DISTRIBUTIONAL ASPECTS OF SHORT-TERM 2022 20-METER SEQUENTIAL MATCHED WSPR DAEMON NOISE OBSERVATIONS

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ABOUT ME

- Licensed 1971
- QTH Atlanta
- Up to date on QRZ.COM and LinkedIn

- Environmental and public health statistics
- Retired in 2016 from the US CDC
- Consulted since

MOTIVATION

- Ham radio perspective-Why do signals suddenly disappear in the middle of my QSO?
- Statistical perspective

PREVIOUS WORK

- For a pair of stations, differences at two-minute intervals in reported SNR of WSPR reports were investigated.
- Attempted to model all and extreme values of those differences as a function of hour, month, and path length.
- Patterns existed but accounted for only a (very) small proportion of the observed variation.
- Data had extreme values that warranted investigation and explanation.

CURRENT EFFORT

- In a similar fashion, look at the WSPRDaemon FFT Noise Level data from 2022.
- Brief aside: The RMS Noise Level was well correlated with the FFT Noise Level data

FIRST STEPS

- **Need to understand the data, what it is measuring.**

CAUTION

> Wrangling data is like interrogating a prisoner. Just because you wrangled a confession doesn't mean you wrangled the answer.

Brad Schneider

APPROACH

- Control for as much as possible:
  - Looking at reports from multiple single stations and receivers in 2022
  - 20 meters only
  - Over the smallest possible time interval-2 minutes

APPROACH

- What is not controlled for:
  - Temporal variations
    - Solar
    - Seasonal
    - Diurnal
  - Station configuration changes
  - Environmental changes
  - Et al., et al., ad nauseum

EXPLORATORY DATA ANALYSIS(EDA)

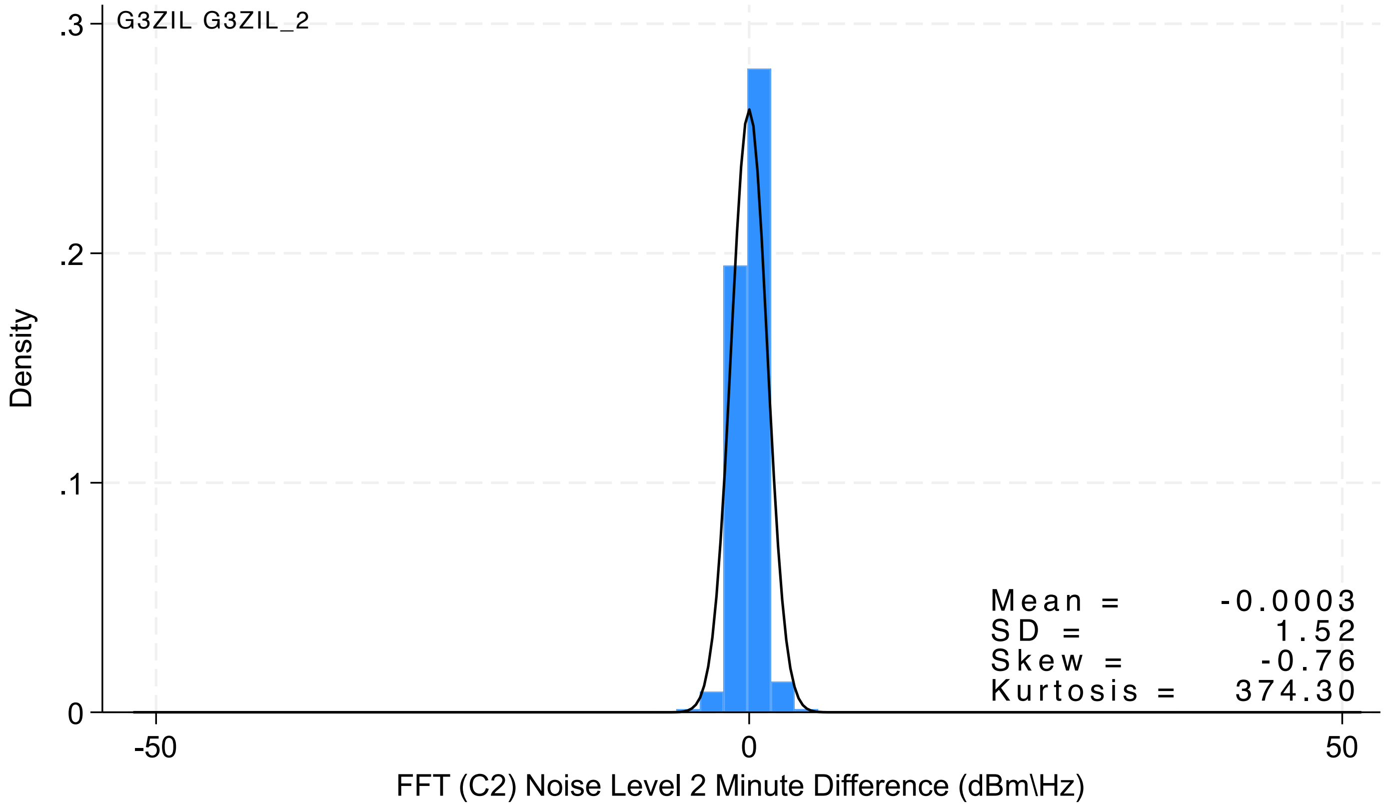
EDA TOOLS

- Descriptive statistics
- Histograms
- Box plots
- Scatter plots

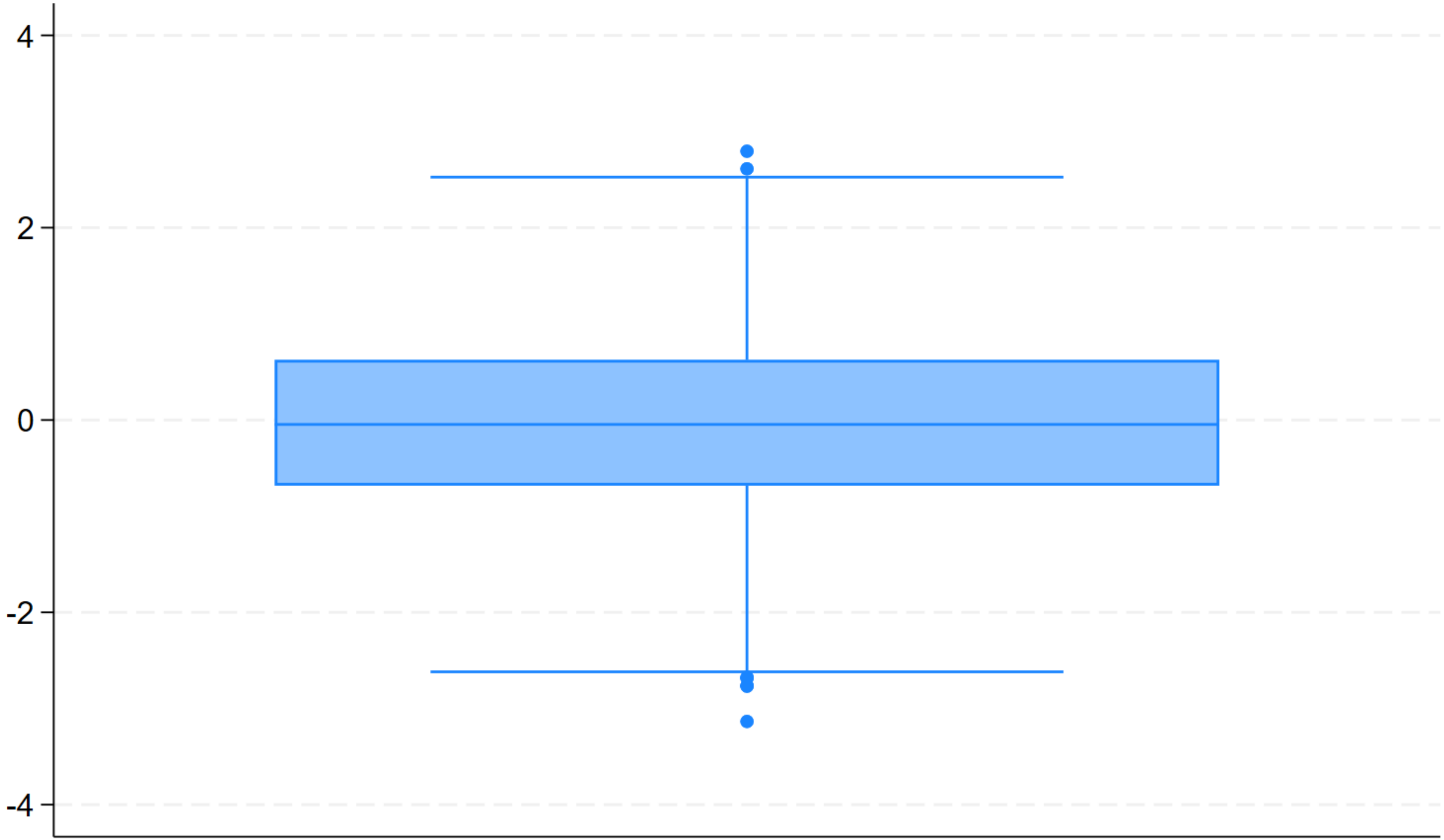
EDA TOOLS

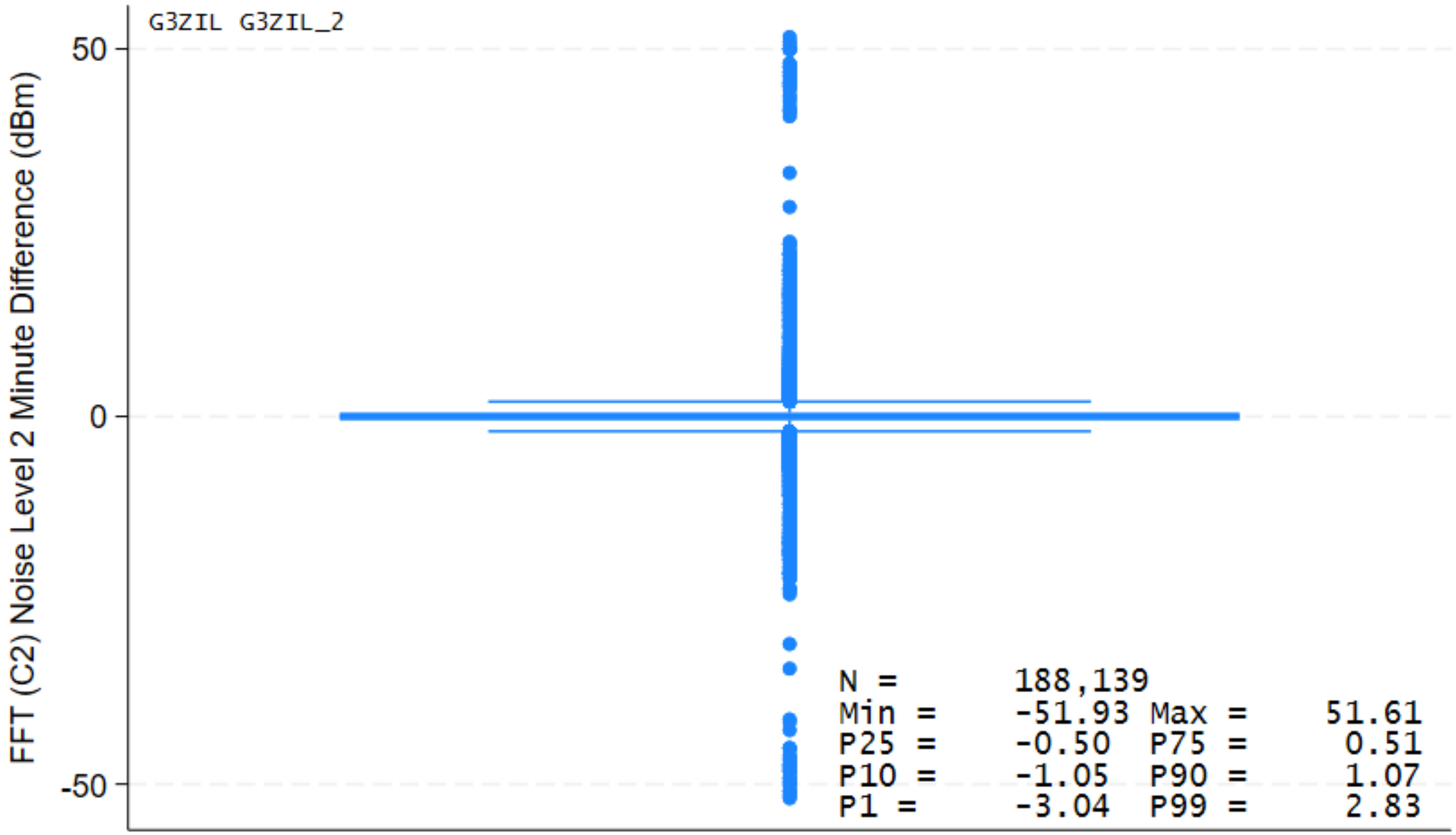
- Scatter plots, line graphs, bar charts, histograms, spike plots, kernel density plots, cumulative distribution plots, box plots, violin plots, dot plots, stem and leaf plots, skew plots, quantile plots, symmetry plots, heat maps, pie charts, radar charts, jitter plots, table plots, matrix plots, treemaps, bubble charts, area charts, donut charts, Sankey diagrams, choropleth maps, contour plots, 3D surface plots, Chernoff faces, parallel coordinates plots, mosaic plots, sunburst diagrams, network graphs, word clouds, streamgraphs, alluvial diagrams, candlestick charts, bullet graphs, Gantt charts, waterfall charts, funnel charts, Pareto charts, sparklines, slope graphs, waffle charts, ridgeline plots, ternary plots, polar area charts, chord diagrams, cartograms, hexbin plots, lollipop charts, bump charts, Marimekko charts, dumbbell plots, packed bubble charts, radial bar charts, horizon charts, Nightingale rose charts, Rootograms, raincloud plots, parallel coordinates plot, andrews curves, star plots, stream graphs, horizon charts, et. al.

HISTOGRAMS

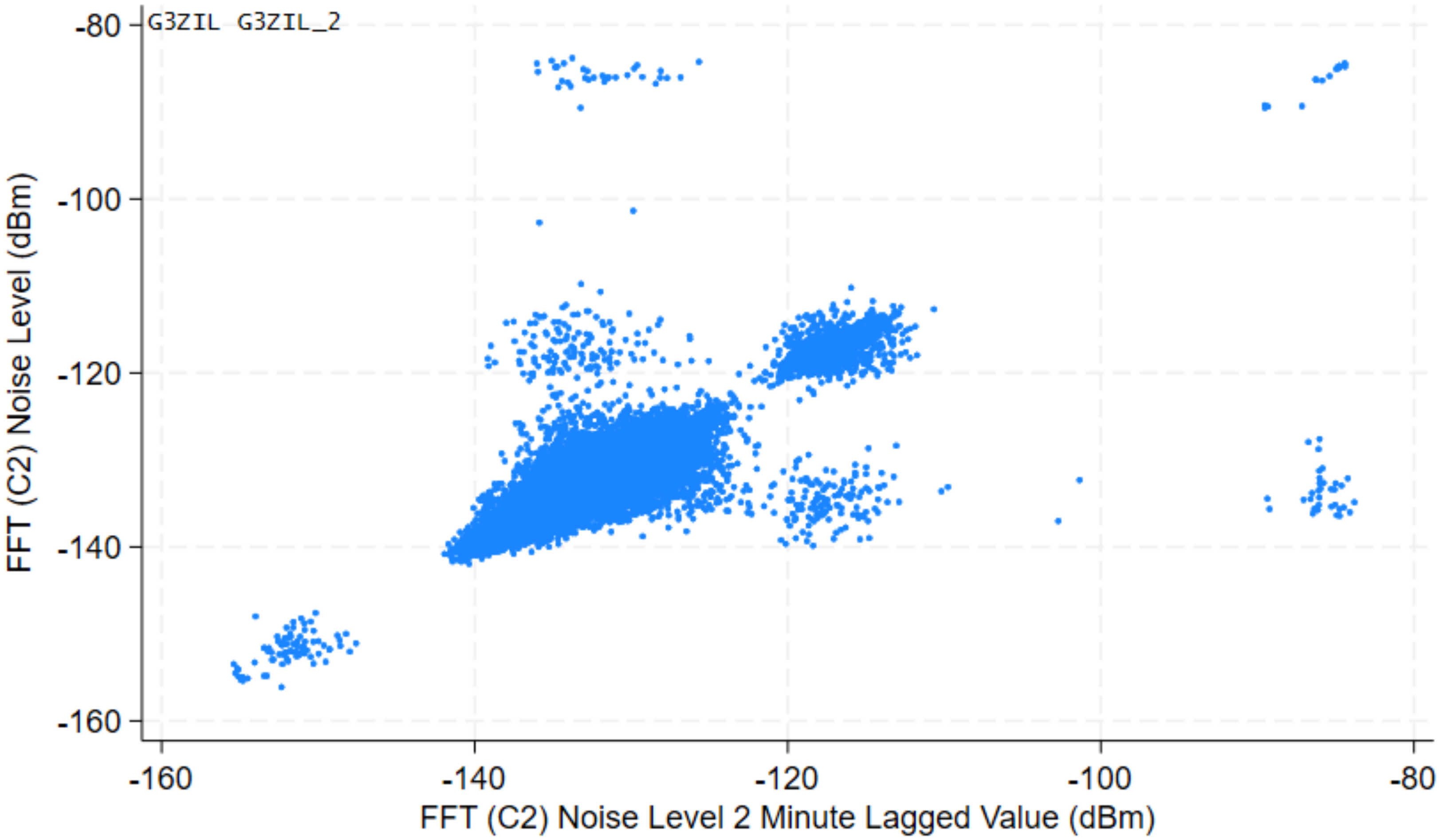

G3ZIL G3ZIL_2
.3
.2
.1
0
Density
-50
0
50
FFT (C2) Noise Level 2 Minute Difference (dBm\Hz)
Mean = -0.0003
SD = 1.52
Skew = -0.76
Kurtosis = 374.30

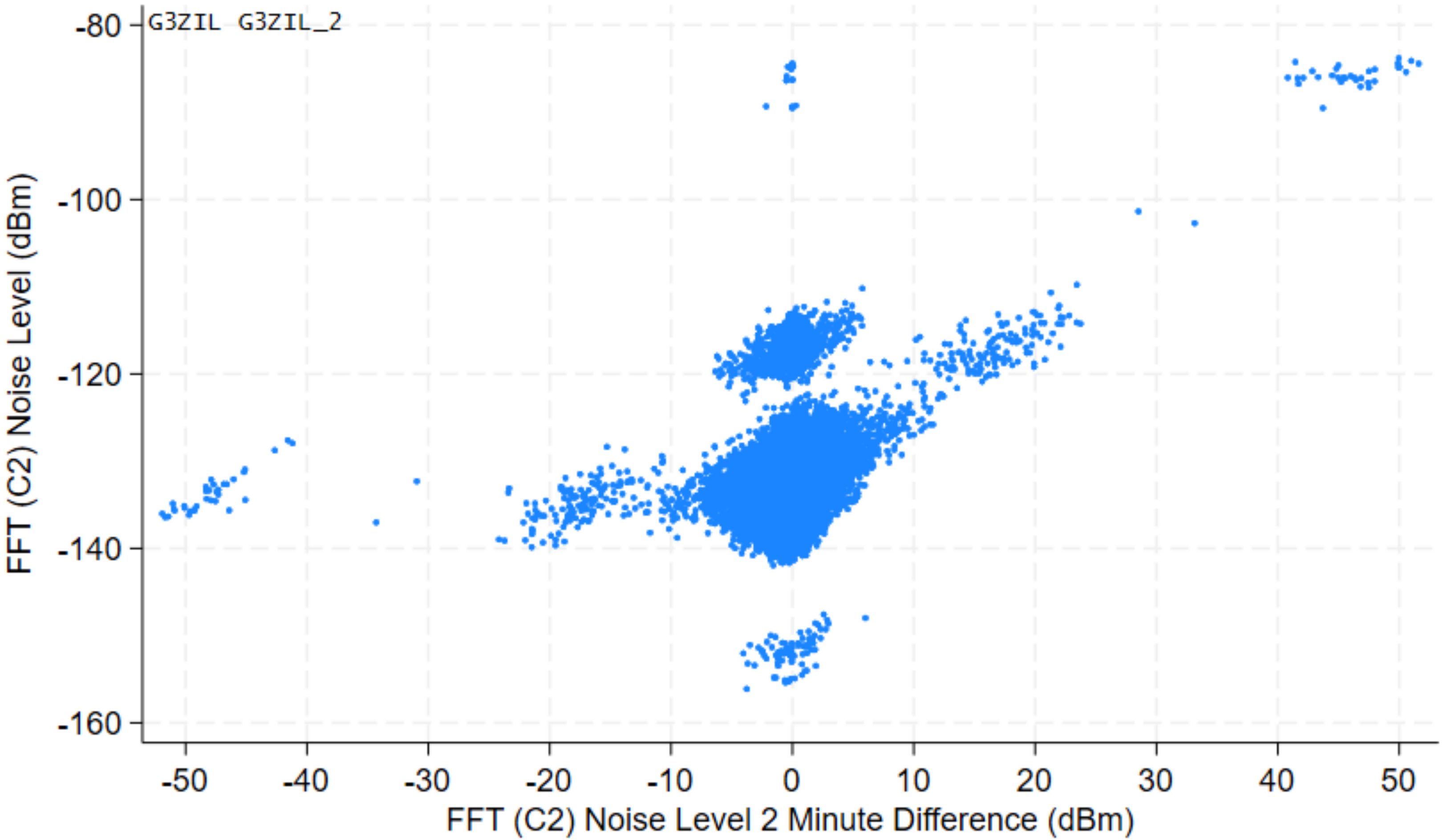
BOX PLOTS

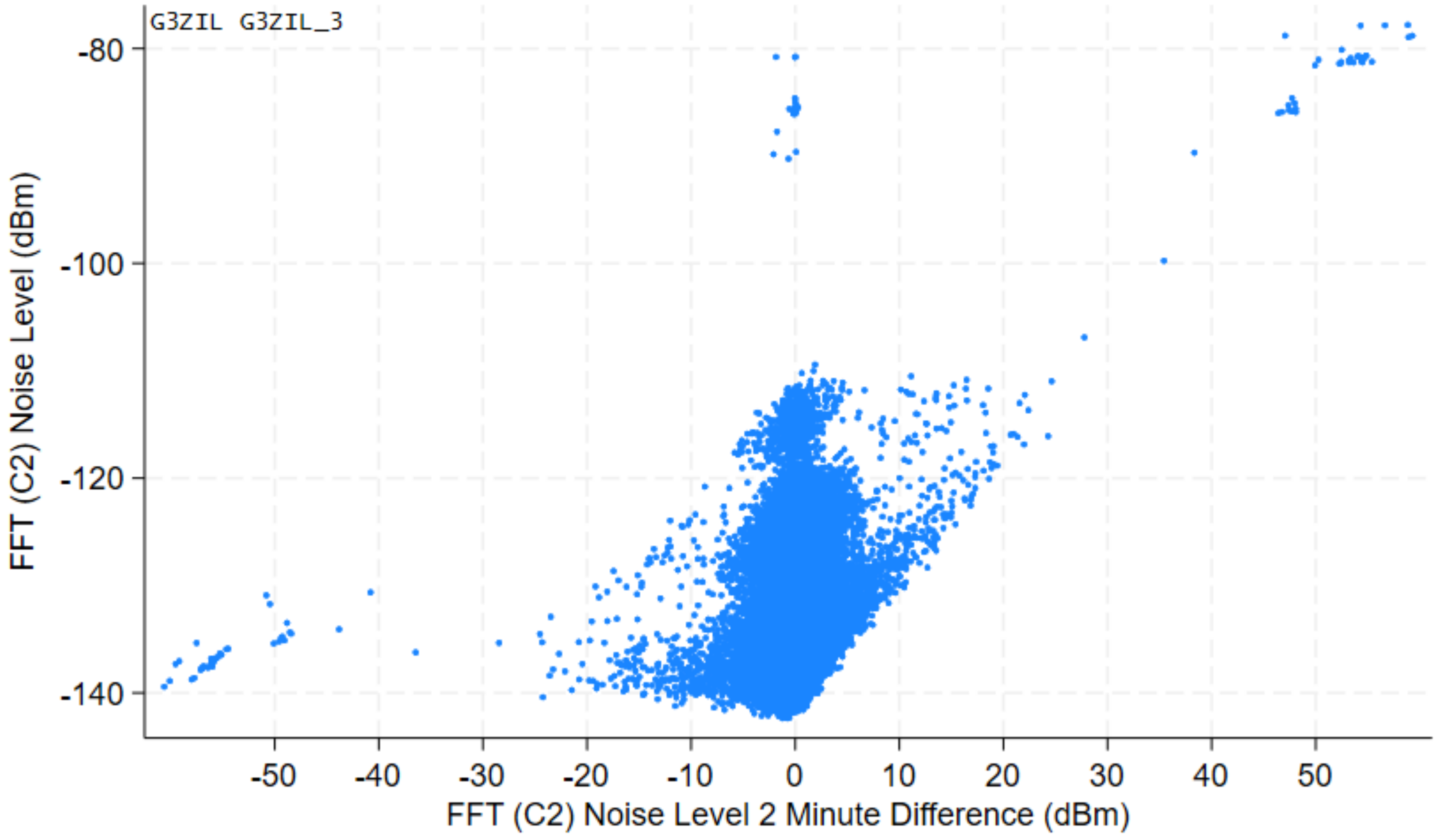

4
2
0
-2
-4

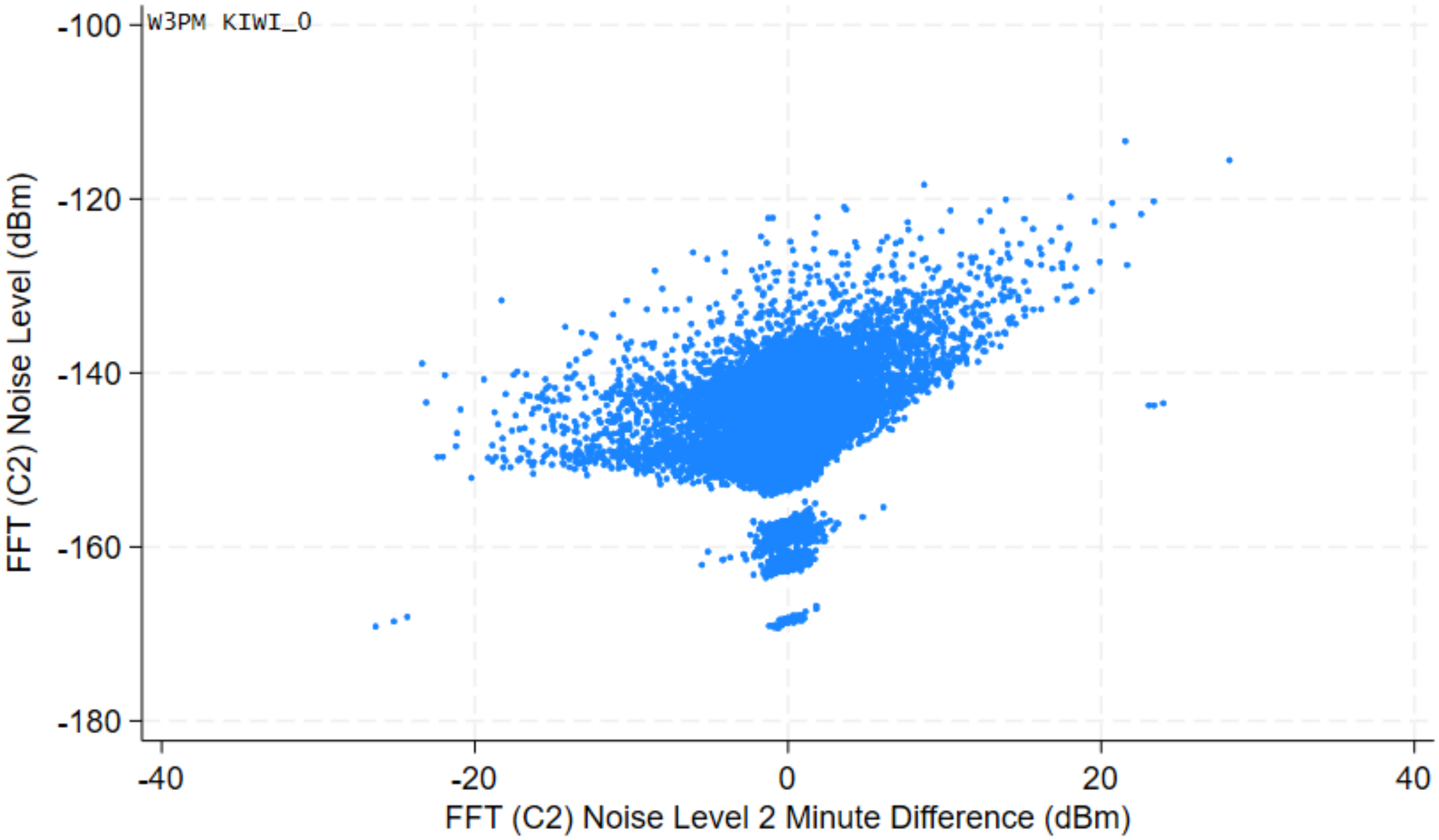

G3ZIL G3ZIL_2
FFT (C2) Noise Level 2 Minute Difference (dBm)
50
0
-50
N = 188,139
Min = -51.93 Max = 51.61
P25 = -0.50 P75 = 0.51
P10 = -1.05 P90 = 1.07
P1 = -3.04 P99 = 2.83

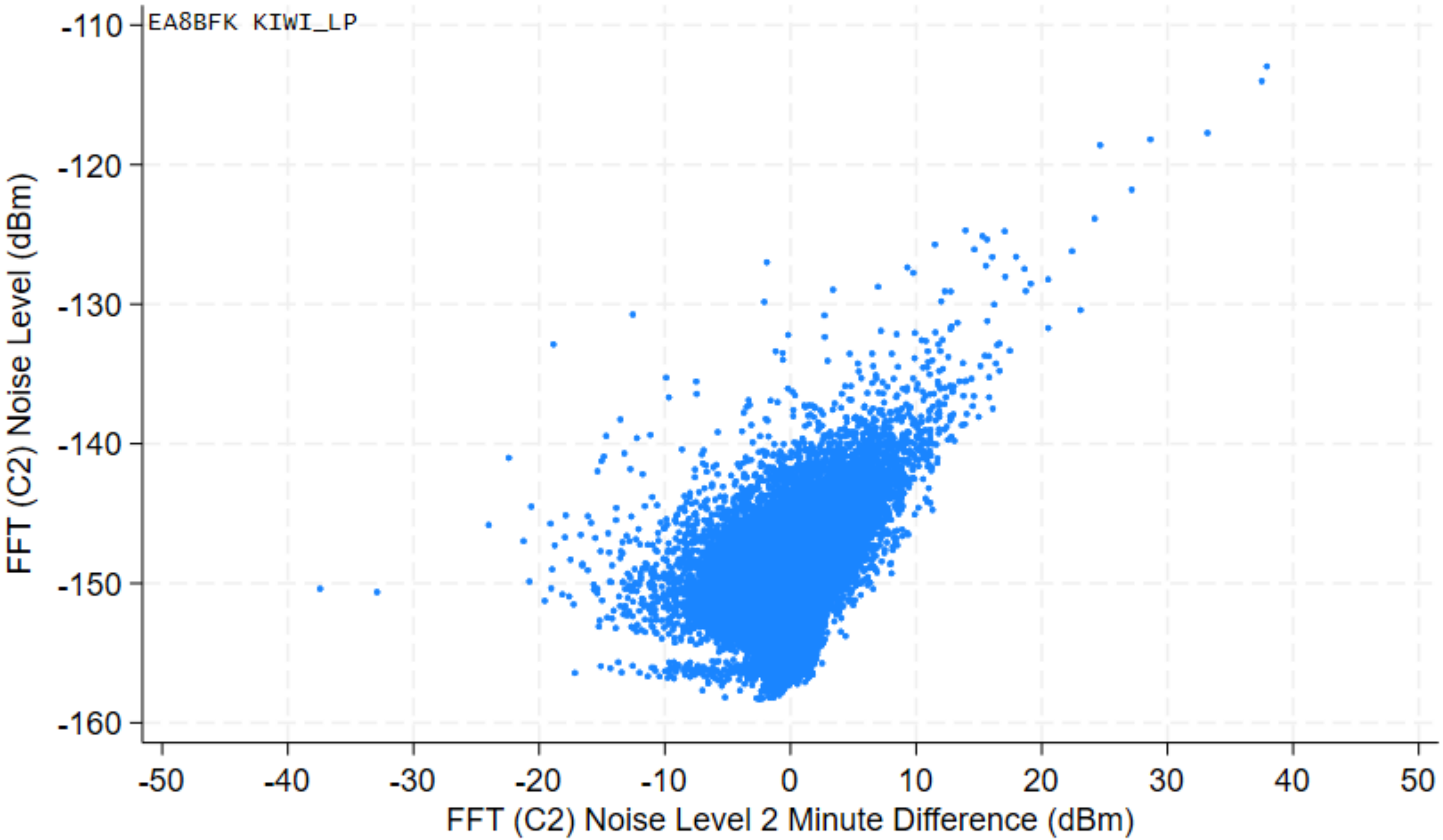
SCATTER PLOTS

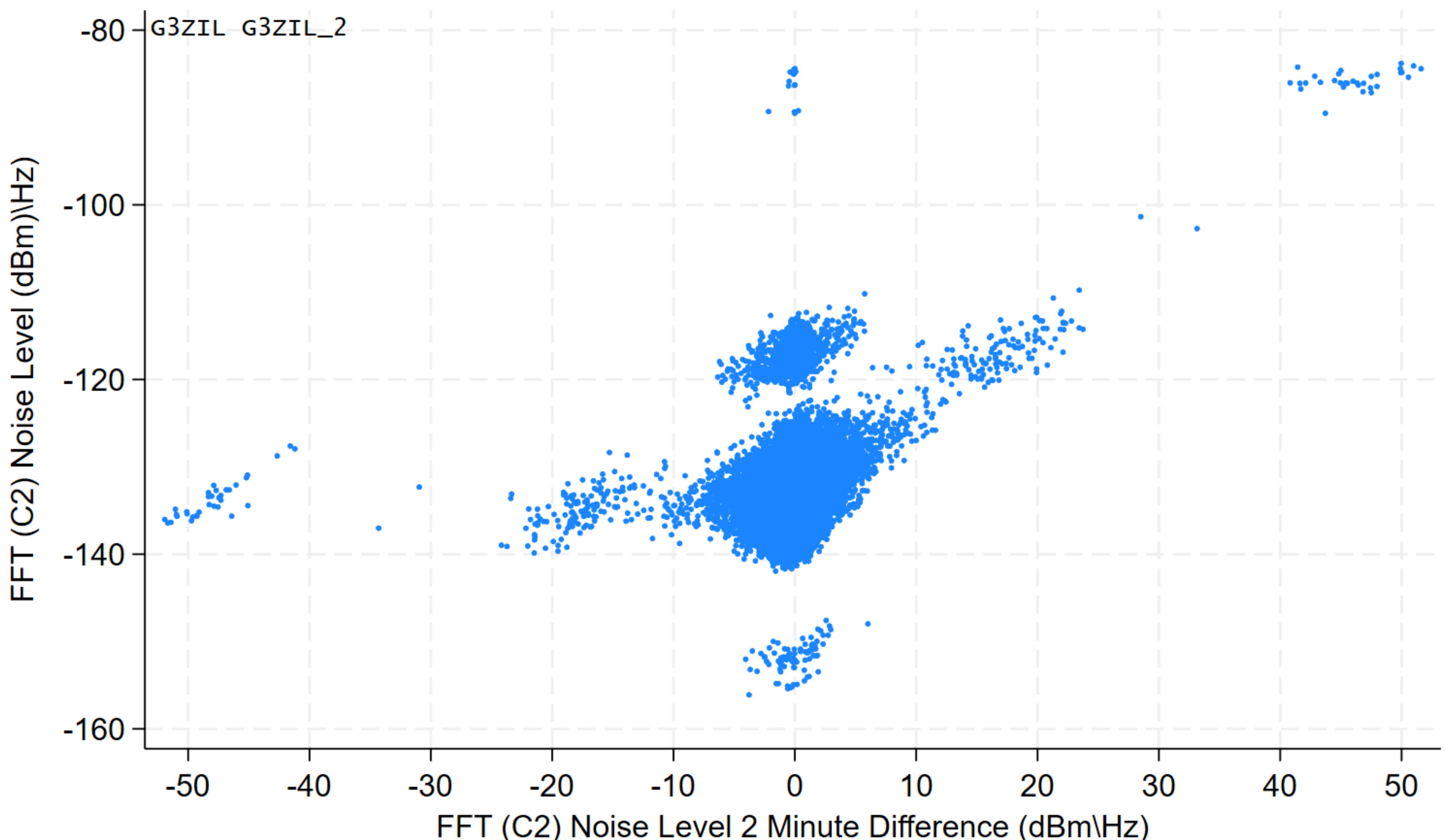

G3ZIL G3ZIL_2
FFT (C2) Noise Level (dBm)
-80
-100
-120
-140
-160
-160
-140
-120
-100
-80
FFT (C2) Noise Level 2 Minute Lagged Value (dBm)

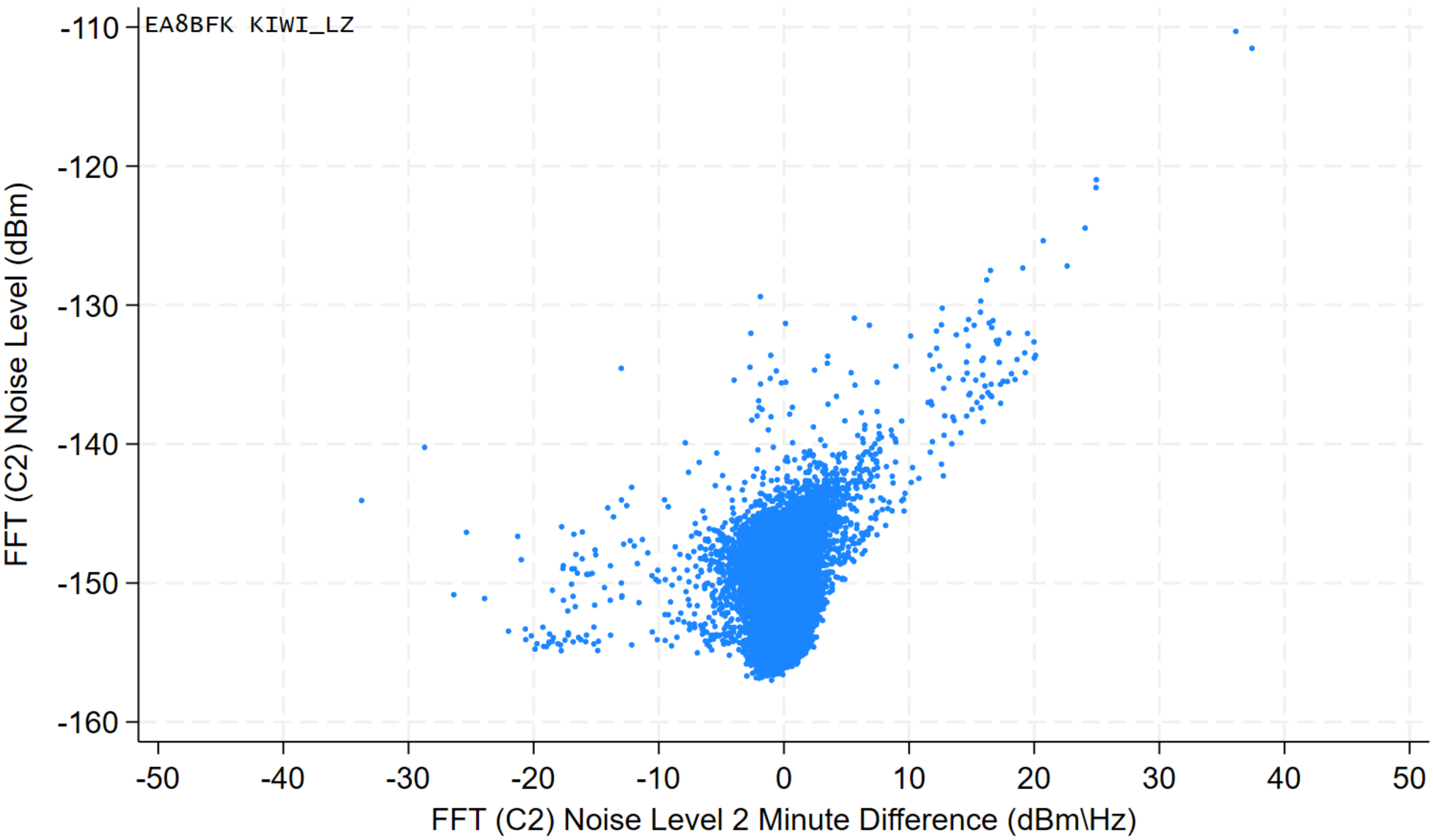

G3ZIL G3ZIL_2
-80
-100
-120
-140
-160
FFT (C2) Noise Level (dBm)
-50
-40
-30
-20
-10
0
10
20
30
40
50
FFT (C2) Noise Level 2 Minute Difference (dBm)

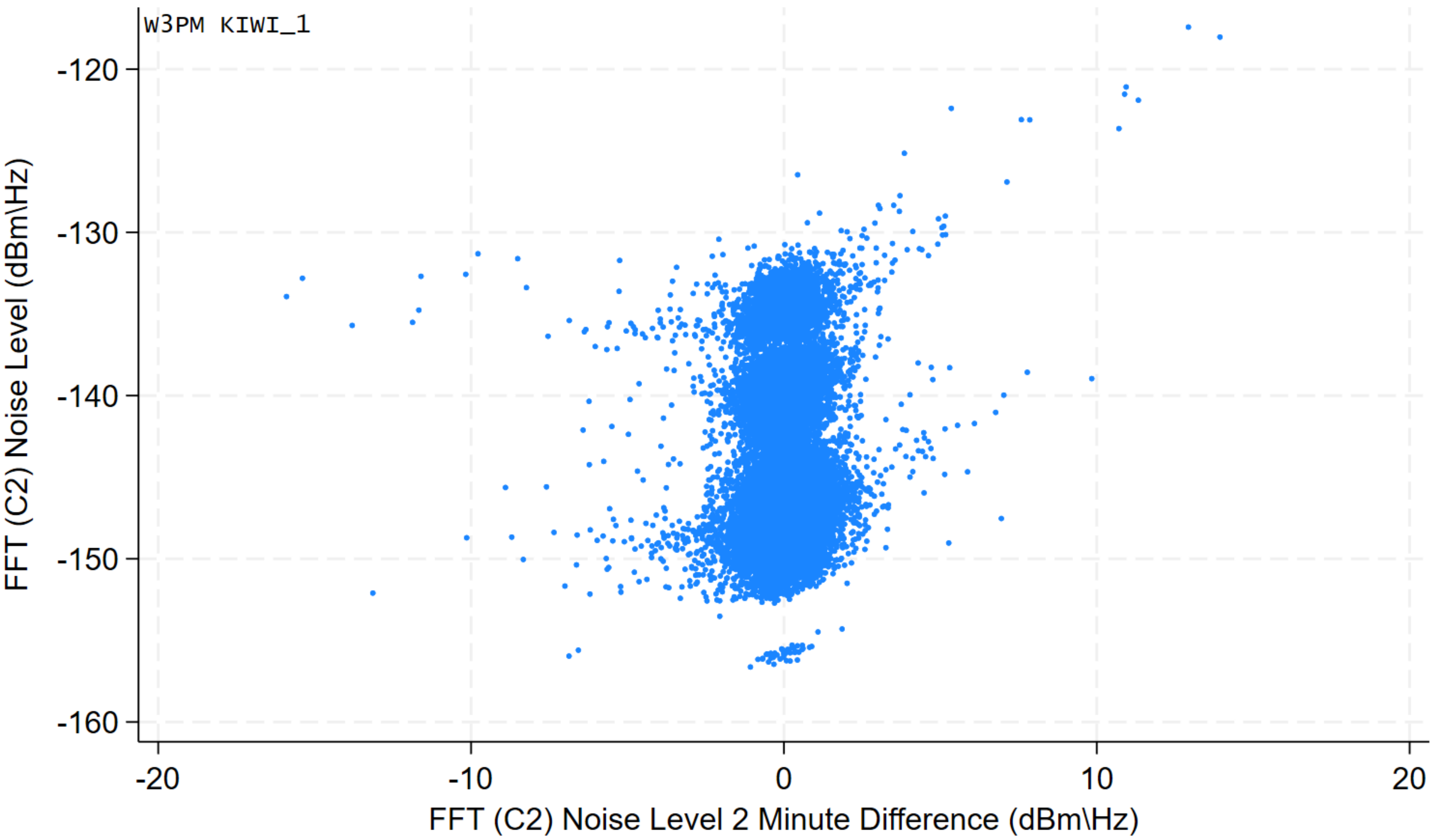

G3ZIL G3ZIL_3
-80
-100
-120
-140
FFT (C2) Noise Level (dBm)
-50
-40
-30
-20
-10
0
10
20
30
40
50
FFT (C2) Noise Level 2 Minute Difference (dBm)


W3PM KIWI_0
-100
-120
-140
-160
-180
FFT (C2) Noise Level (dBm)
-40
-20
0
20
40
FFT (C2) Noise Level 2 Minute Difference (dBm)


EA8BFK KIWI_LP
-110
-120
-130
-140
-150
-160
FFT (C2) Noise Level (dBm)
-50
-40
-30
-20
-10
0
10
20
30
40
50
FFT (C2) Noise Level 2 Minute Difference (dBm)


G3ZIL G3ZIL_2
-80
-100
-120
-140
-160
FFT (C2) Noise Level (dBm)\Hz
-50
-40
-30
-20
-10
0
10
20
30
40
50
FFT (C2) Noise Level 2 Minute Difference (dBm\Hz)


EA8BFK KIWI_LZ
FFT (C2) Noise Level (dBm)
-110
-120
-130
-140
-150
-160
-50
-40
-30
-20
-10
0
10
20
30
40
50
FFT (C2) Noise Level 2 Minute Difference (dBm\Hz)


W3PM KIWI_1
-120
-130
-140
-150
-160
FFT (C2) Noise Level (dBm\Hz)
-20
-10
0
10
20
FFT (C2) Noise Level 2 Minute Difference (dBm\Hz)

NEXT STEPS

- More EDA
- Cleaning Rules ?
- Explore relationship with Kp, TEC, something else?

NEXT STEPS

- Collaboration
- A database of station metadata
- Generate a conversation

Questions?\Discussion

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HamSCI silhouette photo by Ann Marie Rogalcheck-Frissell KC2KRQ.