GFZRNX – RINEX GNSS Data Conversion and Manipulation Toolbox

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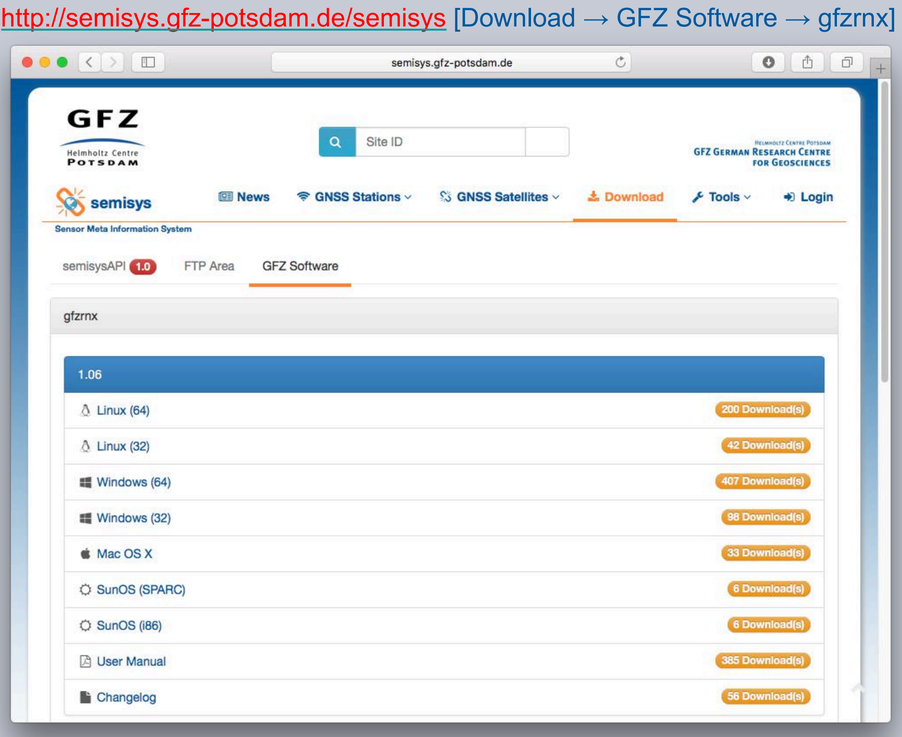
gfzrnx is a software (command line executable) allowing a bunch of formal operations on GNSS data RINEX-files of the major RINEX versions **2** and **3.** Several Operating systems are supported including **Linux** (64- and 32-bit), Microsoft **Windows** (64- and 32-bit) , **MacOS** and **Solaris** (SPARC and i86). At GFZ this is the standard tool for the Operational Data Center and Analysis activities connected with automised data handling procedures.The goal is to provide proven and RINEX standard conform **Obs**ervation-, **Nav**igation- and **Met**eorological data files.

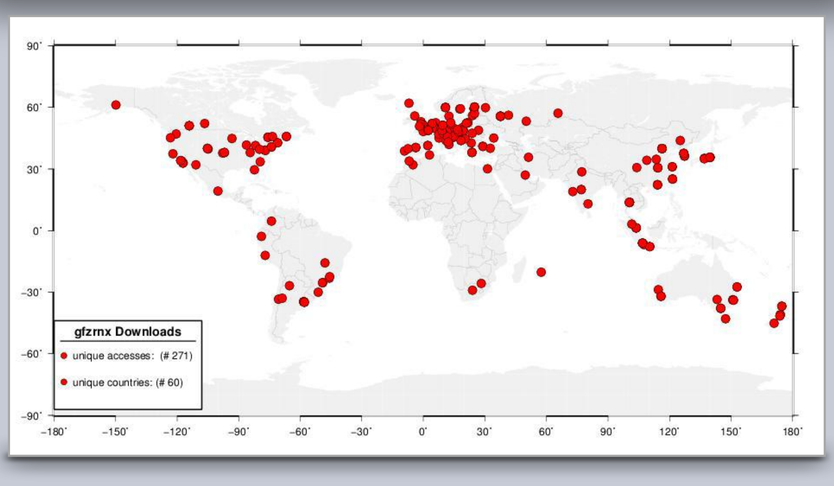
gfzrnx - Scope of Operation

- **full formal support for RINEX-2 (2.11) and RINEX-3 (3.03)**
- **file check and formal repair,**
- **file splice,**
- **file split**
- **file statistics**
- **file header editing**
- **automatic file naming (versions 2 and 3)**
- **file (re)naming support**
- **file meta data extraction**
- **file comparison (diff)**
- **file format conversion (2<->3)**
- **data editing including**
  - **data sampling**
  - **observation types extraction**
  - **satellite system extraction**
  - **epoch interval extraction**
  - **elimination of empty or sparse observation types**
  - **PRN renaming**

Download

http://semisys.gfz-potsdam.de/semisys [Download → GFZ Software → gfzrnx]





Basic File Input/Output (examples)

(using **gzip**- and Hatanaka- de/compression **rnx2crx**, **crx2rnx**)

- **Input via STDIN (pipe)**

```
cat      pots007a.15o | gfzrnx …
crx2rnx pots007a.15d | gfzrnx …
```

- **Input via input file command line parameter (-finp)**

```
gfzrnx -finp pots007a.15o …
```

- **Output via STDOUT (pipe)**

```
gfzrnx -finp pots007a.15o > pots007a.15o_rx3
gfzrnx -finp pots007a.15o | rnx2crx > pots007a.15d
gfzrnx -finp pots007a.15o | rnx2crx | gzip > pots007a.15d.gz
```

- **Output via output file command line parameter (-fout)**

```
gfzrnx -finp pots007a.15o -fout pots007a.15o_rx3
```

User Manual

Detailed information can be found in the user manual which is provided via the download area of the software.

Follow us

@gfzrnx

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(join via gfzrnx-**on**@gfz-potsdam.de)

Reference

Thomas Nischan (2016): GFZRNX - RINEX GNSS Data Conversion and Manipulation Toolbox GFZ Data Services. http://doi.org/10.5880/GFZ.1.1.2016.002

Compilation of Key Functions (examples)

- **Check and Repair**

```
gfzrnx -finp pots0070.15o -fout pots0070.15o_chk -chk -kv -f
 -chk - all formal checks are done
 -kv  - keep input file major RINEX version     (std. output version is RINEX 3)
 -f   - force overwrite if file already exists  (std. is not to overwrite)
```

Statistical information is added or updated in the file header: “PRN / # OF OBS”, “# OF SATELLITES”, “INTERVAL”, “TIME OF FIRST OBS”, “TIME OF LAST OBS”.

- **Automatic Output File Naming**

Providing the output file naming pattern **::RX2::** or **::RX3::** an automatic output file naming of RINEX-2 or RINEX-3 style is activated.

```
gfzrnx -finp pots0070.15o -fout ::RX3::00,DEU -f
```

In case of automatic RINEX-3 output file naming (::RX3::) the “Marker/Receiver” numbers (00) and the ISO country code (DEU) have to be given additionally.
The output file name for the ::RX3:: case will be **POTS00DEU_R_20150070000_01D_30S_MO.rnx**.

- **Data Splicing**

Data Splicing is initiated providing simply a list of input files via the -finp command line parameter.

Splicing of hourly observation data files to a daily file. Preparations like a sorted input file order or a unique observation types order in all input files are not needed !

```
gfzrnx -finp pots007[a-x].15o -fout pots0070.15o -kv -f
```

Splicing of all GPS navigation data files of day 2015-007 to create a daily summary navigation file:

```
gfzrnx -finp ????007?.15n      -fout brdc0070.15n -kv –f -nav_sort time
-nav_sort [prn|time] - nav. data sorting scheme (std. is prn mode)
                       prn - sort by prn and time | time - sort by time and prn
```

- **Data Split**

Split of a daily observation data file into houly files (3600 s) to the output directory /tmp using automatic standard RINEX-2 file naming (::RX2::):

```
gfzrnx -finp pots0070.15o -fout /tmp/::RX2:: -kv -split 3600
```

- **Data Format Conversion (versions 2<->3)**

The standard output format of gfzrnx is RINEX-3. In case of RINEX-2 input no additional parameter is needed in the conversion case:

```
gfzrnx -finp pots0070.15o -fout /tmp/::RX3::00,DEU -f
```

The output file name for the ::RX3:: case will be **/tmp/POTS00DEU_R_20150070000_01D_30S_MO.rnx**. The output format version for RINEX-2 to RINEX-3 conversion is **3.01** and the observation type names are left as they are (please see the manual for details).

For the RINEX-3 to RINEX-2 conversion the output version (-vo) has to be given. The following two commands will create the same output file.

```
gfzrnx -finp POTS00DEU_R_20150070000_01D_30S_MO.rnx -fout /tmp/::RX2::      -vo 2
gfzrnx -finp POTS00DEU_R_20150070000_01D_30S_MO.rnx -fout /tmp/pots0070.15o -vo 2
```

- **Data Editing**

The data values itself are not edited using gfzrnx ! The editing is only a reduction of the data amount driven by a user wish like **data sampling**, **satellite system selection**, **observation types selection** or **PRN de/selection** tasks to shrink the amount of data for a specific application. All the data editing options can be mostly combined with other editing options and functions like the ones given above.

Sampling of input observation file using a 30 s sampling rate and extraction of GPS and GLONASS observation data only to the output file:

```
gfzrnx -finp pots0070.15o -fout pots0070.15o_30s_GR -kv -smp 30 -satsys GR
```

The observation types selection can be done down to a single observation type per satellite system. In general a **left oriented pattern matching** is used to ease up the selection configuration settings.

Global selection over all satellite systems (simple mode) selecting phase and code observations only:

```
gfzrnx ... -obs_types L1,L2,C1,C2,P1,P2
```

Selection of frequencies 1, 2 only:

```
gfzrnx ... -obs_types 1,2
```

Example for a multi GNSS global selection (L1,L2,C1,C2) with special selections for Beidou (C:L1,L7,C1,C7) and GPS (G:L1C,L2W,C1,C2):

```
gfzrnx ... -obs_types L1,L2,C1,C2+C:L1,L7,C1,C7+G:L1C,L2W,C1,C2
```

- **Header Editing**

Header editing can be done providing a configuration file (crux_config.txt) via the **-crux** command line parameter storing the information for the **update or insert** of header elements. The header editing can be done via every gfzrnx call. For a header edit only mode (faster) the **-hded** command line parameter has to be added additionally.

```
gfzrnx -finp pots0070.15o -fout pots0070.15o_hded -kv -crux crux_config.txt
```

There are several possibilities to organise the header editing configuration file. The most clear form would be to organise it per station.
Below you can find a configuration example for the single station **POTS** covering the whole station history information for **O**bservation and **M**eteo file header entries with and without time dependent settings to be used. For every header label a list of column numbers/value pairs (**n:”value”**) has to be given, which are used for the update or insert. Despite usual header edit options there is a possibility to edit **observations types** and **PRNs**.

Site related configuration entries:

```
update_insert:
#-----------
OM - POTS:

"APPROX POSITION XYZ" : { 0:"3800689.6341", 1:"882077.3857", 2:"5028791.3179" }
"MARKER NAME"         : { 0:"POTS" }
"MARKER NUMBER"       : { 0:"14106M003" }
"OBSERVER / AGENCY"   : { 0:"GFZ", 1:"GFZ" }

"REC # / TYPE / VERS" + 1994274:00000 1996015:86340 : { 0:"289",  1:"ROGUE SNR-8000",      ...}
"REC # / TYPE / VERS" + 1996016:49680 1996151:28380 : { 0:"279",  1:"ROGUE SNR-8000",      ...}
"REC # / TYPE / VERS" + 1996151:28860 1999231:00000 : { 0:"289",  1:"ROGUE SNR-8000",      ...}
"REC # / TYPE / VERS" + 1999232:00000 2000232:00000 : { 0:"281",  1:"AOA SNR-8000 ACT",    ...}
"REC # / TYPE / VERS" + 2000233:00000 2009089:00000 : { 0:"281-U",1:"AOA SNR-8000 ACT",    ...}
"REC # / TYPE / VERS" + 2009089:00000 2011046:61200 : { 0:"1358", 1:"SEPT POLARX2",        ...}
"REC # / TYPE / VERS" + 2011046:61200 0000000:00000 : { 0:"205",  1:"JAVAD TRE_G3TH DELTA",...}

"ANT # / TYPE"        + 1994301:00000 1995276:28800 : { 0:"261",  1:"AOAD/M_T",       2:"NONE" }
"ANT # / TYPE"        + 1995276:28800 2009105:47700 : { 0:"235",  1:"AOAD/M_T",       2:"NONE" }
"ANT # / TYPE"        + 2009105:47700 2011046:61200 : { 0:"354-U",1:"AOAD/M_T",       2:"NONE" }
"ANT # / TYPE"        + 2011046:61200 0000000:00000 : { 0:"316",  1:"JAV_RINGANT_G3T",2:"NONE" }

"ANTENNA: DELTA H/E/N"+ 1994301:00000 2011046:61200 : { 0:"0.046", 1:"0", 2:"0" }
"ANTENNA: DELTA H/E/N"+ 1995276:28800 2009105:47700 : { 0:"0.046", 1:"0", 2:"0" }

"SENSOR MOD/TYPE/ACC" + 1996254:00000 2006011:00000 + 3:"PR" : { 0:"Vaisala", 1:"PTB100B",... }
"SENSOR MOD/TYPE/ACC" + 2006011:00000 0000000:00000 + 3:"PR" : { 0:"Vaisala", 1:"PTU200", ... }

"SENSOR MOD/TYPE/ACC" + 1996254:00000 2006011:00000 + 3:"HR" : { 0:"Timetech",1:"HC 500", ... }
"SENSOR MOD/TYPE/ACC" + 2006011:00000 0000000:00000 + 3:"HR" : { 0:"Vaisala", 1:"HMP45A-P",.. }

"SENSOR MOD/TYPE/ACC" + 1996254:00000 2006011:00000 + 3:"TD" : { 0:"Timetech",1:"PT100",  ... }
"SENSOR MOD/TYPE/ACC" + 2006011:00000 0000000:00000 + 3:"TD" : { 0:"Vaisala", 1:"HMP45A-P",.. }
```

Observation Types and PRN renaming options (stations: ABCD, ABC1,...):

```
    rename: prn
    #----------

    ON - 20140105:000000 20150101:000000 - E51 - E01 : ALL
    ON - 20140105:000000 00000000:000000 - E52 - E02 : ABC1.ABC2.ABC3

    E51 - E01 : ALL
    E52 - E02 : ALL


    rename: obs
    #----------

    20140105:000000 20150101:000000 - L2X - L2L - G : ABCD
    20140105:000000 20150101:000000 - L2L - L2X - G : ABCD

    20140105:000000 20150101:000000 - *2* - *1* - C : ALL
    20140105:000000 20150101:000000 - *2  - *1  - C : ALL

    20140105:000000 20150101:000000 - **X - **L - C : ALL
    20140105:000000 20150101:000000 - *2  - *1  - C : ALL

    20140105:000000 20150101:000000 - **X - **L - G04.G08 : ALL
    20140105:000000 20150101:000000 - *2  - *1  - G04.G08 : ALL

    *2* - *1* - C : ALL
    *2  - *1  - C : ALL
```

- **Meta Data Extraction / Statistics**

There are a lot of possibilities to extract meta information, observation- and epoch statistics from data files suitable for monitoring applications.

```
gfzrnx -finp pots0070.15o -meta full:json -fout pots0070.15o_meta.json
gfzrnx -finp pots0070.15o -stk_obs        -fout pots0070.15o_stk_obs
gfzrnx -finp pots0070.15o -stk_epo        -fout pots0070.15o_stk_epo
```

- **Observation File Comparison (diff)**

The comparison of files of e.g. different data sources (Receiver, Stream) can be done with the file diff. mode of gfzrnx. This is possible in case of different observation types orders of the two input files. The result is a RINEX-like output showing the differences per observation type only.

```
gfzrnx -fdiff –finp pots0070.15o_rec pots0070.15o_str -fout pots0070.15o_rs_diff
```

- **Quality Check of Observation Data**

A full Multi-GNSS quality check option is under construction and is planned to be presented in the near future.