RINEX 3

Provide higher precision of CORS positions

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What is RINEX?
(**Receiver INdependent Exchange**)

- Since 1993 the RINEX 2 is available
  - No updates since 2005
  - QC with *teqc*, which is no longer supported
- RINEX version 3.05 available December 2020
  - Supports all Global Navigation Satellite System (GNSS): signals, tracking modes and satellites
- The most recent version is RINEX 4.00 from December 2021
  - Test only

What is RINEX …

- The acceptance by the IGS in 2012 of the RINEX 3 as the only GNSS data exchange format moving forward.
- RINEX 3 was developed to better handle the many modernized codes from today's multitude of available satellite systems.
- Currently, NGS ingests, stores, archives, and processes raw GNSS data in the older RINEX version 2 (RINEX 2) format. PAGES processes data in RINEX 2 format, and NGS provides CORS' data in RINEX 2 format.
- Several IGS stations currently only output RINEX 3 files. NGS must convert these data files to RINEX 2 prior to using them for baseline processing or orbit determination.
- Adopt RINEX 3 at NGS in order to keep up with the GNSS community and make use of the modernized GNSS signals.

GNSS Systems

- RINEX 3
  - GPS - US
  - GLONASS - Russia
  - Galileo - EU
  - BeiDou - China
  - QZSS - Japan
  - IRNSS - India
- RINEX 2
  - GPS
  - GLONASS
  - Galileo
  - BeiDou

Naming Convention

- For **daily** RINEX 3 files:
  - al303600.21d.Z
  which becomes, with the RINEX 3 long names;
  - AL3000USA_R_20213600000_01D_30S_MO.crx.gz
- For **hourly** RINEX 3 files:
  - al30360b.21d.Z
  which becomes, with the RINEX 3 long names;
  - AL3000USA_R_20213600100_01H_30S_MO.crx.gz

RINEX 3 File Format

RINEX 3 format files

nnnnMRCCC_S_YYYYDDDHHMM_PPU_FFU_CT.fmt[*.cmp*]

where:

nnnn	=	4 character station ID
M	=	Monument number. Currently only zero (0) is used
R	=	Receiver number. Currently only zero (0) is used
CCC	=	ISO country code (GBR)
S	=	Data source. "R" = receiver; "S" = stream; "U" = unknown
YYYY	=	4 digit year of first epoch of data in the file
DDD	=	3 digit day of year (inc. leading zeros) of first epoch of data in the file
HH	=	2 digit hour (inc. leading zero) of first epoch of data in the file (GPS Time)
MM	=	2 digit minute (inc. leading zero) of first epoch of data in the file (GPS Time)
PP	=	2 digit file period (inc. leading zero)
U	=	Units of period *PP*. "M" = min; "H" = hour, "D" = day; "Y" = years; "U" = unspecified
FF	=	2 digit frequency of the observations (inc. leading zero)
U	=	Units of frequency *FF*. "C" = 100Hz; "Z" = Hz; "S" = sec; "M" = min; "H" = hour; "D" = day; "U" = unspecified NB - *_FFU* is omitted for files containing navigation data
C	=	Constellation indicator. "M" = mixed; "G" = GPS; "E" = Galileo; "R" = GLONASS; "C" = Beidou; "J" = QZSS; "I" = IRNSS; "S" = SBAS
T	=	Data type indicator. "O" = observations; "N" = navigation; "M" = meteo (no associated constellation so *MM*)
fmt	=	File format indicator. "rnx" = RINEX; "crx" = Hatanaka compacted RINEX
cmp	=	[Optional] Compression method. E.g. "zip", "gz"

Beta

- https://geodesy.noaa.gov/corsdata/beta/rnx/

Index of /corsdata/beta/rnx/2022/185/al30

Name	Last modified	Size	Description
Parent Directory		-	
AL3000USA_R_20221850000_01D_01S_MO.crx.gz	2022-07-05 01:01	25M	
AL3000USA_R_20221850000_01D_01S_MO.rnx.gz	2022-07-04 20:20	74M	
AL3000USA_R_20221850000_01D_GN.rnx.gz	2022-07-05 01:01	31K	
AL3000USA_R_20221850000_01D_RN.rnx.gz	2022-07-05 01:01	30K	
AL30185.xml.gz	2022-07-05 01:01	1.7K	
AL30185.xtr.gz	2022-07-05 01:01	80K	

Index of /corsdata/beta/rnx/2022/187/al30

Name	Last modified	Size	Description
Parent Directory		-	
AL3000USA_R_20221870000_01H_01S_MO.crx.gz	2022-07-05 21:20	1.2M	
AL3000USA_R_20221870000_01H_01S_MO.rnx.gz	2022-07-05 21:20	3.5M	
AL3000USA_R_20221870000_01H_GN.rnx.gz	2022-07-05 21:20	7.9K	
AL3000USA_R_20221870000_01H_RN.rnx.gz	2022-07-05 21:20	3.8K	
AL3000USA_R_20221870100_01H_01S_MO.crx.gz	2022-07-05 22:20	1.1M	
AL3000USA_R_20221870100_01H_01S_MO.rnx.gz	2022-07-05 22:20	3.3M	
AL3000USA_R_20221870100_01H_GN.rnx.gz	2022-07-05 22:20	6.0K	
AL3000USA_R_20221870100_01H_RN.rnx.gz	2022-07-05 22:20	3.6K	

Who uses RINEX 3?

- M-PAGES (Multi-GNSS PAGES)
  - Replaces PAGES: Program for the Adjustment of GPS Ephemerides
  - In-house NGS software is still currently in development and testing
  - Processing engine for all GNSS services at NGS:
    - OPUS Static
    - OPUS Projects
    - NOAA CORS Network (NCN) coordinate maintenance
    - Orbit production
  - Capable of ingesting all GNSS observables, frequencies, and constellations
  - Capable of ingesting RINEX 2 or 3
  - M-PAGES can support NGS strategic objectives, and will replace PAGES in all applications with no loss of capability or accuracy.

Future Plans

- RINEX 2 and RINEX 3 duality will continue to exist for foreseeable future until the infrastructure is ready to support Rinex 3.
- RINEX 3 --> RINEX 2 down--converter
  - Supports backward compatibility
- UFCORS – will be enhanced for RINEX 3 download