spot data for location in spyder console window

WSPR Analysis



wsprRx_sort_by_us.py