

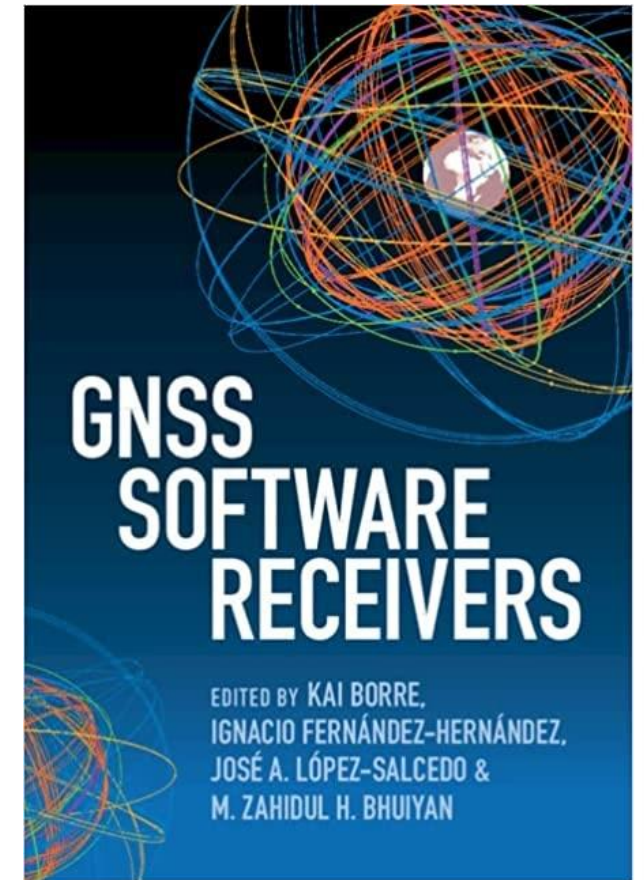
# GNSS SDR Receiver Setup

Kengo Nagaoka  
TUMSAT GNSS Lab.

# GNSS SOFTWARE RECEIVERS

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- ❑ Edited by KAI BORRE
- ❑ First published 2023
- ❑ Including MATLAB code and digital samples
- ❑ You can build and operate multi-GNSS and multi-frequency receivers



# Download and Installation (1)

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- ❑ You can download the latest version of the FGI-GSRx.

LINK: <https://github.com/nlsfi/FGI-GSRx>

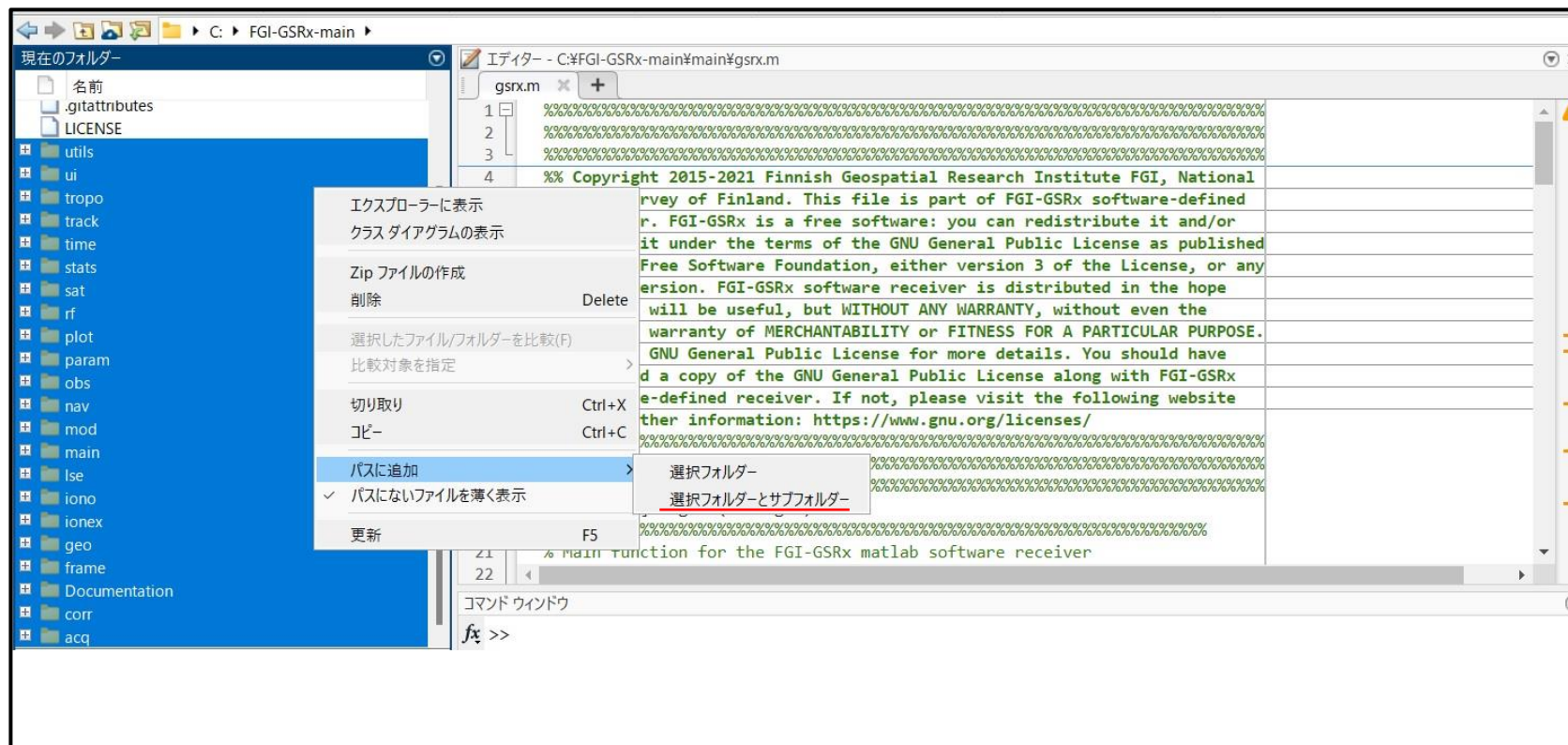
- ❑ Some example data files (raw IQ data files and processed MATLAB data files) can be downloaded .

LINK: <https://tiedostopalvelu.maanmittauslaitos.fi/tp/julkinen/lataus/tuotteet/FGI-GSRx-OS-DATAFILES>

- ❑ It takes a long time to download all data files (5~6 hours).

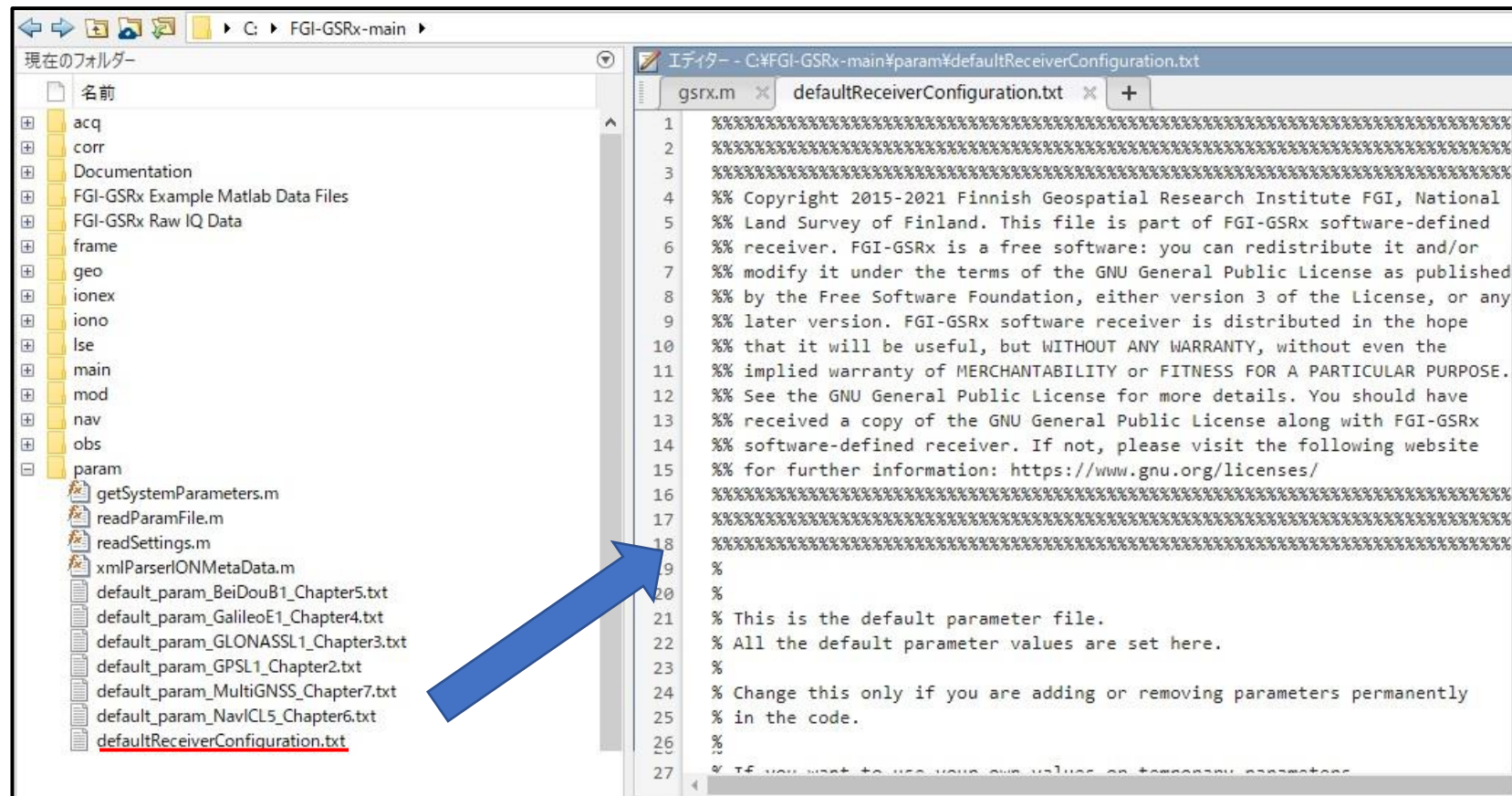
# Download and Installation (2)

- “Add to Path → Selected Folder and Subfolders”.



# Execution (1)

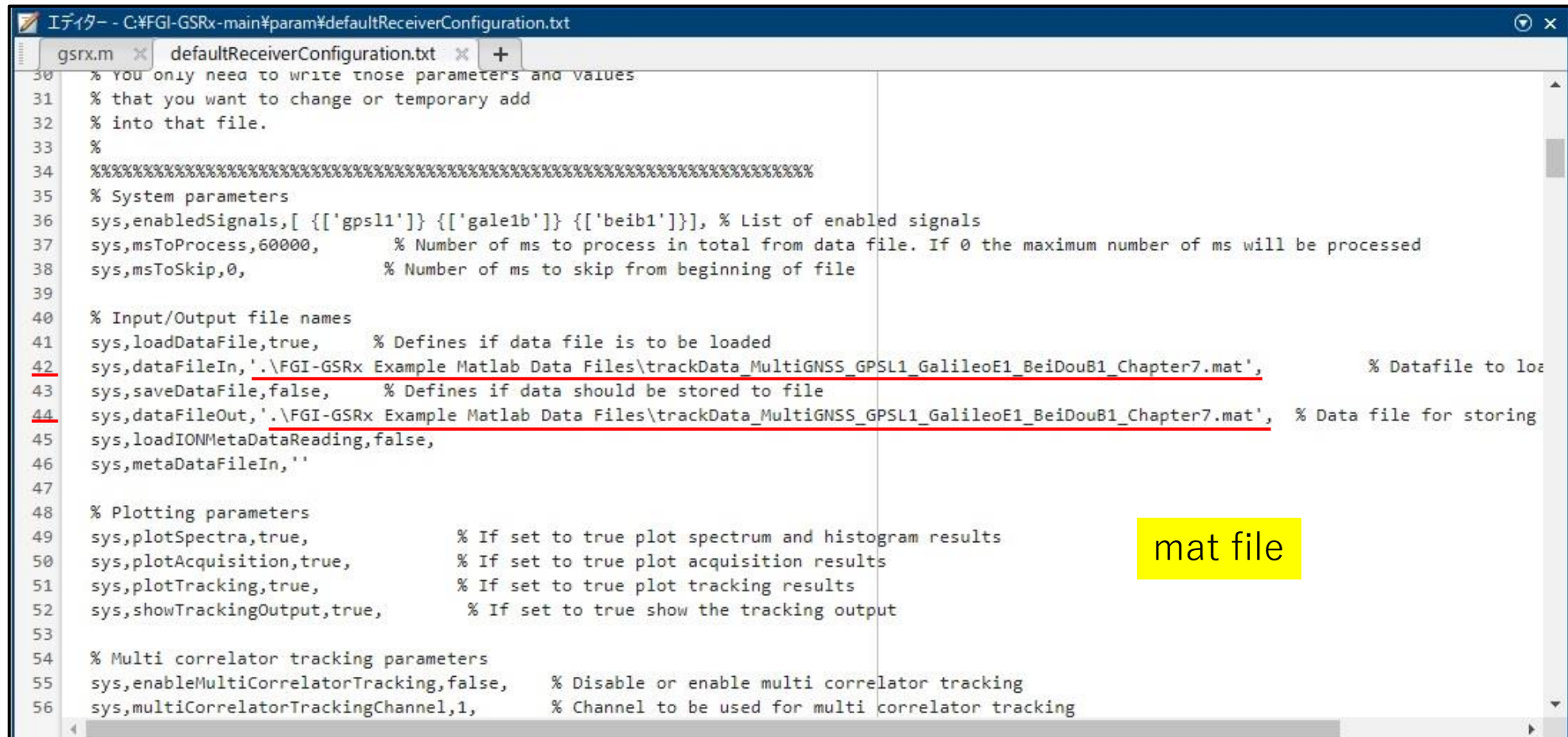
- ❑ Navigate to “/FGI-GSRx/param/ defaultReceiverConfiguration.txt” and open it.





# Execution (2)

- Change the default paths to the paths on your local machine.

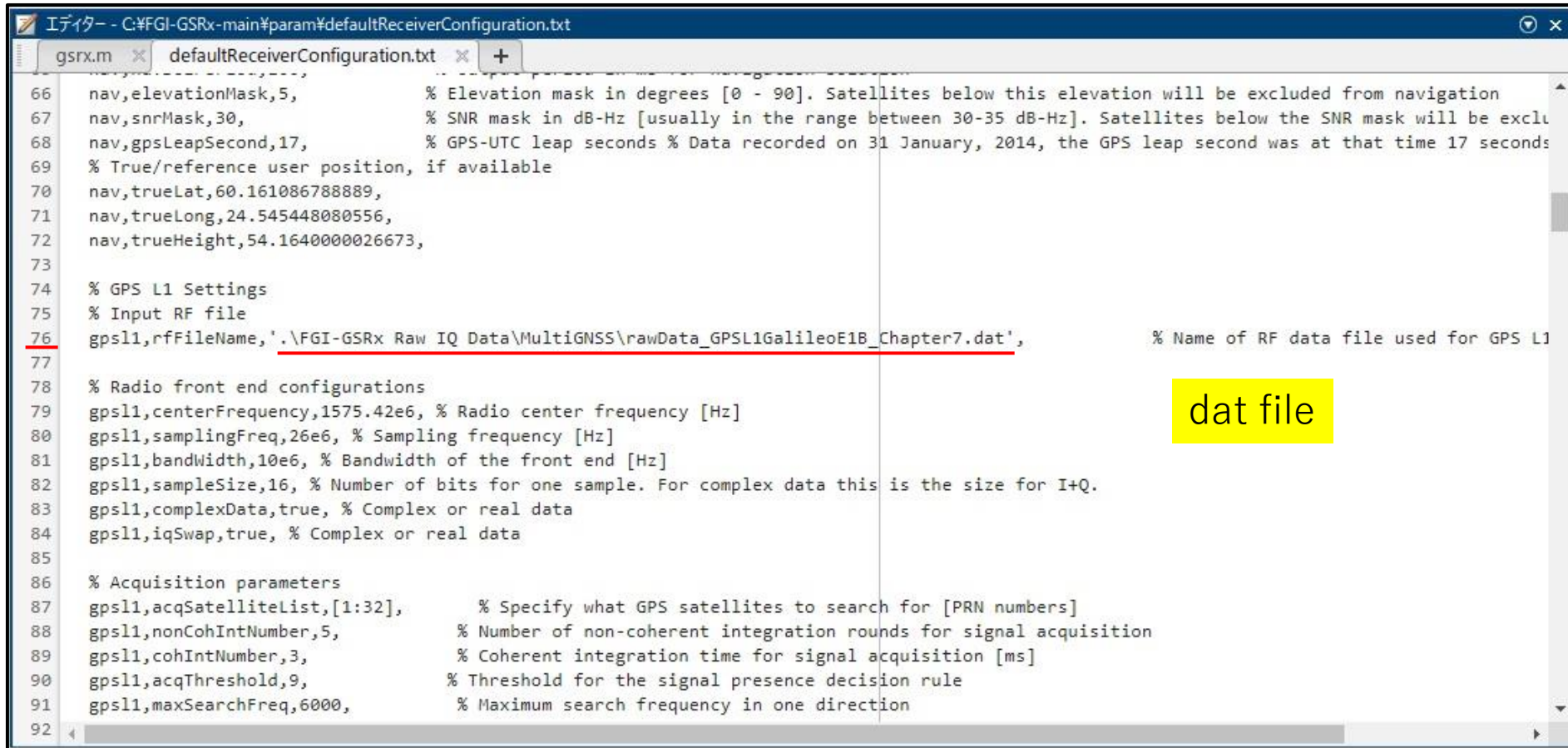


```
30 % You only need to write those parameters and values
31 % that you want to change or temporary add
32 % into that file.
33 %
34 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
35 % System parameters
36 sys,enabledSignals,[ {'gpsl1'} {'gale1b'} {'beib1'}], % List of enabled signals
37 sys,msToProcess,60000, % Number of ms to process in total from data file. If 0 the maximum number of ms will be processed
38 sys,msToSkip,0, % Number of ms to skip from beginning of file
39
40 % Input/Output file names
41 sys,loadDataFile,true, % Defines if data file is to be loaded
42 sys,dataFileIn,'.\FGI-GSRx Example Matlab Data Files\trackData_MultiGNSS_GPSL1_GalileoE1_BeiDouB1_Chapter7.mat', % Datafile to load
43 sys,saveDataFile,false, % Defines if data should be stored to file
44 sys,dataFileOut,'.\FGI-GSRx Example Matlab Data Files\trackData_MultiGNSS_GPSL1_GalileoE1_BeiDouB1_Chapter7.mat', % Data file for storing
45 sys,loadIONMetaDataReading,false,
46 sys,metaDataFileIn,''
47
48 % Plotting parameters
49 sys,plotSpectra,true, % If set to true plot spectrum and histogram results
50 sys,plotAcquisition,true, % If set to true plot acquisition results
51 sys,plotTracking,true, % If set to true plot tracking results
52 sys,showTrackingOutput,true, % If set to true show the tracking output
53
54 % Multi correlator tracking parameters
55 sys,enableMultiCorrelatorTracking,false, % Disable or enable multi correlator tracking
56 sys,multiCorrelatorTrackingChannel,1, % Channel to be used for multi correlator tracking
```

mat file

# Execution (3)

- ❑ Change the default paths to the paths on your local machine.

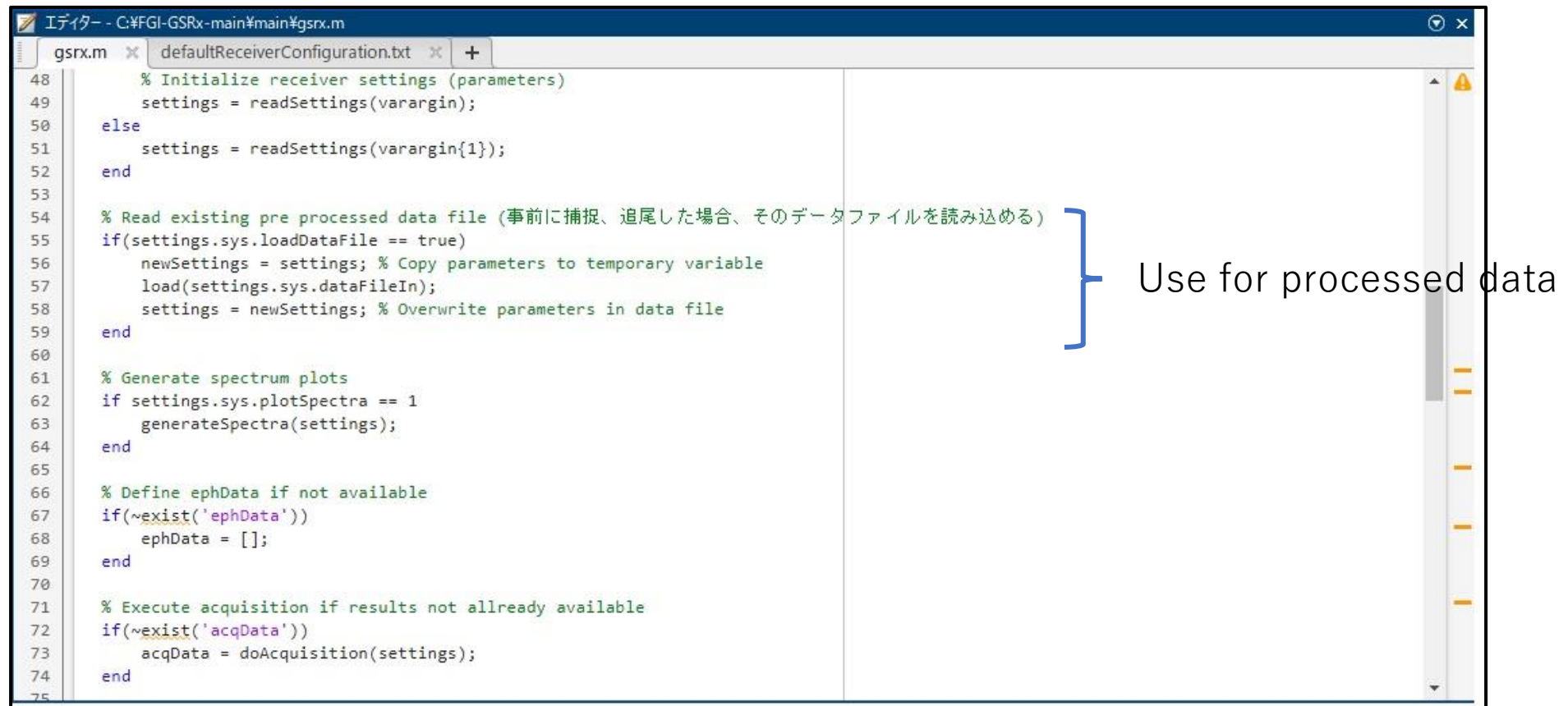


```
66 nav,elevationMask,5, % Elevation mask in degrees [0 - 90]. Satellites below this elevation will be excluded from navigation
67 nav,snrMask,30, % SNR mask in dB-Hz [usually in the range between 30-35 dB-Hz]. Satellites below the SNR mask will be exclu
68 nav,gpsLeapSecond,17, % GPS-UTC leap seconds % Data recorded on 31 January, 2014, the GPS leap second was at that time 17 seconds
69 % True/reference user position, if available
70 nav,trueLat,60.161086788889,
71 nav,trueLong,24.545448080556,
72 nav,trueHeight,54.1640000026673,
73
74 % GPS L1 Settings
75 % Input RF file
76 gpsl1,rfFileName,'.\FGI-GSRx Raw IQ Data\MultiGNSS\rawData_GPSL1GalileoE1B_Chapter7.dat', % Name of RF data file used for GPS L1
77
78 % Radio front end configurations
79 gpsl1,centerFrequency,1575.42e6, % Radio center frequency [Hz]
80 gpsl1,samplingFreq,26e6, % Sampling frequency [Hz]
81 gpsl1,bandwidth,10e6, % Bandwidth of the front end [Hz]
82 gpsl1,sampleSize,16, % Number of bits for one sample. For complex data this is the size for I+Q.
83 gpsl1,complexData,true, % Complex or real data
84 gpsl1,iqSwap,true, % Complex or real data
85
86 % Acquisition parameters
87 gpsl1,acqSatelliteList,[1:32], % Specify what GPS satellites to search for [PRN numbers]
88 gpsl1,nonCohIntNumber,5, % Number of non-coherent integration rounds for signal acquisition
89 gpsl1,cohIntNumber,3, % Coherent integration time for signal acquisition [ms]
90 gpsl1,acqThreshold,9, % Threshold for the signal presence decision rule
91 gpsl1,maxSearchFreq,6000, % Maximum search frequency in one direction
92
```

dat file

# Execution (4)

- ❑ If you want to execute using raw data (dat file), comment out the line 55~59.



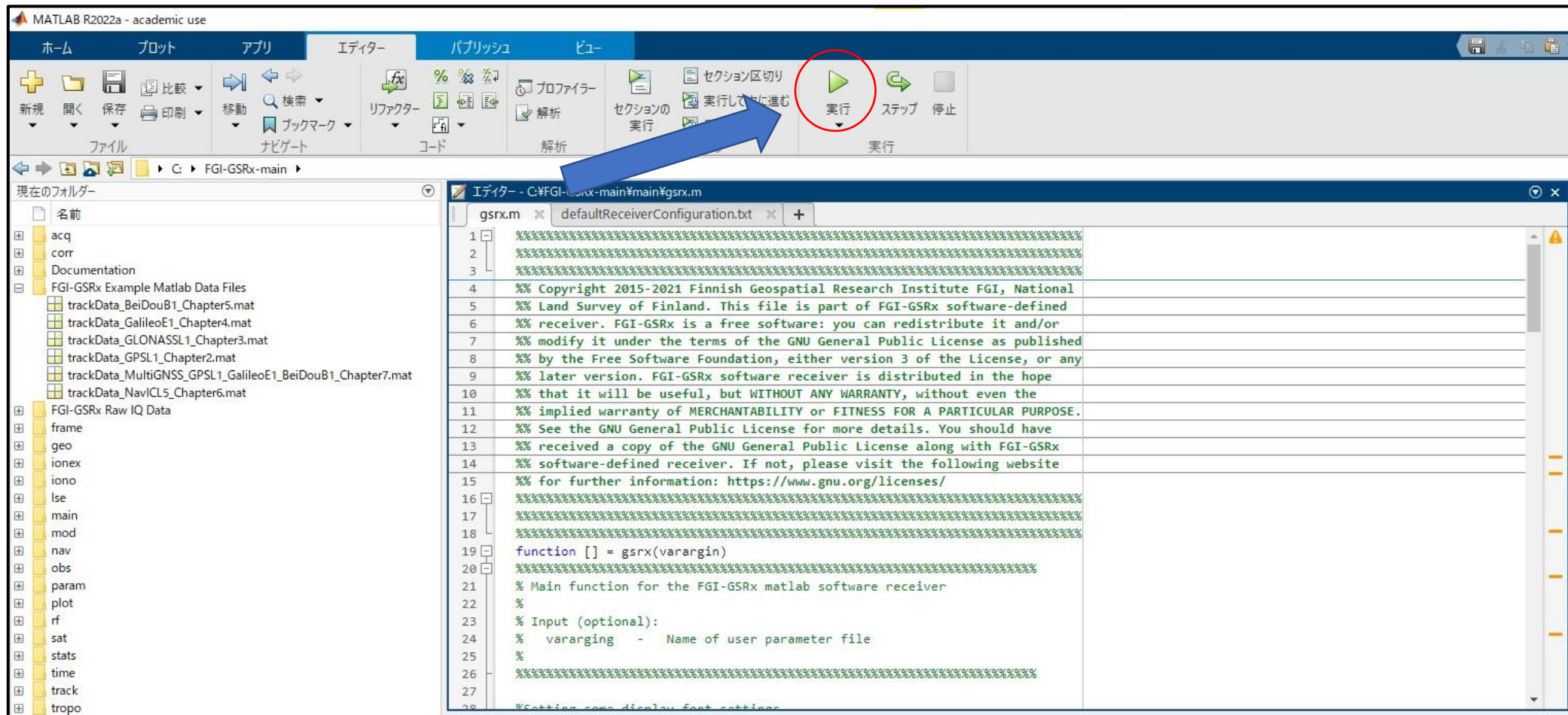
```
gsrx.m x defaultReceiverConfiguration.txt +
48 % Initialize receiver settings (parameters)
49 settings = readSettings(varargin);
50 else
51 settings = readSettings(varargin{1});
52 end
53
54 % Read existing pre processed data file (事前に捕捉、追尾した場合、そのデータファイルを読み込める)
55 if(settings.sys.loadDataFile == true)
56 newSettings = settings; % Copy parameters to temporary variable
57 load(settings.sys.dataFileIn);
58 settings = newSettings; % Overwrite parameters in data file
59 end
60
61 % Generate spectrum plots
62 if settings.sys.plotSpectra == 1
63 generateSpectra(settings);
64 end
65
66 % Define ephData if not available
67 if(~exist('ephData'))
68 ephData = [];
69 end
70
71 % Execute acquisition if results not allready available
72 if(~exist('acqData'))
73 acqData = doAcquisition(settings);
74 end
75
```

Use for processed data

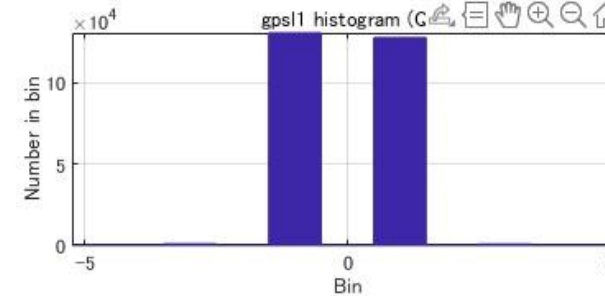
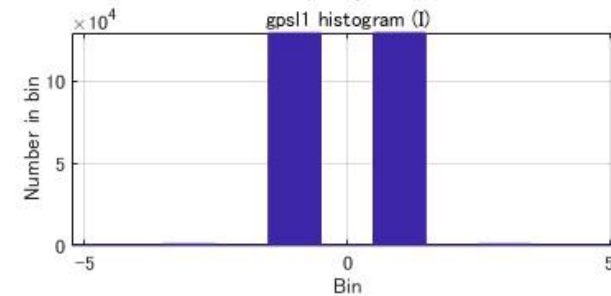
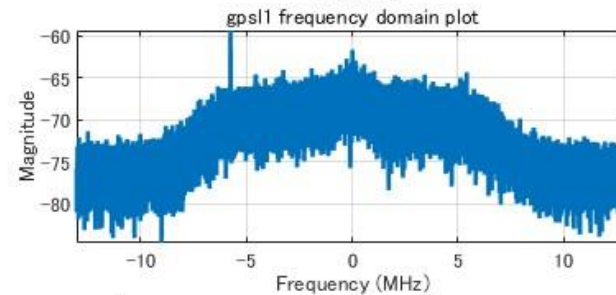
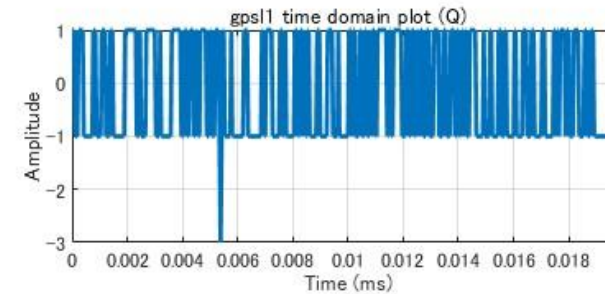
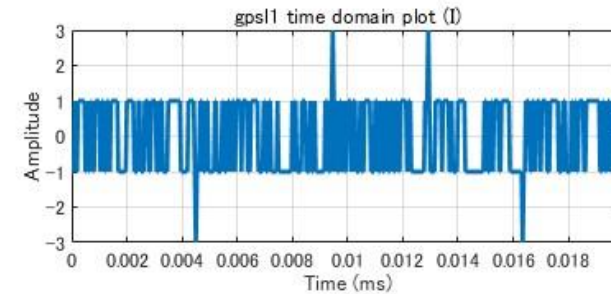


# Execution (5)

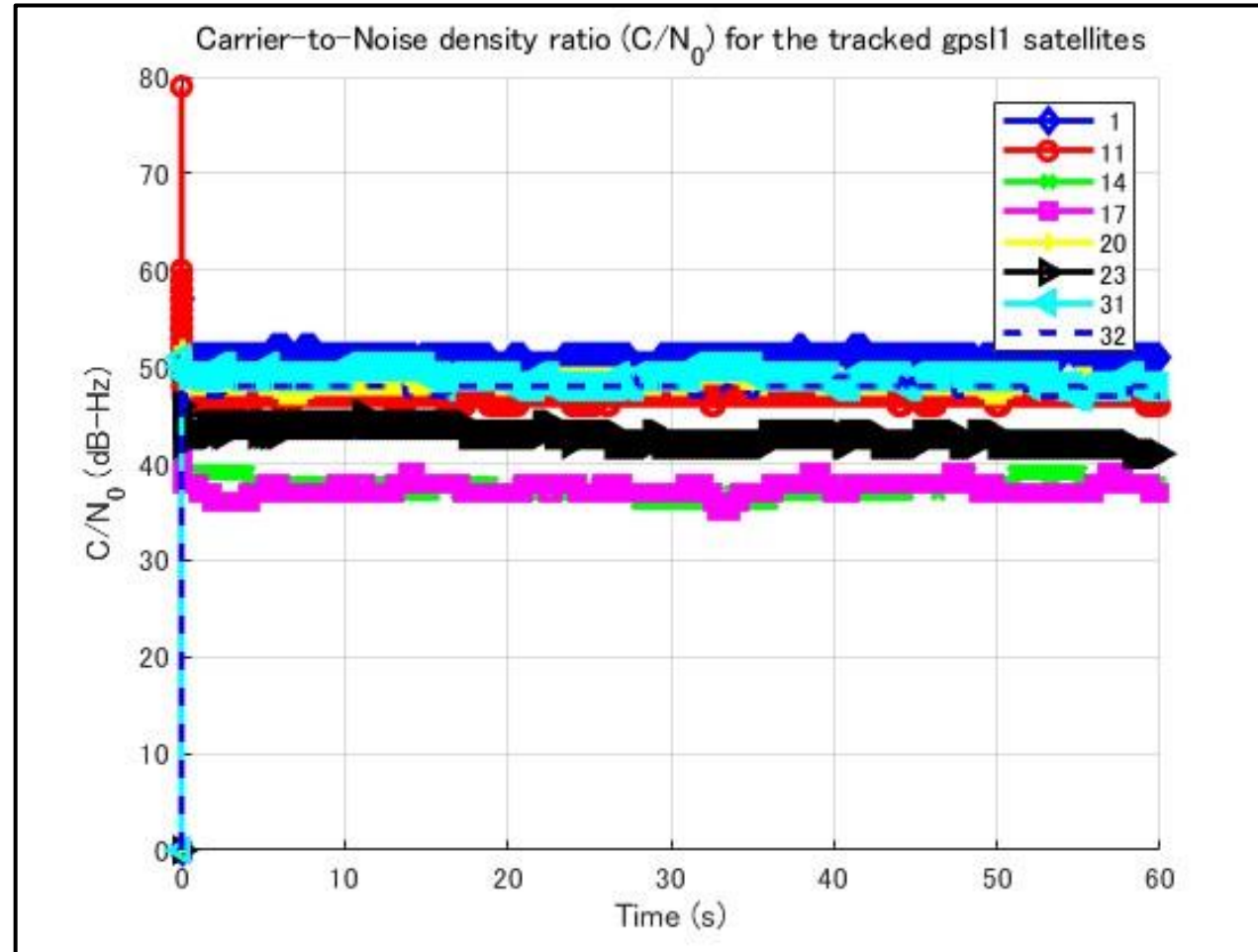
- Navigating to “/MATLAB/FGI-GSRx/main” and calling “gsrx()”.



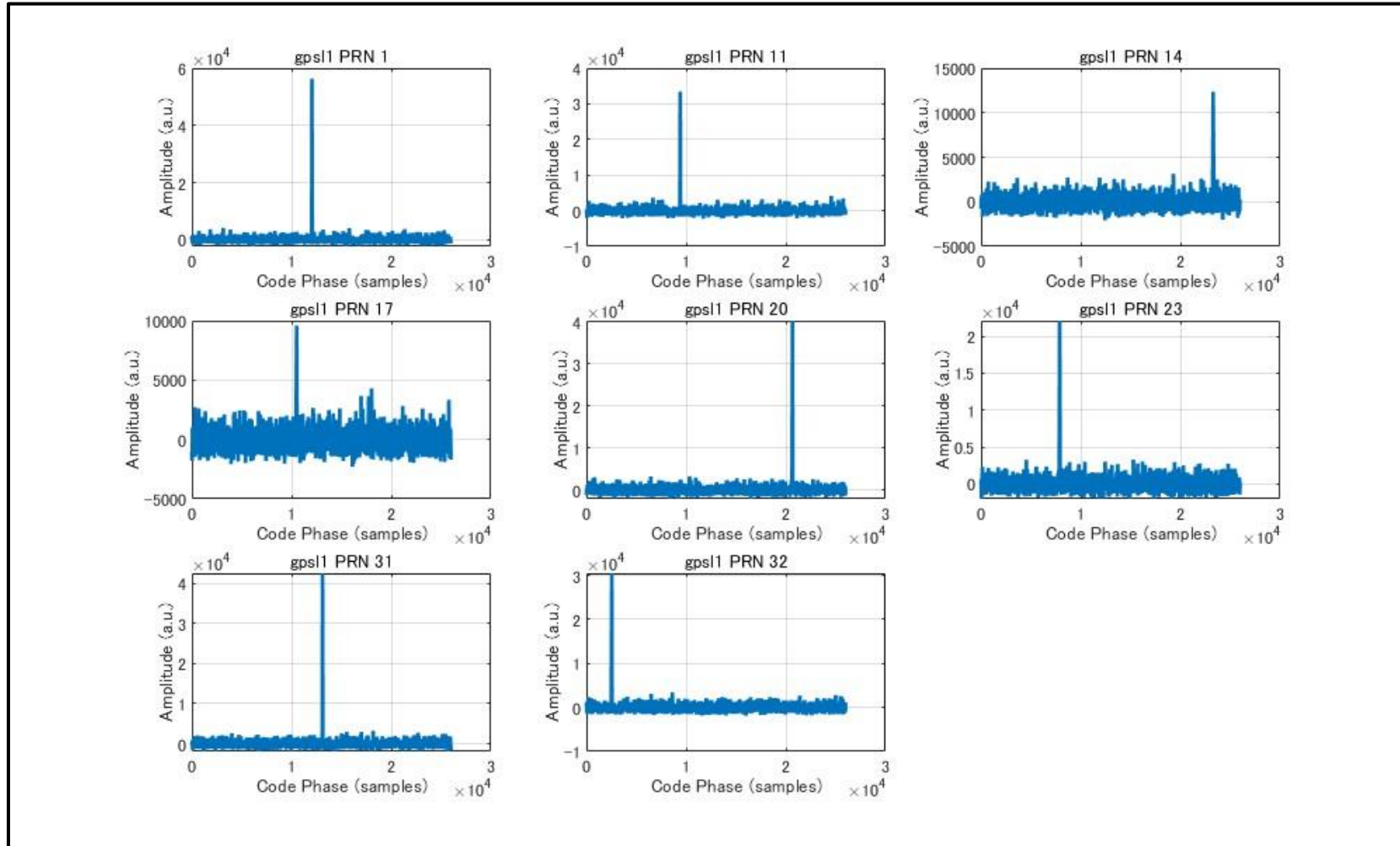
# Results (GPSL1 time domain)



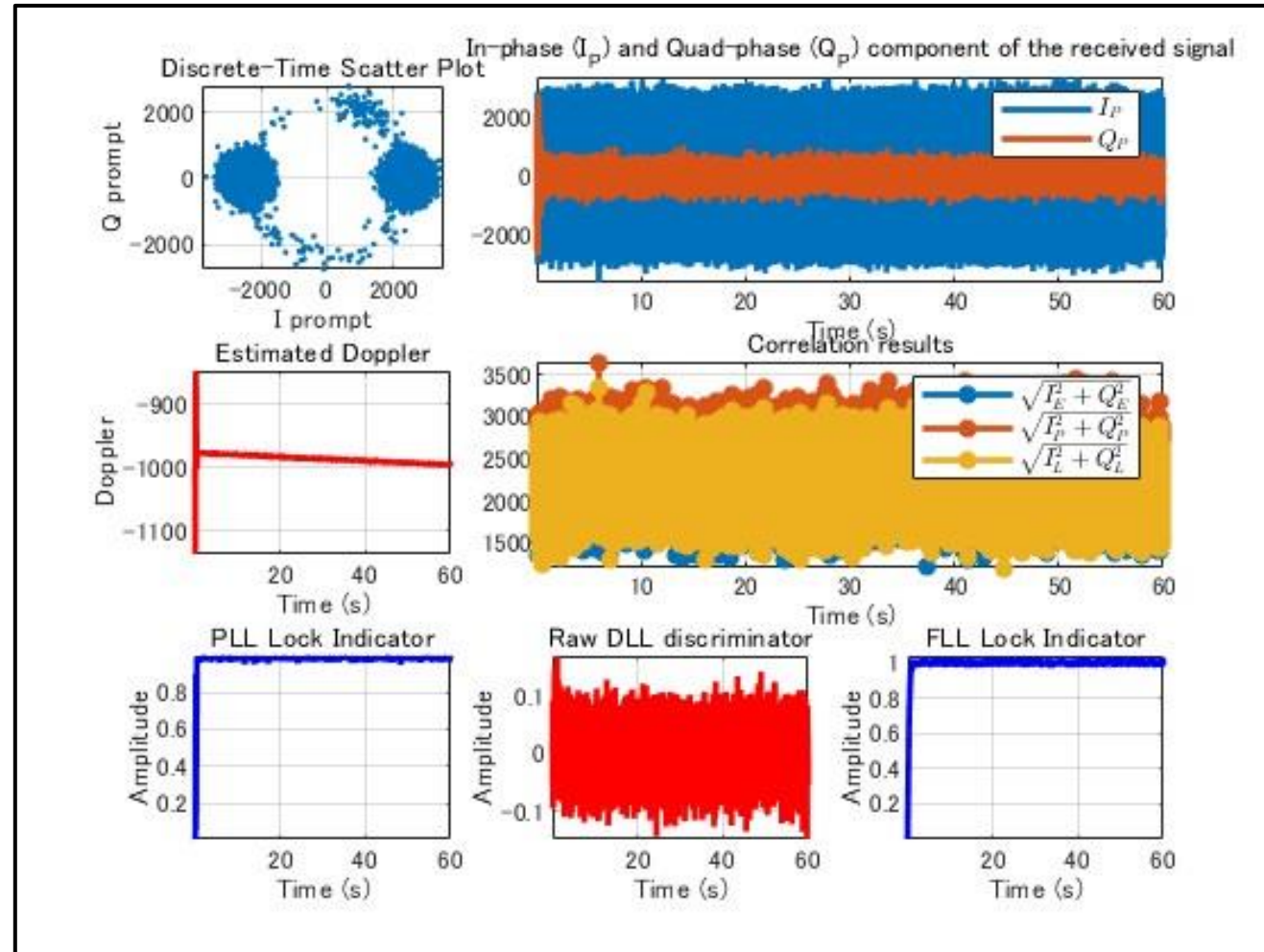
# Results (GPSL1 C/N0)



# Results (GPSL1 Code Phase)

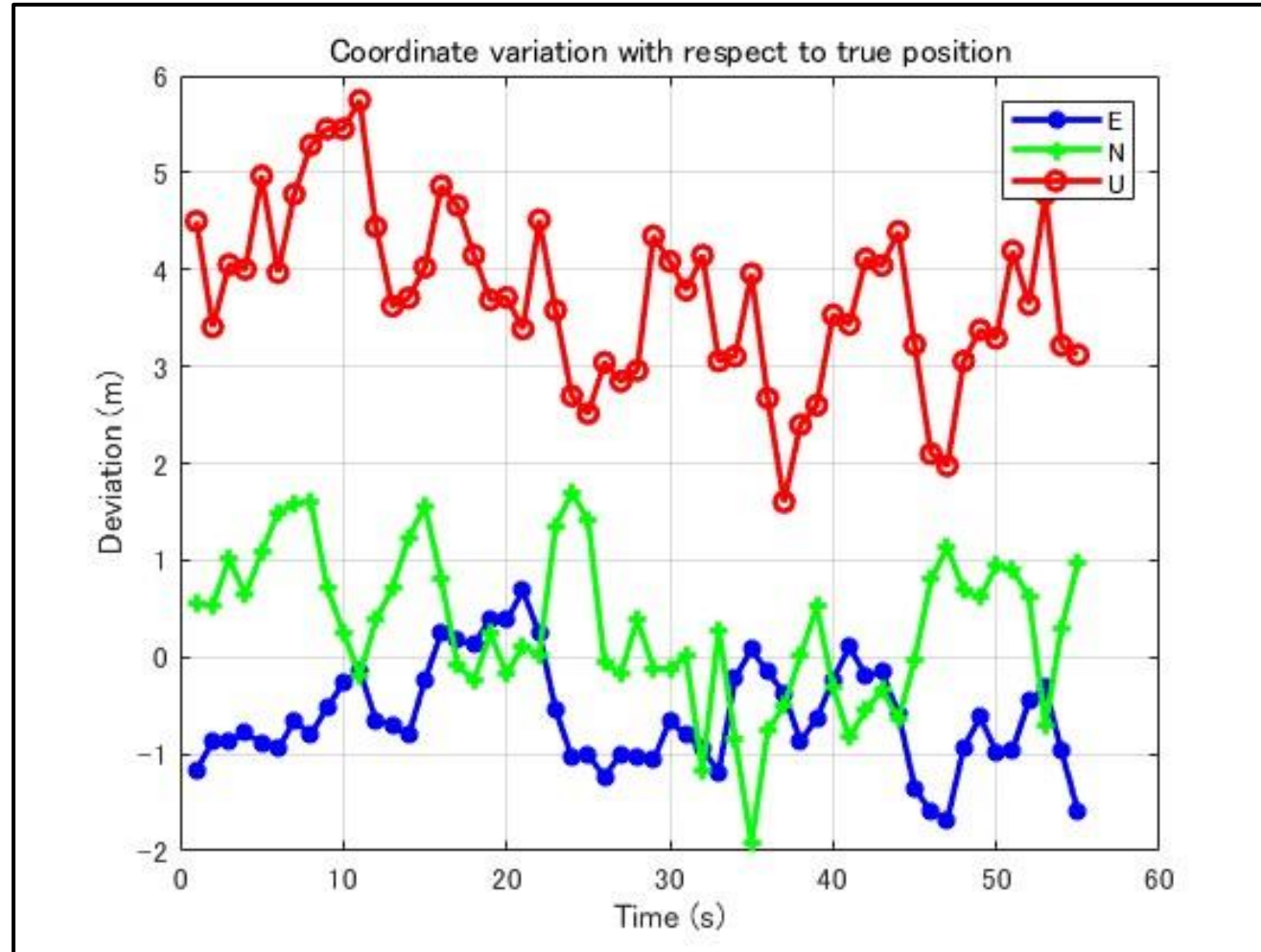


# Results (GPSL1 Tracking PRN11)





# Results (GPSL1 Position)



BDS and Galileo results are also produced.