

GPS 응용



May 6, 2025

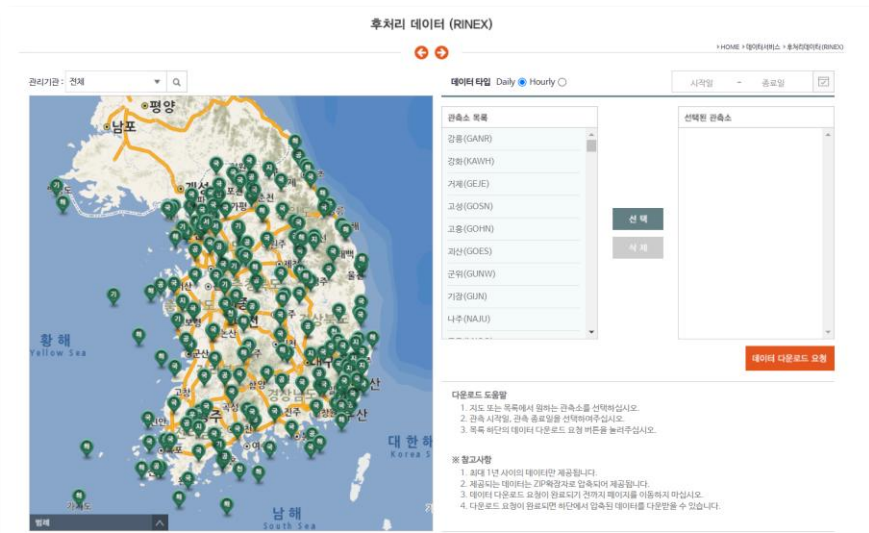
설 윤 환

학습 목표

- 기준국의 Observation RINEX 다운로드(crx)
- CRX 파일 → RNX 파일 변환
- RNX파일 → QM(Quick Measurement) 파일 생성
- QM파일 활용

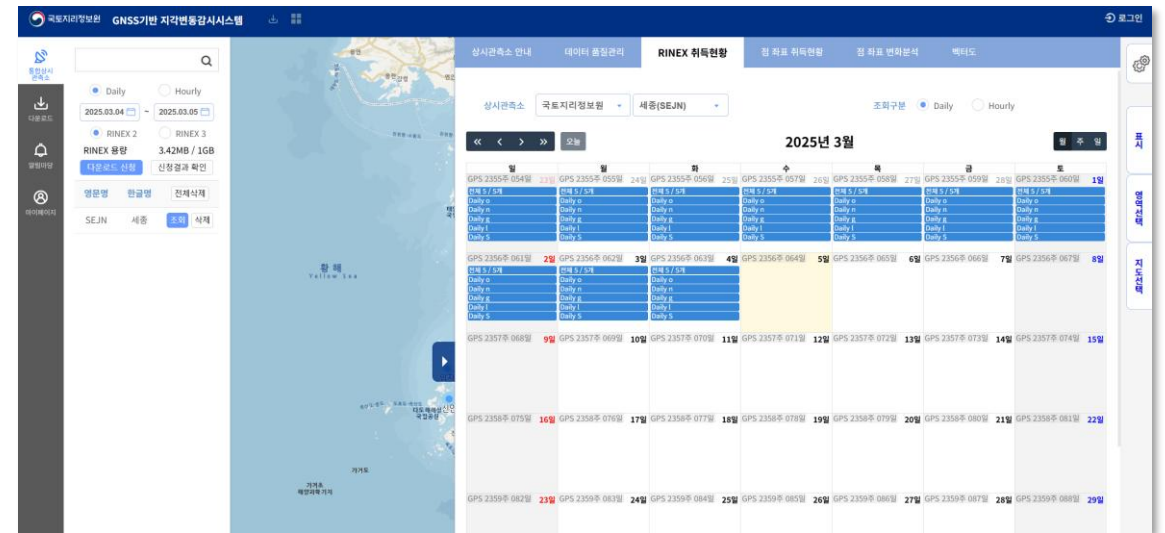
Observation RINEX File

- GNSS 데이터 통합센터



<https://gnssdata.or.kr/download/getDownloadView.do>

- 국토지리정보원 GNSS기반 지각변동 감시 시스템



<https://geodesy.ngii.go.kr/>

Observation RINEX File

- Federal Agency for Cartography and Geodesy
- NASA's Crustal Dynamics Data Information System

GNSS Stations
GAMB00PYF
GAMG00KOR
GANP00SVK
GAP100ESP
GARI00ITA
max. 80 stations selectable

File Type
☒ Observation
☐ Navigation
☐ Meteorological

File Period
☒ Daily
☐ Hourly
☐ 15min (1Hz) Obs

RINEX Version
☒ 2 ☐ 3

Data Source
☒ Receiver
☐ Stream

Start Date (UTC)
2025-02-28T00:00:00

End Date (UTC)
2025-03-05T06:35:22

Select all Clear selection Download selected files

20 entries per page Search:

Name	Start Date	Version	Size
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<https://igs.bkg.bund.de/searchRINEX>

CDDIS NASA's Archive of Space Geodesy Data

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Parent Directory

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<https://cddis.nasa.gov/archive/gnss/data/daily/yyyy/doy/yyd/>
<https://cddis.nasa.gov/archive/gnss/data/daily/2025/005/25d/>

Compact RINEX Format(CRX)

```

3.0 COMPACT RINEX FORMAT CRINEX VERS / TYPE
RNX2CRX ver.4.1.0 02-Jan-24 00:28 CRINEX PROG / DATE
3.04 OBSERVATION DATA M RINEX VERSION / TYPE
sbf2rin-15.6.1 20240102 001822 UTC PGM / RUN BY / DATE
GAMG MARKER NAME
23910M001 MARKER NUMBER
GEODETIC MARKER TYPE
REGINA CNES OBSERVER / AGENCY
3222793 SEPT POLARX5TR 5.5.0 REC # / TYPE / VERS
726358 LEIAR25.R4 LEIT ANT # / TYPE
-3191606.8465 4096898.5400 3691838.0622 APPROX POSITION XYZ
2.0340 0.0000 0.0000 ANTENNA: DELTA H/E/N
G 22 C1C L1C D1C S1C C1W S1W C2W L2W D2W S2W C2L L2L D2L SYS / # / OBS TYPES
S2L C5Q L5Q D5Q S5Q C1L L1L D1L S1L SYS / # / OBS TYPES
E 20 C1C L1C D1C S1C C6C L6C D6C S6C C5Q L5Q D5Q S5Q C7Q SYS / # / OBS TYPES
L7Q D7Q S7Q C8Q L8Q D8Q S8Q SYS / # / OBS TYPES
S 8 C1C L1C D1C S1C C5I L5I D5I S5I SYS / # / OBS TYPES
R 16 C1C L1C D1C S1C C1P L1P D1P S1P C2P L2P D2P S2P C2C SYS / # / OBS TYPES
L2C D2C S2C SYS / # / OBS TYPES
C 24 C1P L1P D1P S1P C5P L5P D5P S5P C2I L2I D2I S2I C7I SYS / # / OBS TYPES
L7I D7I S7I C6I L6I D6I S6I C7D L7D D7D S7D SYS / # / OBS TYPES
J 24 C1C L1C D1C S1C C2L L2L D2L S2L C5Q L5Q D5Q S5Q C1L SYS / # / OBS TYPES
L1L D1L S1L C1Z L1Z D1Z S1Z C5P L5P D5P S5P SYS / # / OBS TYPES
I 4 C5A L5A D5A S5A SYS / # / OBS TYPES
SEPTENTRIO RECEIVERS OUTPUT ALIGNED CARRIER PHASES. COMMENT
NO FURTHER PHASE SHIFT APPLIED IN THE RINEX ENCODER. COMMENT

```

```

END OF FILE
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```

RNXCMP

<https://terras.gsi.go.jp/ja/crx2rnx.html>

1. `D:\>cd D:\youna\Desktop\GPS응용 배포자료\RNXCMP_4.1.0_Windows_mingw_64bit\bin`
2. `D:\youna\Desktop\GPS응용 배포자료\RNXCMP_4.1.0_Windows_mingw_64bit\bin> crx2rnx D:\youna\Desktop\GAMG00KOR_R_20240010000_01D_30S_M0.crx`
3. `D:\youna\Desktop\GPS응용 배포자료\RNXCMP_4.1.0_Windows_mingw_64bit\bin>`

[cmd 창]

1. CRZ2RNX.exe 파일이 있는 폴더로 경로 변경(cd 명령어 이용)
2. crx2rnx + 변환하고자 하는 crx 파일의 전체 경로
3. 완료

Observation RINEX File

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2.11      OBSERVATION DATA  M (MIXED)      RINEX VERSION / TYPE
teqc 2016Nov7      20250205 00:37:48UTCPGM / RUN BY / DATE
INCH      MARKER NAME
99113     MARKER NUMBER
GEODESY DIVISION.  NGII      OBSERVER / AGENCY
5737R51053      TRIMBLE NETR9      5.63      REC # / TYPE / VERS
5614361579      TRM59800.00      SCIS      ANT # / TYPE
-3030123.3430  4067231.0150  3854557.4360  APPROX POSITION XYZ
      0.0580      0.0000      0.0000  ANTENNA: DELTA H/E/N
      1      1      WAVELENGTH FACT L1/2
      5  C1  L1  C2  P2  L2      # / TYPES OF OBSERV
      18      LEAP SECONDS
      30.0000  INTERVAL
Linux2.4.20-8|i386|gcc|Win32-MinGW32|=  COMMENT
NetR9 5.63      Receiver Operator  20250204 000000 UTC  COMMENT
L2C CARRIER PHASE MEASUREMENTS: PHASE SHIFTS REMOVED  COMMENT
L2C PHASE MATCHES L2 P PHASE      COMMENT
GLONASS C/A & P PHASE MATCH: PHASE SHIFTS REMOVED  COMMENT
      2025      2      4      0      0      0.0000000  GPS      TIME OF FIRST OBS
      END OF HEADER
25  2  4  0  0  0.0000000  0  21R17G25G26G16R07G29R09G31R10G03R06G28
      R16G32G10E29E30E27E07E19E21
23915991.703 3 127979234.21313
21762758.773 7 114364210.510 7 21762769.246 5 21762767.53149 89114877.24349
21571290.539 8 113357868.409 8 21571300.719 6 21571299.93049 88330867.12049
24188072.680 1
20389254.805 9 109145258.156 9 20389259.820 7 20389259.449 6 84890773.756 6
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```

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sbF2rin-15.6.1      20240102 001822 UTC  PGM / RUN BY / DATE
GAMG      MARKER NAME
23910M001   MARKER NUMBER
GEODETIC    MARKER TYPE
REGINA      CNES      OBSERVER / AGENCY
3222793     SEPT POLARX5TR      5.5.0      REC # / TYPE / VERS
726358      LEIAR25.R4      LEIT      ANT # / TYPE
-3191606.8465  4096898.5400  3691838.0622  APPROX POSITION XYZ
      2.0340      0.0000      0.0000  ANTENNA: DELTA H/E/N
G  22  C1C  L1C  D1C  S1C  C1W  S1W  C2W  L2W  D2W  S2W  C2L  L2L  D2L  SYS / # / OBS TYPES
      S2L  C5Q  L5Q  D5Q  S5Q  C1L  L1L  D1L  S1L  SYS / # / OBS TYPES
E  20  C1C  L1C  D1C  S1C  C6C  L6C  D6C  S6C  C5Q  L5Q  D5Q  S5Q  C7Q  SYS / # / OBS TYPES
      L7Q  D7Q  S7Q  C8Q  L8Q  D8Q  S8Q  SYS / # / OBS TYPES
S  8  C1C  L1C  D1C  S1C  C5I  L5I  D5I  S5I  SYS / # / OBS TYPES
R  16  C1C  L1C  D1C  S1C  C1P  L1P  D1P  S1P  C2P  L2P  D2P  S2P  C2C  SYS / # / OBS TYPES
      L2C  D2C  S2C  SYS / # / OBS TYPES
C  24  C1P  L1P  D1P  S1P  C5P  L5P  D5P  S5P  C2I  L2I  D2I  S2I  C7I  SYS / # / OBS TYPES
      L7I  D7I  S7I  C6I  L6I  D6I  S6I  C7D  L7D  D7D  S7D  SYS / # / OBS TYPES
J  24  C1C  L1C  D1C  S1C  C2L  L2L  D2L  S2L  C5Q  L5Q  D5Q  S5Q  C1L  SYS / # / OBS TYPES
      L1L  D1L  S1L  C1Z  L1Z  D1Z  S1Z  C5P  L5P  D5P  S5P  SYS / # / OBS TYPES
I  4  C5A  L5A  D5A  S5A  SYS / # / OBS TYPES
SEPTENTRIO RECEIVERS OUTPUT ALIGNED CARRIER PHASES.  COMMENT
NO FURTHER PHASE SHIFT APPLIED IN THE RINEX ENCODER.  COMMENT
G  L1C      SYS / PHASE SHIFT
G  L2W      SYS / PHASE SHIFT
G  L2L  0.00000  SYS / PHASE SHIFT
G  L5Q  0.00000  SYS / PHASE SHIFT
  
```

QM(Quick Measurement)

①	②	③	④	⑤	⑥	⑦	
86400.000	504	524	38060998.000	149359845.438	520.797	52.800	8
86400.000	504	124	38060990.613	200012169.500	697.418	51.100	8
86400.000	128	524	24725115.961	97026668.676	2175.301	41.100	6
86400.000	128	224	24725114.020	101245213.096	2269.879	37.700	6
86400.000	128	223	24725113.895	101245234.107	2269.879	17.400	2
86400.000	128	103	24725104.188	129931322.766	2913.012	34.000	5
86400.000	123	524	20147630.414	79063614.873	-324.500	55.700	9
86400.000	123	224	20147629.445	82501171.671	-338.609	54.100	9
86400.000	123	223	20147629.367	82501150.661	-338.609	46.700	7
86400.000	123	103	20147622.914	105876418.371	-434.551	48.800	8
86400.000	503	224	37134117.934	152058302.905	-346.508	39.200	6
86400.000	503	103	37134106.523	195141277.604	-444.684	36.100	6
86400.000	503	524	37134116.637	145722555.138	-332.070	42.200	7
86400.000	503	124	37134104.910	195141379.645	-444.684	40.900	6
86400.000	118	524	24126163.832	94676158.984	-2277.738	43.200	7
86400.000	118	224	24126162.320	98792517.723	-2376.770	40.000	6
				.			
				.			
				.			

Column #1:	GPS week second; (time-tag)	meters
Column #2:	PRN ID	-
Column #3:	Observation Type	-
Column #4:	Measurement(pseudo-range)	meters
Column #5:	Measurement(carrier-phase)	cycles
Column #6:	Measurement(doppler)	Hz
Column #7:	Signal to Noise Ratio	dbHz

QM(Quick Measurement)

①	②	③	④	⑤	⑥	⑦	
86400.000	504	524	38060998.000	149359845.438	520.797	52.800	8
86400.000	504	124	38060990.613	200012169.500	697.418	51.100	8
86400.000	128	524	24725115.961	97026668.676	2175.301	41.100	6
86400.000	128	224	24725114.020	101245213.096	2269.879	37.700	6
86400.000	128	223	24725113.895	101245234.107	2269.879	17.400	2
86400.000	128	103	24725104.188	129931322.766	2913.012	34.000	5
86400.000	123	524	20147630.414	79063614.873	-324.500	55.700	9
86400.000	123	224	20147629.445	82501171.671	-338.609	54.100	9
86400.000	123	223	20147629.367	82501150.661	-338.609	46.700	7
86400.000	123	103	20147622.914	105876418.371	-434.551	48.800	8
86400.000	503	224	37134117.934	152058302.905	-346.508	39.200	6
86400.000	503	103	37134106.523	195141277.604	-444.684	36.100	6
86400.000	503	524	37134116.637	145722555.138	-332.070	42.200	7
86400.000	503	124	37134104.910	195141379.645	-444.684	40.900	6
86400.000	118	524	24126163.832	94676158.984	-2277.738	43.200	7
86400.000	118	224	24126162.320	98792517.723	-2376.770	40.000	6
				.			
				.			
				.			

100 : GPS

200 : BDS

300 : GLO

400 : GAL

500 : QZSS

600 : SBAS

700 : NavIC

+

PRN Number

Ex)

GPS PRN 23 → 123

Galileo PRN 07 → 407

QM(Quick Measurement)

①	②	③	④	⑤	⑥	⑦	
86400.000	504	524	38060998.000	149359845.438	520.797	52.800	8
86400.000	504	124	38060990.613	200012169.500	697.418	51.100	8
86400.000	128	524	24725115.961	97026668.676	2175.301	41.100	6
86400.000	128	224	24725114.020	101245213.096	2269.879	37.700	6
86400.000	128	223	24725113.895	101245234.107	2269.879	17.400	2
86400.000	128	103	24725104.188	129931322.766	2913.012	34.000	5
86400.000	123	524	20147630.414	79063614.873	-324.500	55.700	9
86400.000	123	224	20147629.445	82501171.671	-338.609	54.100	9
86400.000	123	223	20147629.367	82501150.661	-338.609	46.700	7
86400.000	123	103	20147622.914	105876418.371	-434.551	48.800	8
86400.000	503	224	37134117.934	152058302.905	-346.508	39.200	6
86400.000	503	103	37134106.523	195141277.604	-444.684	36.100	6
86400.000	503	524	37134116.637	145722555.138	-332.070	42.200	7
86400.000	503	124	37134104.910	195141379.645	-444.684	40.900	6
86400.000	118	524	24126163.832	94676158.984	-2277.738	43.200	7
86400.000	118	224	24126162.320	98792517.723	-2376.770	40.000	6

•
•
•

Band Index (B)	Band	System
1	L1	GPS, QZSS, SBAS
	G1	GLO
	E1	GAL
	B1C; B1A	BDS
2	L2	GPS, QZSS
	G2	GLO
	B1	BDS
3	G3	GLO
4	G1a	GLO
5	L5	GPS, QZSS, SBAS, NavIC
	E5a	GAL
	B2a	BDS
6	E6	GAL
	L6	QZSS
	B3; B3A	BDS
	G2a	GLO
7	E5b	GAL
	B2; B2b	BDS
8	E5(E5a+b)	GAL
	B2(B2a+b)	BDS
9	S	NavIC

Chan.	A	B	C	D	E	F	G	H	I	J	K	L	M
CC	01	02	03	04	05	06	07	08	09	10	11	12	13
Chan.	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
CC	14	15	16	17	18	19	20	21	22	23	24	25	26

Appendix

GNSS System	Freq. Band /Frequency	Channel or Code	Observation Codes			
			Pseudo Range	Carrier Phase	Doppler	Signal Strength
GPS	L1/1575.42	C/A	C1C	L1C	D1C	S1C
		L1C (D)	C1S	L1S	D1S	S1S
		L1C (P)	C1L	L1L	D1L	S1L
		L1C (D+P)	C1X	L1X	D1X	S1X
		P (AS off)	C1P	L1P	D1P	S1P
		Z-tracking and similar (AS on)	C1W	L1W	D1W	S1W
		Y	C1Y	L1Y	D1Y	S1Y
		M	C1M	L1M	D1M	S1M
		codeless		L1N	D1N	S1N
	L2/1227.60	C/A	C2C	L2C	D2C	S2C
		L1(C/A)+(P2-P1) (semi-codeless)	C2D	L2D	D2D	S2D
		L2C (M)	C2S	L2S	D2S	S2S
		L2C (L)	C2L	L2L	D2L	S2L
		L2C (M+L)	C2X	L2X	D2X	S2X
		P (AS off)	C2P	L2P	D2P	S2P
		Z-tracking and similar (AS on)	C2W	L2W	D2W	S2W
		Y	C2Y	L2Y	D2Y	S2Y
		M	C2M	L2M	D2M	S2M
		codeless		L2N	D2N	S2N
	L5/1176.45	I	C5I	L5I	D5I	S5I
		Q	C5Q	L5Q	D5Q	S5Q
		I+Q	C5X	L5X	D5X	S5X

https://files.igs.org/pub/data/format/rinex304.pdf?_gl=1*1wskikk*_ga*MTEyMzcwOTI4My4xNz M1NTM1MzIz*_ga_Z5RH7R682C*MTc0MTE2MjM4MC40NS4wLjE3NDExNjIzODYuNTQuMC4w &_ga=2.45170785.436934635.1741087015-1123719283.1735535323 (Page 17~)

Table 4 : RINEX Version 3.04 GPS Observation Codes

Writeobs

RINEX Ver 2.x → WriteObs2.p

RINEX Ver 3.x → WriteObs3.p

* 파일 경로 지정에 유의

QM파일 저장 위치

실행 구문

The screenshot shows a MATLAB environment with the following details:

- File Explorer:** Displays the directory `D:\MATLAB\GNSS\CODE_main`. A list of files is shown with their sizes, including `24_151_14.m` (26 KB), `24_151_15_2.m` (31 KB), `24_151_15.m` (31 KB), `24_151_16.asv` (28 KB), `24_151_16.m` (29 KB), `24_151_19_onlyPR.asv` (9 KB), `24_151_19_onlyPR.m` (9 KB), `24_159_9.m` (12 KB), `24_224_15.asv` (22 KB), `24_224_15.m` (22 KB), `24_265_17.asv` (23 KB), `24_265_17.m` (24 KB), `24_265_18_onlyPR.m` (8 KB), `24_265_18_onlyPRCP.m` (13 KB), `24_265_19_onlyPR.m` (9 KB), `24_265_20_RPCPA1.m` (13 KB), `24_265_20_RPCPA1ED_2.m` (17 KB), `24_265_20_RPCPA1ED.asv` (17 KB), `24_265_20_RPCPA1ED.m` (17 KB), `MAIN.m` (4 KB), `.m` (9 KB), `.m` (4 KB), `.m` (7 KB), `.m` (7 KB), `xcompare.asv` (5 KB), `xcompare.m` (5 KB), and `.m` (3 KB).
- Command Window:** Shows the following commands and output:

```
>> addpath(genpath('D:\MATLAB\GNSS\'))  
>> WriteObs3('GAMG00KOR_R_20240010000_01D_30S_M0.rnx')
```

===== RINEX 3.04 : OBSERVATION DATA =====

 - Marker Name : GAMG
 - Marker Number : 23910M001
 - Marker Type : GEODETIC
 - Observer / Agency : REGINA / CNES
 - REC # / Type / VERS : 3222793 / SEPT POLARX5TR / 5.5.0
 - ANT # / Type : 726358 / LEIAR25.R4 LEIT
 - Approx Position XYZ : -3191606.8465 4096898.5400 3691838.0622
 - Interval : 0.000
 - Time of First Obs : 2024-01-01 00:00:00.000
 - Time of Last Obs : 2024-01-01 23:59:30.000
 - Duration : 23:59:30.000
- Progress Bar:** A dialog box titled "Converting... RINEX ---> QM" shows a progress bar at 4.0%.