GNSS Raw Data from Smart-Phone

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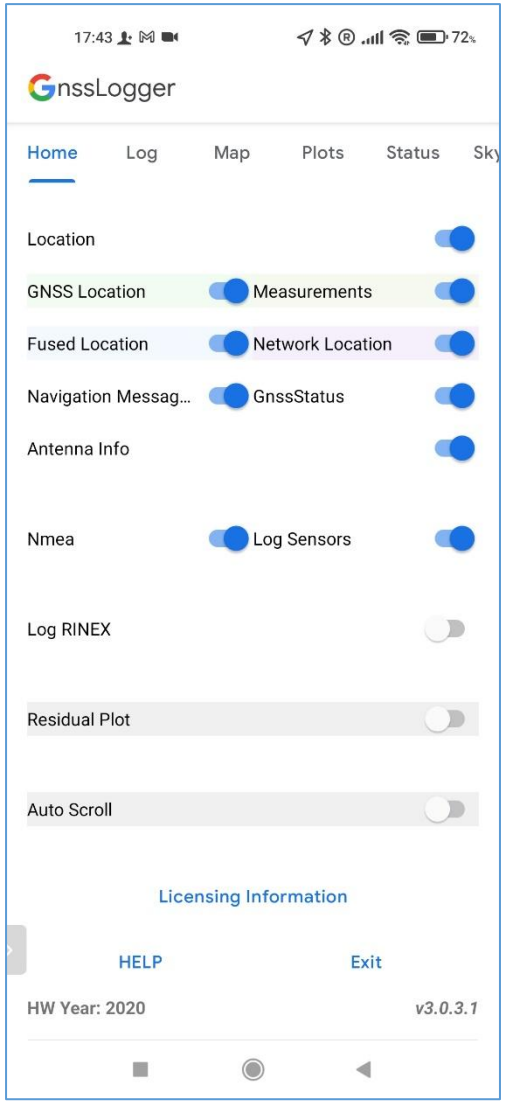
Objectives

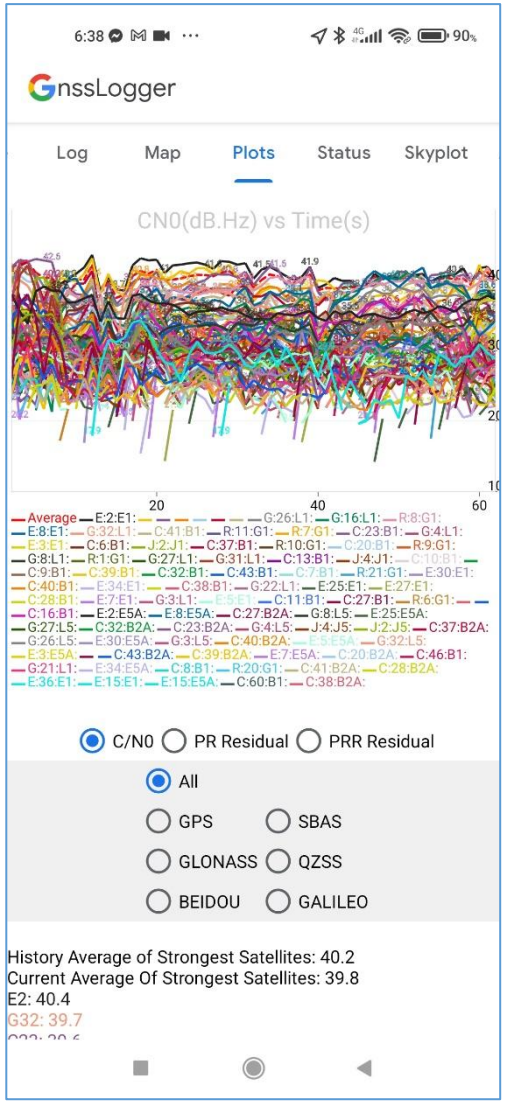
- Provide information about Software, APPs and Tools to log GNSS raw data from smart-phones
- Learn data logging methods using GNSS Logger APK for Android
- Explore possibilities of using raw GNSS data for various applications
- References
  - Android GNSS Tutorial Resources
    - https://sites.google.com/view/gnsstutorial
  - GNSS Logger App
    - To log GNSS raw data from Android device
    - https://play.google.com/store/apps/details?id=com.google.android.apps.location.gps.gnsslogger
  - GPS Measurement Tools
    - Matlab code for processing GPS measurements
    - https://github.com/google/gps-measurement-tools

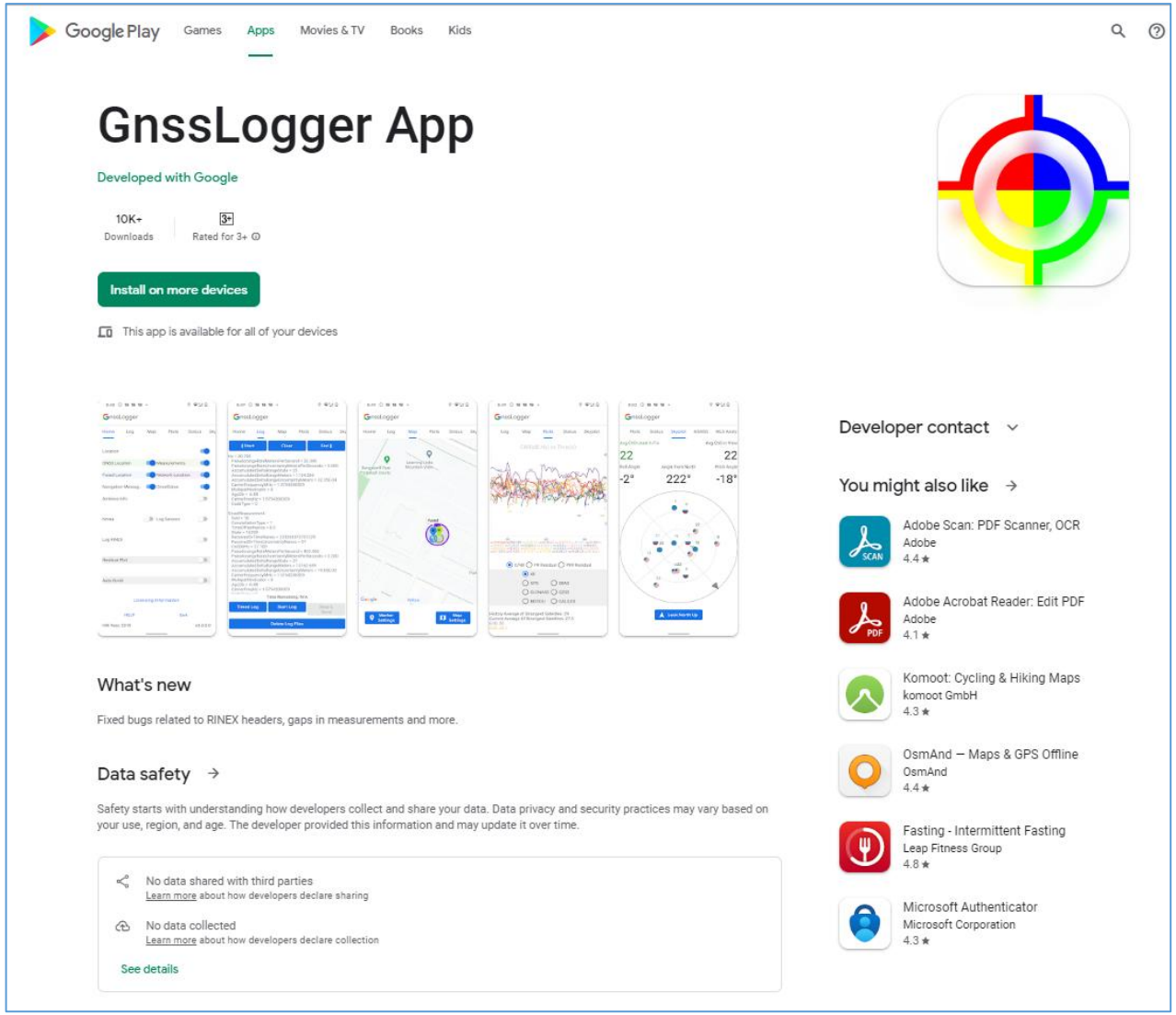
APPs for GNSS Data

- GNSS Logger
  - Logs GNSS Raw Data
    - https://play.google.com/store/apps/details?id=com.google.android.apps.location.gps.gnsslogger&gl=US
- GPS Test
  - Android APP: https://play.google.com/store/apps/details?id=com.android.gpstest
  - GitHub - barbeau/gpstest: The #1 open-source Android GNSS/GPS test program
- Geo++ RINEX logger
  - Log GNSS data in RINEX format: useful for post-processing kinematic (PPK)
  - https://play.google.com/store/apps/details?id=de.geopp.rinexlogger&gl=US
- RTKDROID
  - Perform RTK using an external GNSS receiver connected to an android device
    - https://home.csis.u-tokyo.ac.jp/~dinesh/LCHAR.htm
- MADROID
  - MADOCA PPP using Android Device: External GNSS Receiver shall be connected to android device
  - https://home.csis.u-tokyo.ac.jp/~dinesh/LCHAR.htm

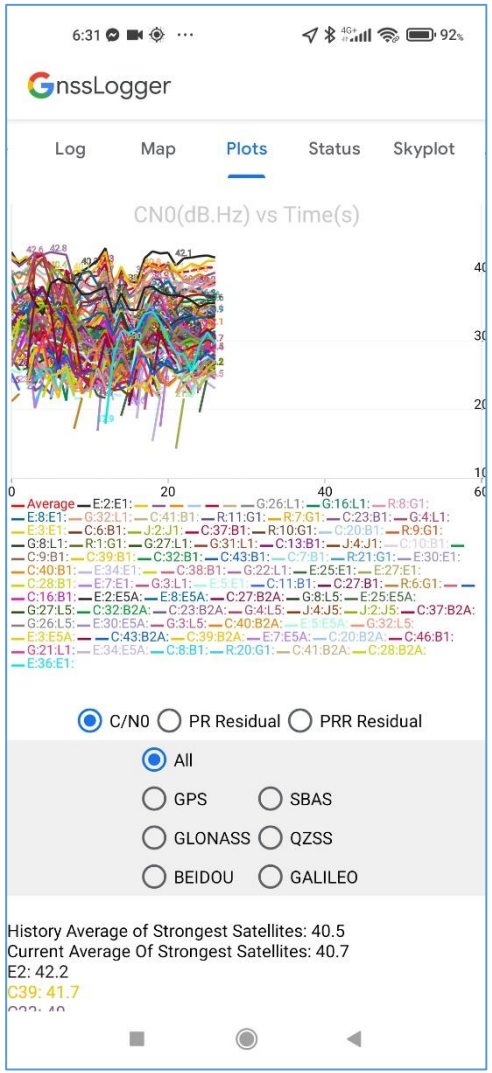
GnssLogger App: To Log GNSS Raw Data from Android Smart-Phone

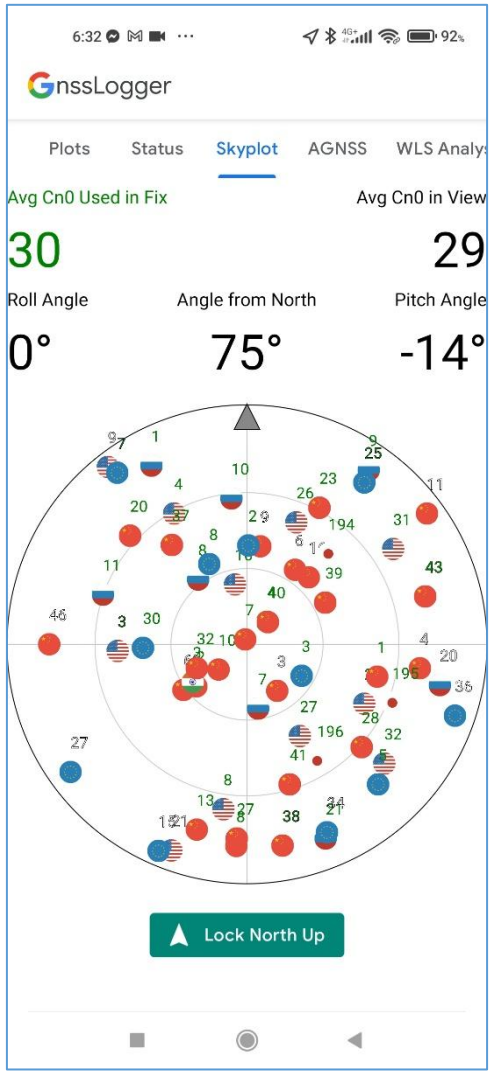


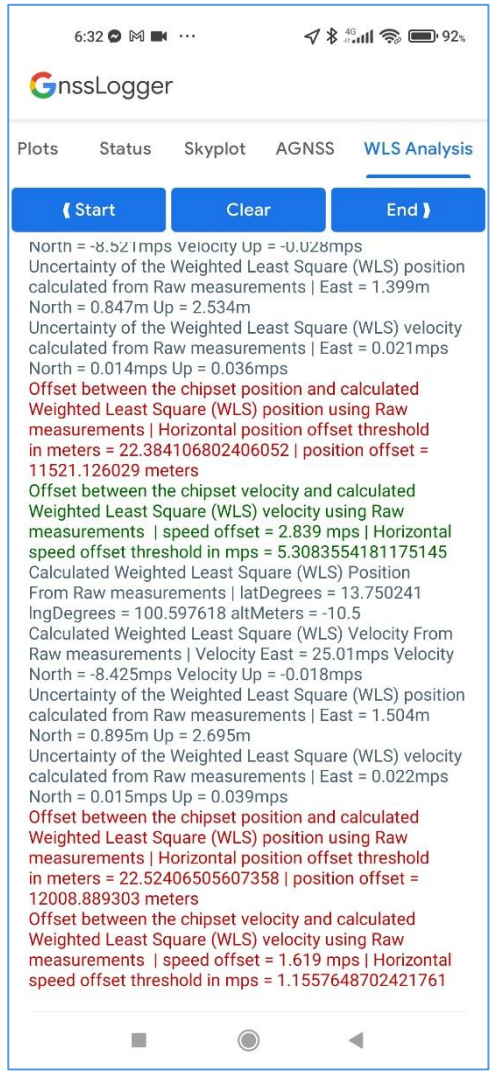


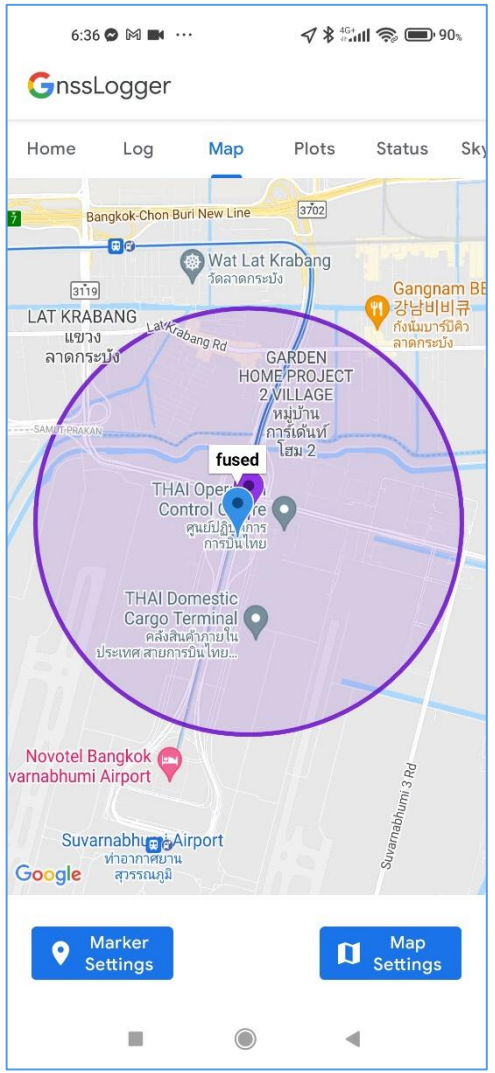


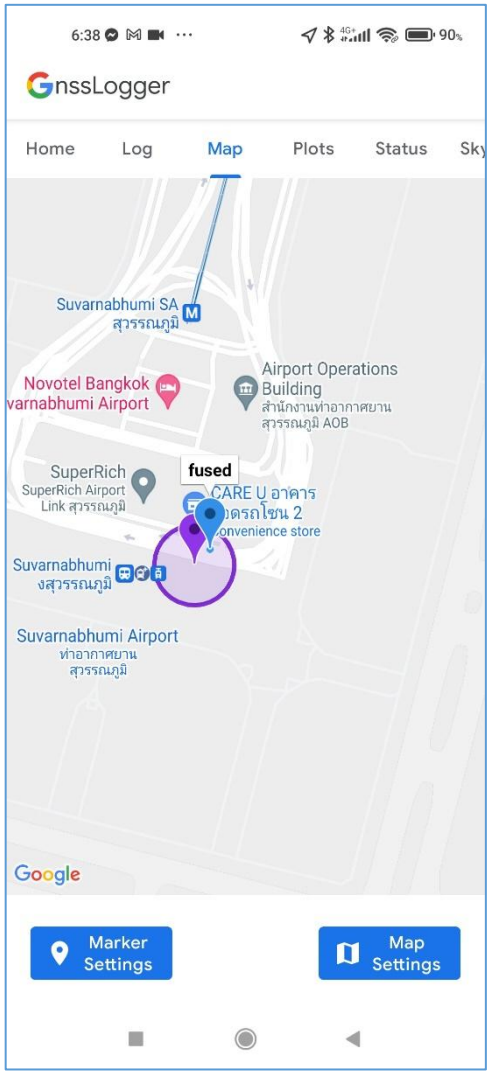
GnssLogger App: Signal Strength, Skyplot, Position Computation, Map Display



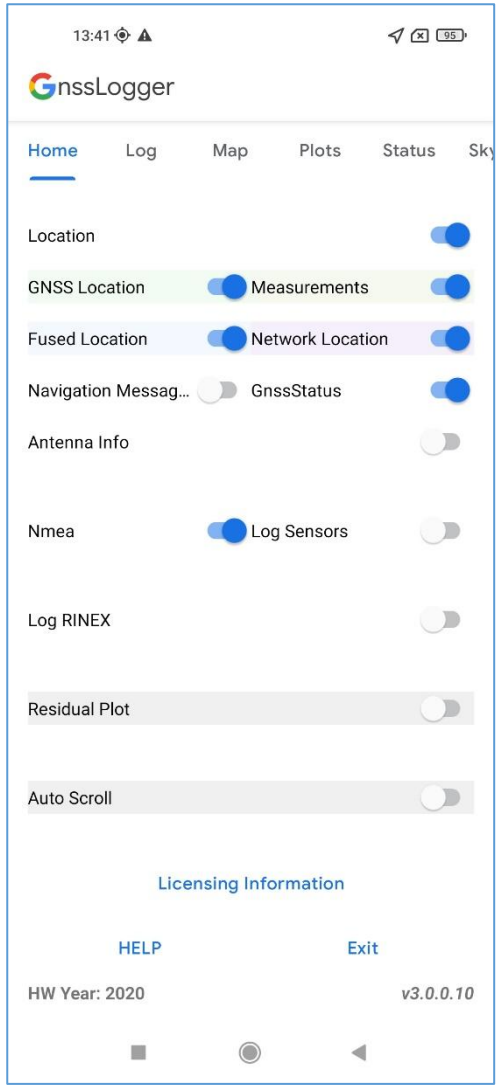


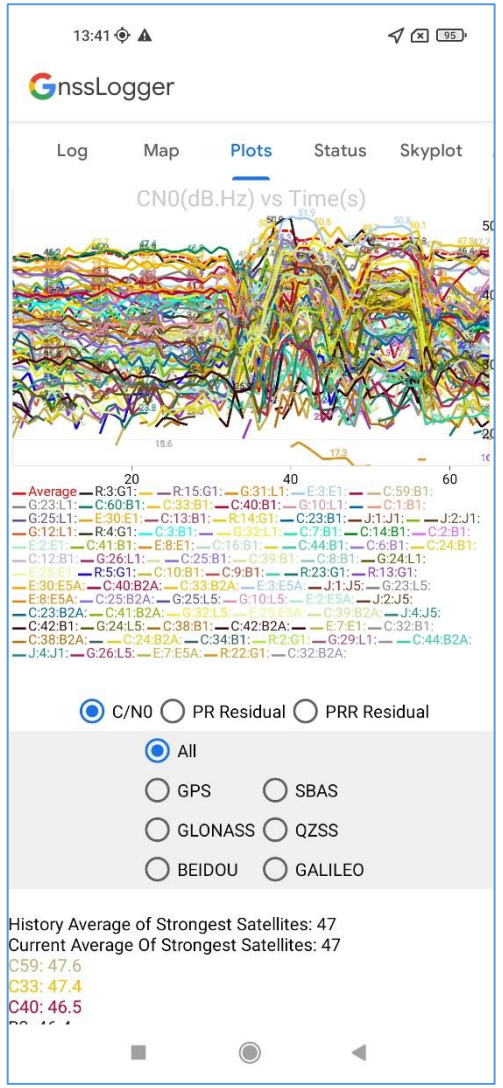




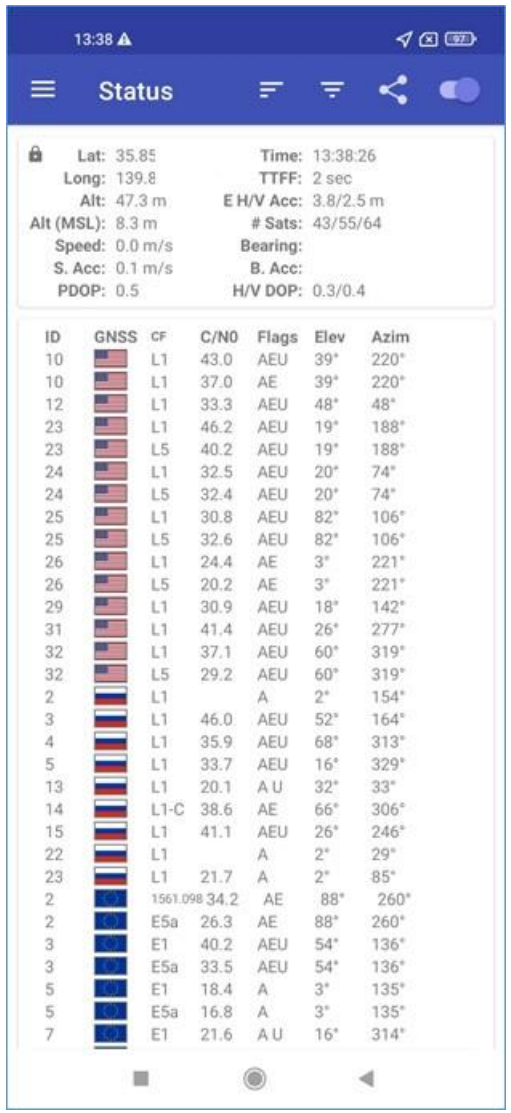


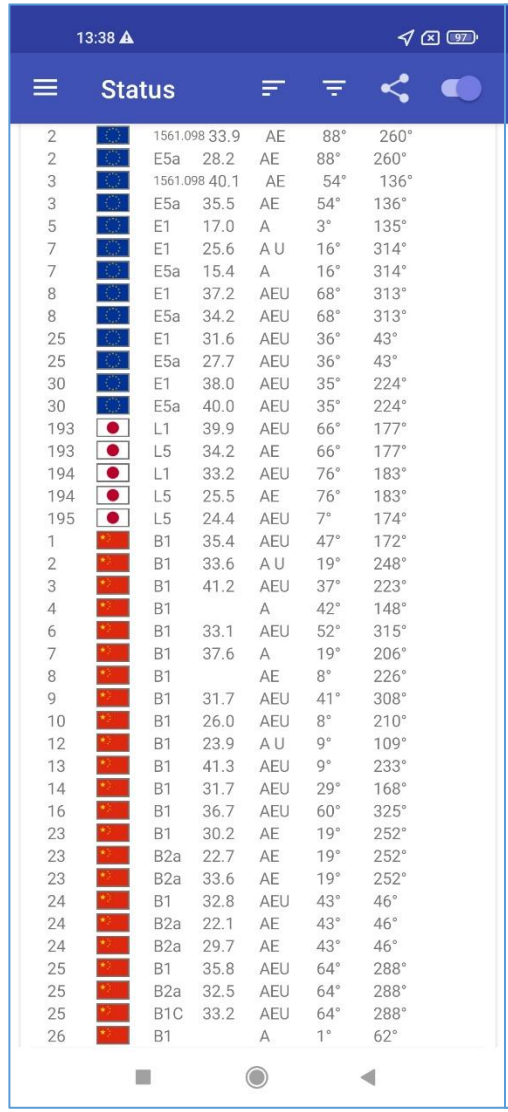
Xiaomi Mi11 Lite 5G Screen Shots

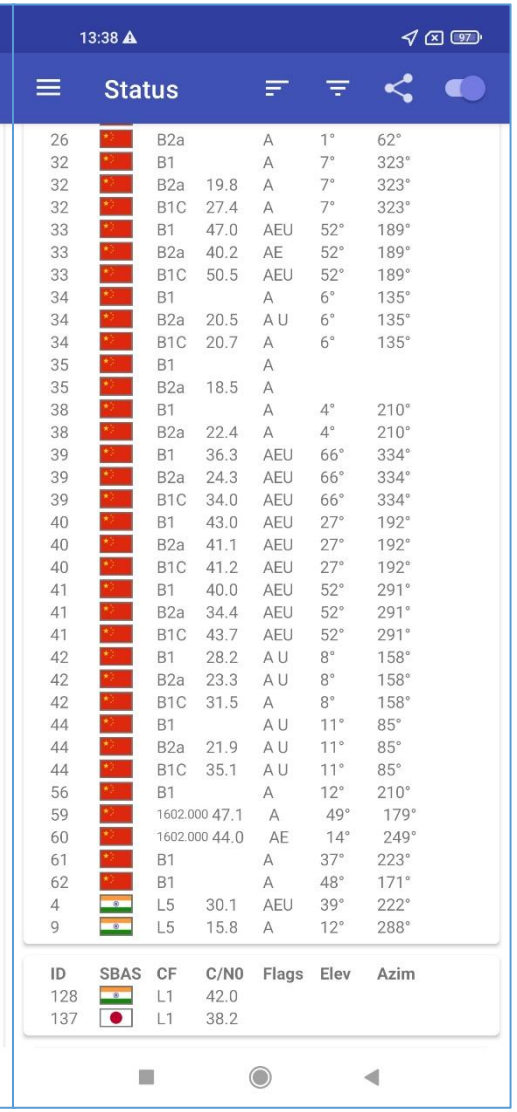


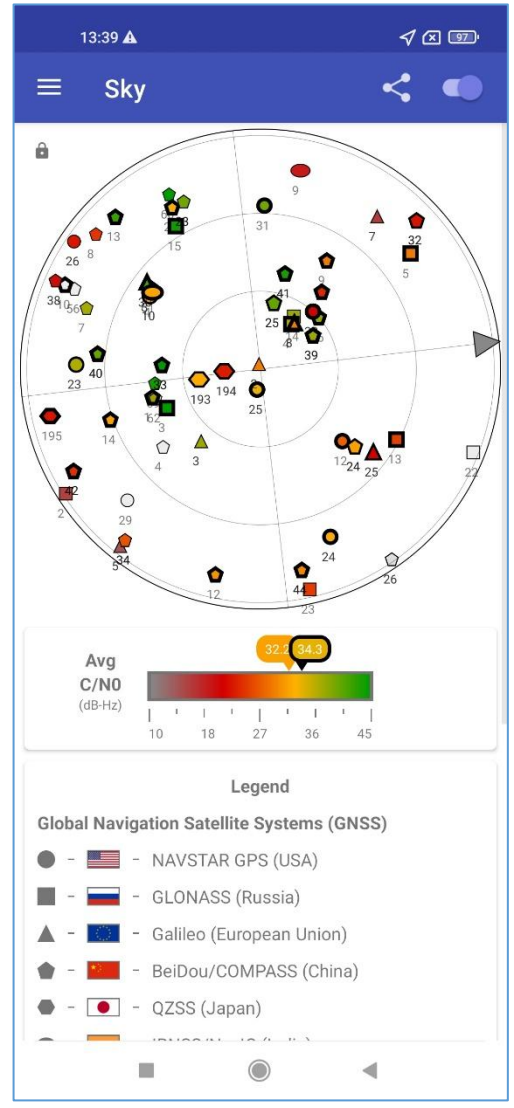


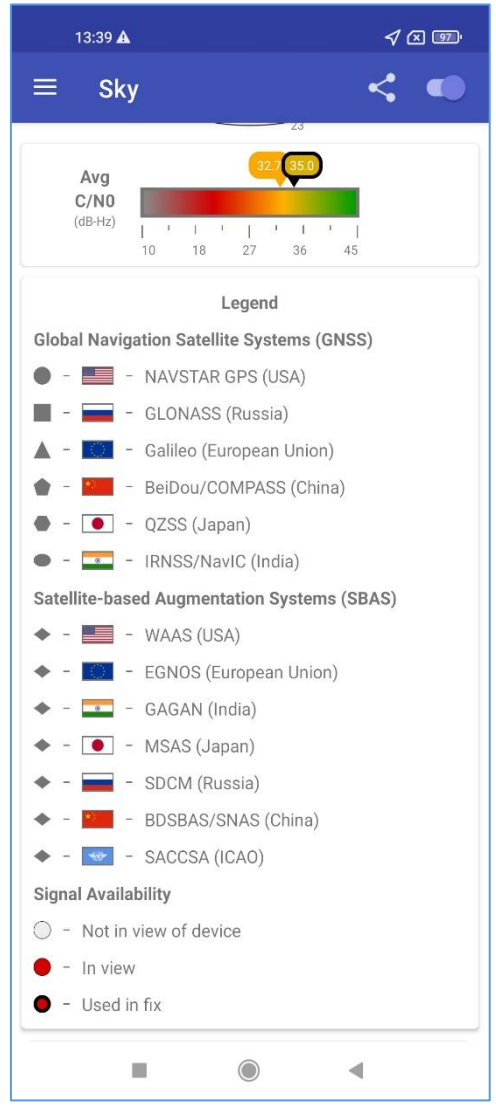
Xiaomi Mi11 Lite 5G Screen Shots



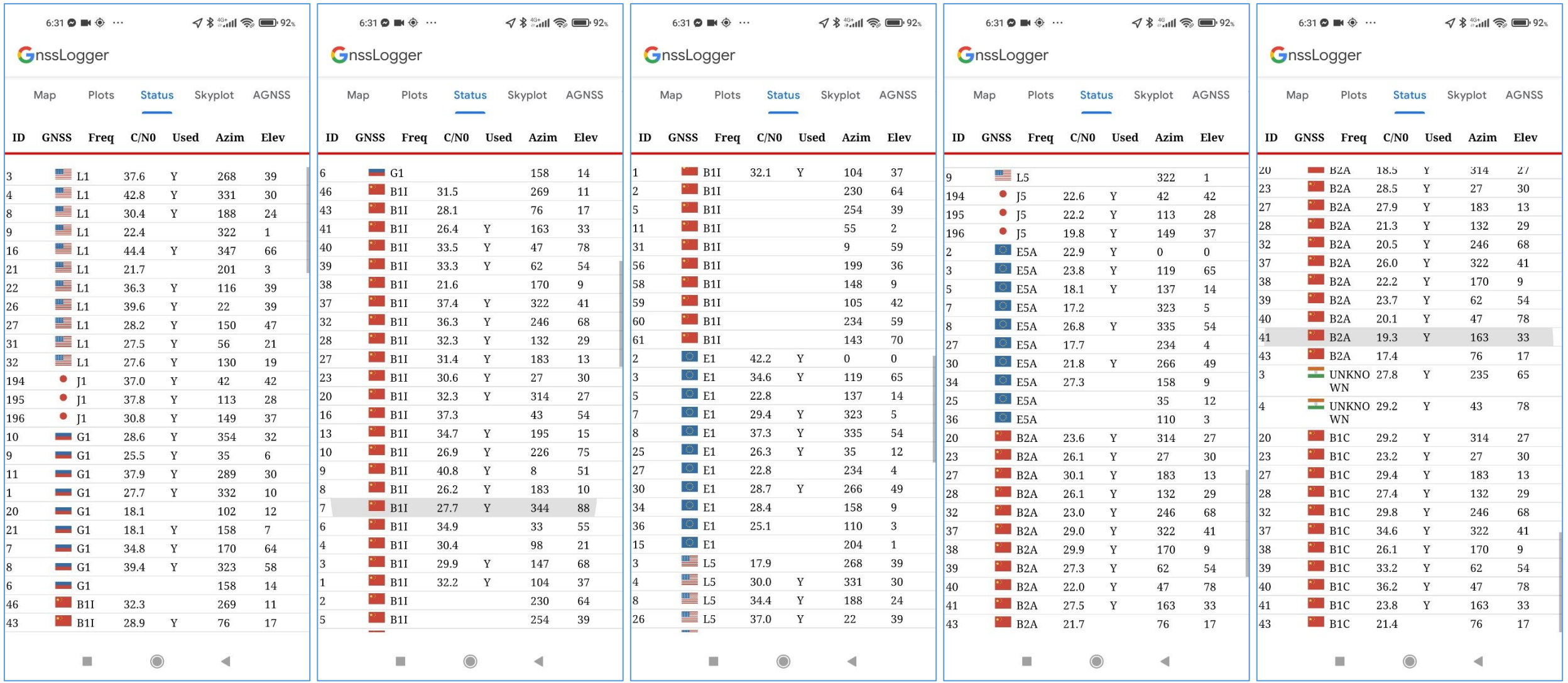








GnssLogger App: Visible Satellite Status



GnssLogger

Map | Plots | Status | Skyplot | AGNSS

ID	GNSS	Freq	C/N0	Used	Azim	Elev
3	L1		37.6	Y	268	39
4	L1		42.8	Y	331	30
8	L1		30.4	Y	188	24
9	L1		22.4		322	1
16	L1		44.4	Y	347	66
21	L1		21.7		201	3
22	L1		36.3	Y	116	39
26	L1		39.6	Y	22	39
27	L1		28.2	Y	150	47
31	L1		27.5	Y	56	21
32	L1		27.6	Y	130	19
194	J1		37.0	Y	42	42
195	J1		37.8	Y	113	28
196	J1		30.8	Y	149	37
10	G1		28.6	Y	354	32
9	G1		25.5	Y	35	6
11	G1		37.9	Y	289	30
1	G1		27.7	Y	332	10
20	G1		18.1		102	12
21	G1		18.1	Y	158	7
7	G1		34.8	Y	170	64
8	G1		39.4	Y	323	58
6	G1				158	14
46	B1I		32.3		269	11
43	B1I		28.9	Y	76	17

GnssLogger

Map | Plots | Status | Skyplot | AGNSS

ID	GNSS	Freq	C/N0	Used	Azim	Elev
6	G1				158	14
46	B1I		31.5		269	11
43	B1I		28.1		76	17
41	B1I		26.4	Y	163	33
40	B1I		33.5	Y	47	78
39	B1I		33.3	Y	62	54
38	B1I		21.6		170	9
37	B1I		37.4	Y	322	41
32	B1I		36.3	Y	246	68
28	B1I		32.3	Y	132	29
27	B1I		31.4	Y	183	13
23	B1I		30.6	Y	27	30
20	B1I		32.3	Y	314	27
16	B1I		37.3		43	54
13	B1I		34.7	Y	195	15
10	B1I		26.9	Y	226	75
9	B1I		40.8	Y	8	51
8	B1I		26.2	Y	183	10
7	B1I		27.7	Y	344	88
6	B1I		34.9		33	55
4	B1I		30.4		98	21
3	B1I		29.9	Y	147	68
1	B1I		32.2	Y	104	37
2	B1I				230	64
5	B1I				254	39

GnssLogger

Map | Plots | Status | Skyplot | AGNSS

ID	GNSS	Freq	C/N0	Used	Azim	Elev
1	B1I		32.1	Y	104	37
2	B1I				230	64
5	B1I				254	39
11	B1I				55	2
31	B1I				9	59
56	B1I				199	36
58	B1I				148	9
59	B1I				105	42
60	B1I				234	59
61	B1I				143	70
2	E1		42.2	Y	0	0
3	E1		34.6	Y	119	65
5	E1		22.8		137	14
7	E1		29.4	Y	323	5
8	E1		37.3	Y	335	54
25	E1		26.3	Y	35	12
27	E1		22.8		234	4
30	E1		28.7	Y	266	49
34	E1		28.4		158	9
36	E1		25.1		110	3
15	E1				204	1
3	L5		17.9		268	39
4	L5		30.0	Y	331	30
8	L5		34.4	Y	188	24
26	L5		37.0	Y	22	39

GnssLogger

Map | Plots | Status | Skyplot | AGNSS

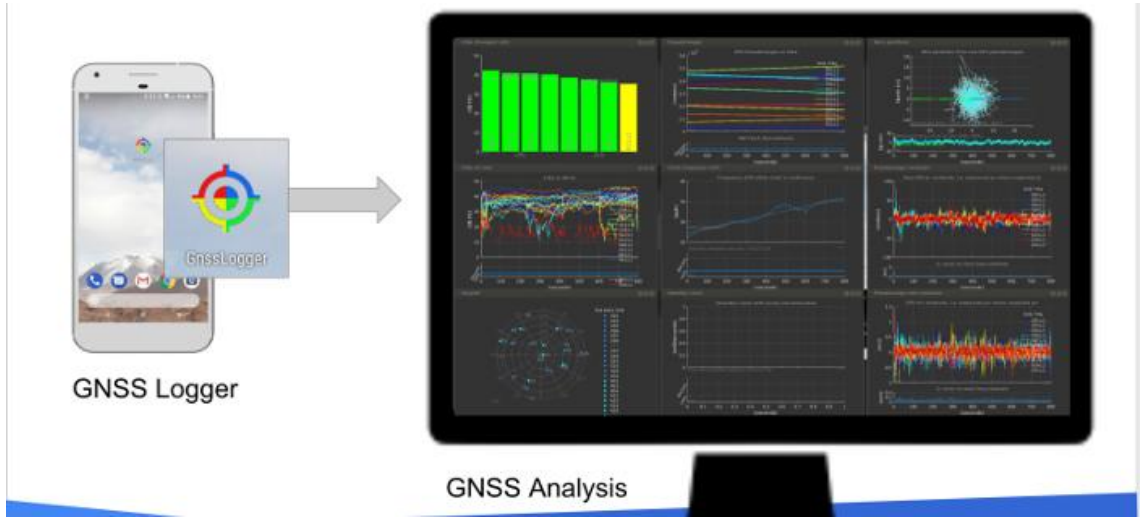
ID	GNSS	Freq	C/N0	Used	Azim	Elev
9	L5				322	1
194	J5		22.6	Y	42	42
195	J5		22.2	Y	113	28
196	J5		19.8	Y	149	37
2	E5A		22.9	Y	0	0
3	E5A		23.8	Y	119	65
5	E5A		18.1	Y	137	14
7	E5A		17.2		323	5
8	E5A		26.8	Y	335	54
27	E5A		17.7		234	4
30	E5A		21.8	Y	266	49
34	E5A		27.3		158	9
25	E5A				35	12
36	E5A				110	3
20	B2A		23.6	Y	314	27
23	B2A		26.1	Y	27	30
27	B2A		30.1	Y	183	13
28	B2A		26.1	Y	132	29
32	B2A		23.0	Y	246	68
37	B2A		29.0	Y	322	41
38	B2A		29.9	Y	170	9
39	B2A		27.3	Y	62	54
40	B2A		22.0	Y	47	78
41	B2A		27.5	Y	163	33
43	B2A		21.7		76	17

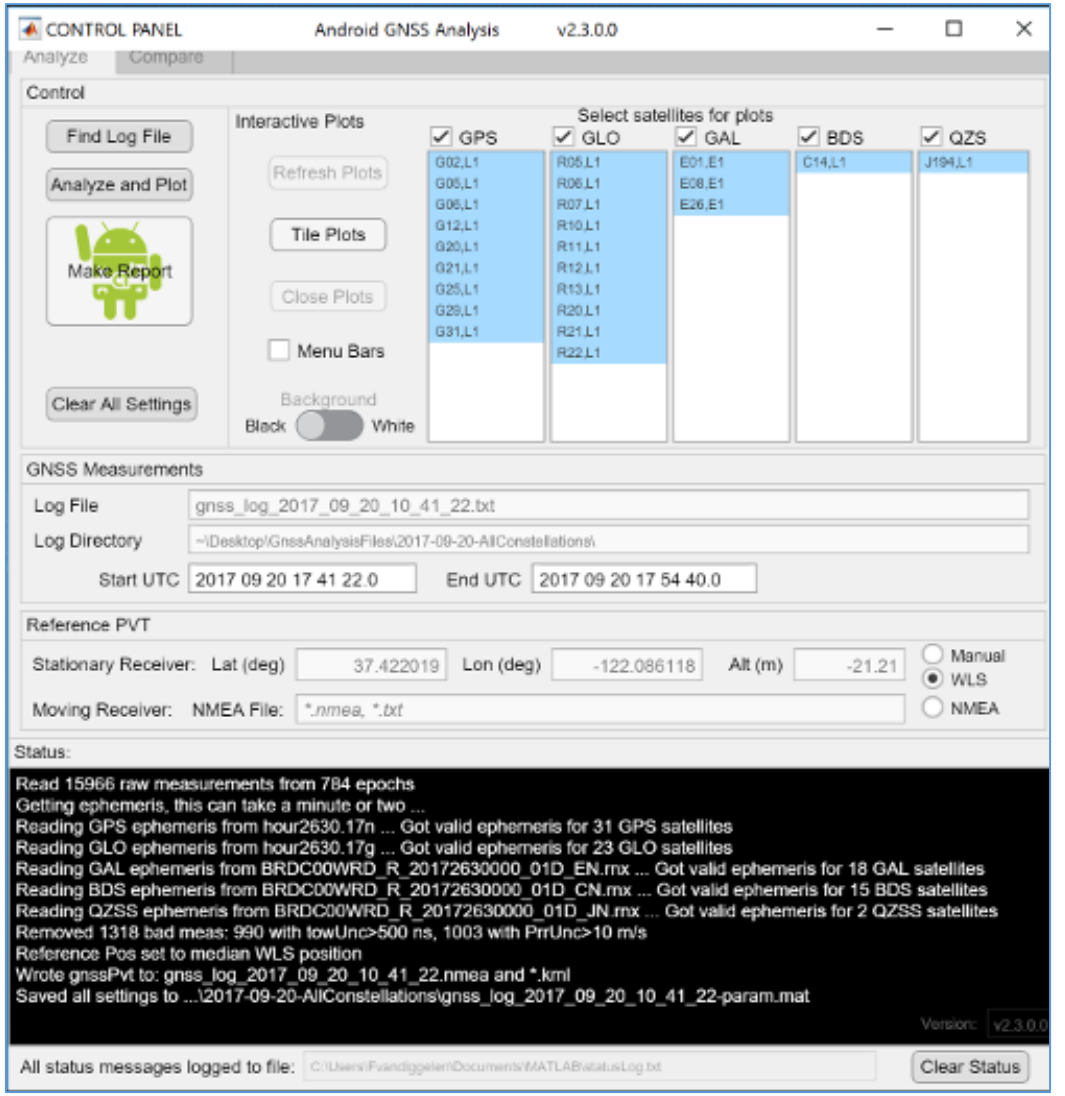
GnssLogger

Map | Plots | Status | Skyplot | AGNSS

ID	GNSS	Freq	C/N0	Used	Azim	Elev
20	B2A		18.5	Y	314	27
23	B2A		28.5	Y	27	30
27	B2A		27.9	Y	183	13
28	B2A		21.3	Y	132	29
32	B2A		20.5	Y	246	68
37	B2A		26.0	Y	322	41
38	B2A		22.2	Y	170	9
39	B2A		23.7	Y	62	54
40	B2A		20.1	Y	47	78
41	B2A		19.3	Y	163	33
43	B2A		17.4		76	17
3	UNKNOWN		27.8	Y	235	65
4	UNKNOWN		29.2	Y	43	78
20	B1C		29.2	Y	314	27
23	B1C		23.2	Y	27	30
27	B1C		29.4	Y	183	13
28	B1C		27.4	Y	132	29
32	B1C		29.8	Y	246	68
37	B1C		34.6	Y	322	41
38	B1C		26.1	Y	170	9
39	B1C		33.2	Y	62	54
40	B1C		36.2	Y	47	78
41	B1C		23.8	Y	163	33
43	B1C		21.4		76	17

GPS Measurement Tool



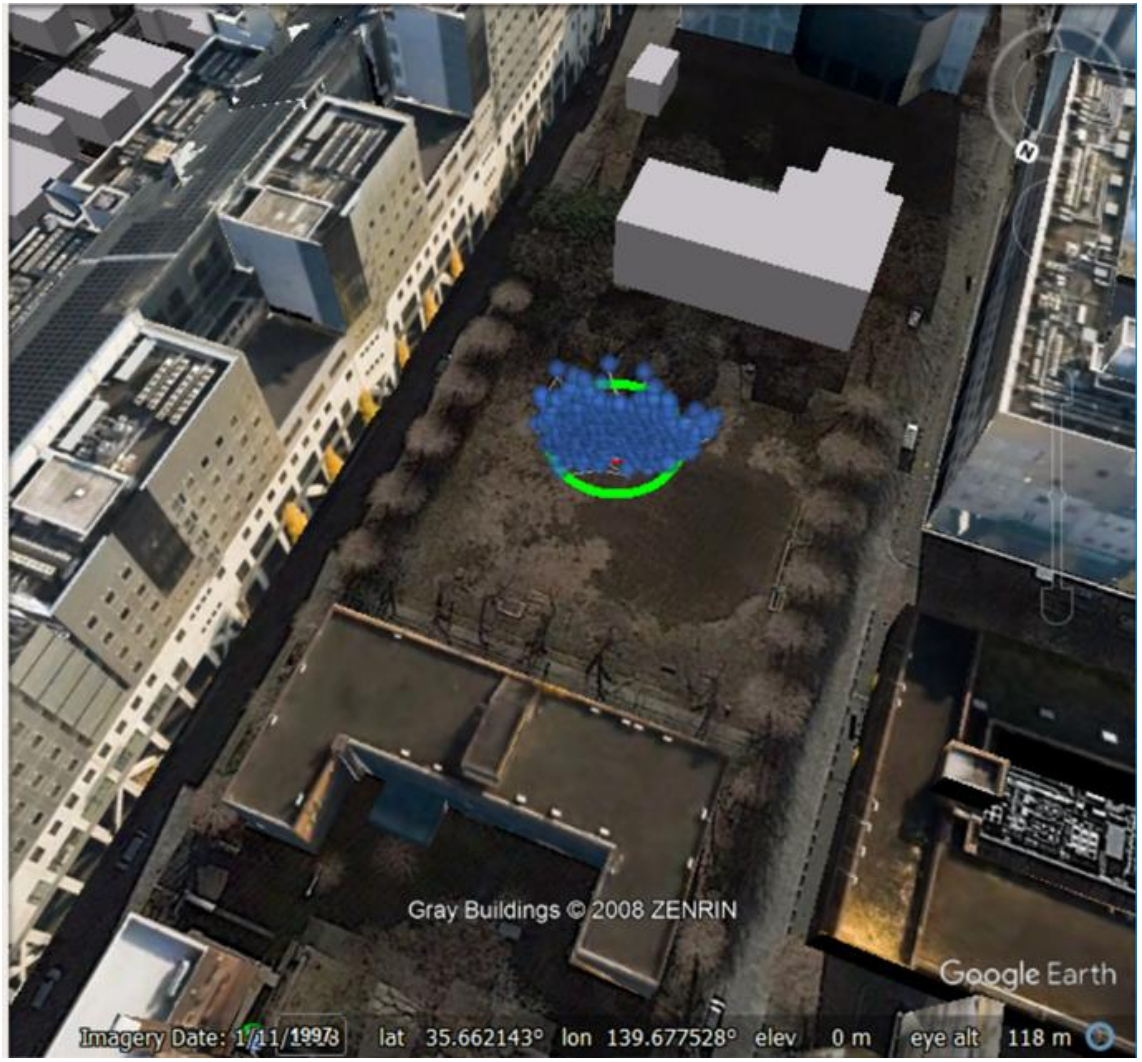


The GNSS Analysis app is built on MATLAB, but you don't need to have MATLAB to run it. The app is compiled into an executable that installs a copy of the MATLAB Runtime.

https://developer.android.com/guide/topics/sensors/gnss.html

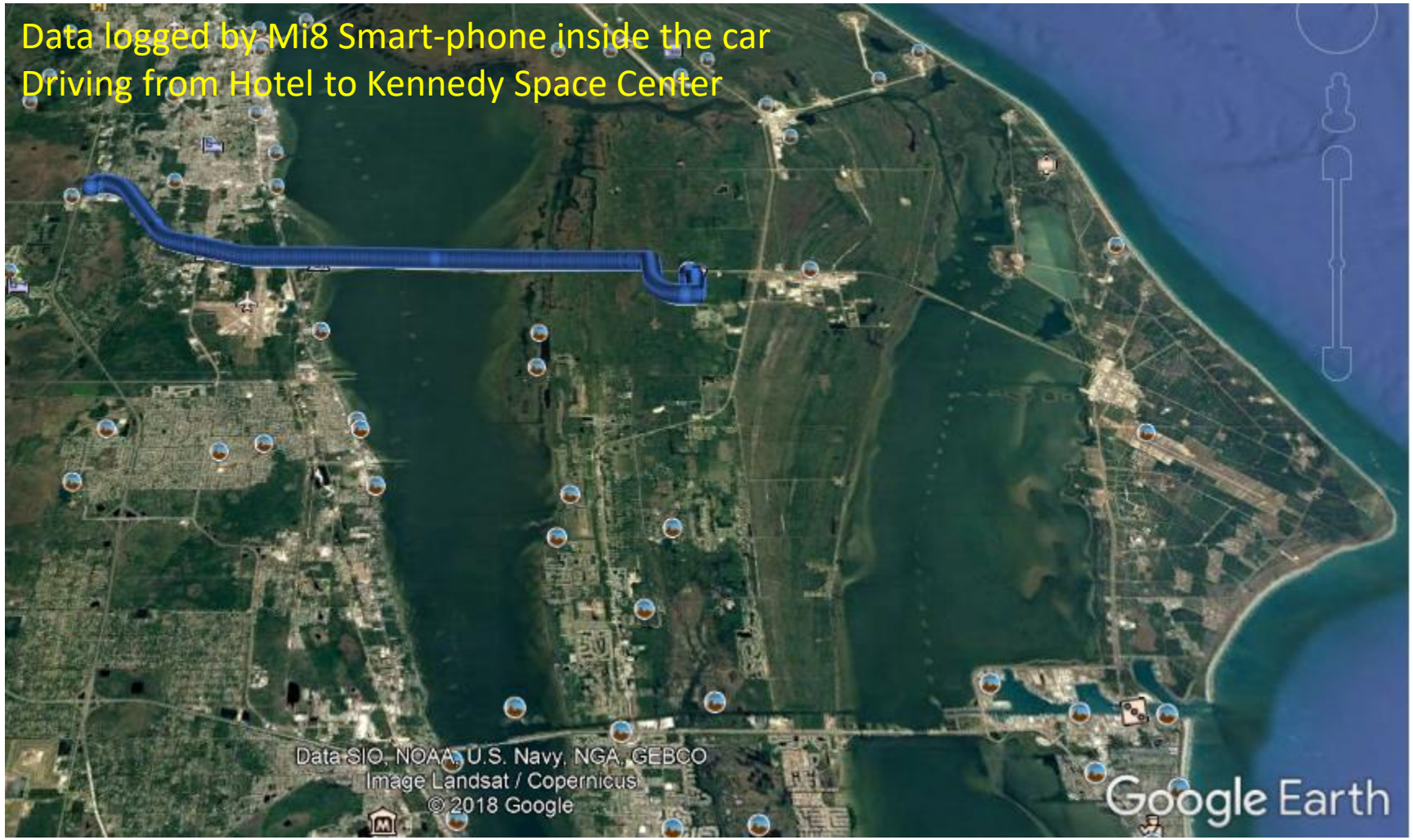
Position Output from Android GNSS Receiver, Tokyo University, Komaba Campus

- Standard Position Computation
  - No DGPS or RTK Corrections
  - All visible GNSS Satellites are used
  - Frequency : L1/L5/E5
  - Surrounding : Tall Buildings around



Output from GNSS Analysis Tool, Data Logged by GNSSLogger

Location:
Kennedy Space Center
Florida



Output from GNSS Analysis Tool, Data Logged by GNSSLogger

Sample GNSS Raw Data from Mi11 Lite 5G

Sample GNSS raw data can be downloaded from the following website:
https://home.csis.u-tokyo.ac.jp/~dinesh/GNSS_Train.htm
Data were taken at the same time by using 4 or 5 different types of devices.
This will help to compare accuracy from different devices as well.

	Smart-Phone Data					
	Xiaomi Mi8 (a)	Xiaomi Mi8 (b)	Xiaomi Mi8 (c)	Xiaomi Mi11 Lite 5G	OppoReno 3 A	
Day 1	Data 01	Data 02	Data 03	Data 08 Data 09	Data 10	
Day 2	Data 04	Data 05 Data 06	Data 07			

GNSS Raw Data from android devices open new opportunities to develop location based applications with high accuracy that were not possible before.