

Modernizing GNSS Data Acquisition,
Pre-Processing, and Distribution at Volcanological
Observatories

Supplementary materials

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1 rinexmod_run synopsis

```
1 usage: rinexmod_run [-h] -i RINEXINPUT [RINEXINPUT ...] -o
  ↳ OUTPUTFOLDER [-s SITELOG] [-k KEY=VALUE [KEY=VALUE ...]] [-m
  ↳ MARKER] [-co COUNTRY] [-n NINECHARFILE] [-sti STATION_INFO] [-lfi
  ↳ FILE_APRIORI] [-r RELATIVE] [-nh] [-c {gz,Z,none}] [-l] [-sh] [-
  ↳ fs] [-fc] [-fr] [-ig] [-a] [-ol OUTPUT_LOGS] [-w] [-v] [-t] [-u]
  ↳ [-fns {basic,flex,exact}] [-mp MULTI_PROCESS] [-d] [-rm] [-krr]
2
3 rinexmod takes RINEX files (v2 or v3/4, compressed or not), renames
  ↳ them,
4 modifies their headers, and writes them back to a destination
  ↳ directory
5
6 options:
7   -h, --help
8       show this help message and exit
9
10 required arguments:
11   -i RINEXINPUT [RINEXINPUT ...], --rinexinput RINEXINPUT [RINEXINPUT
  ↳ ...]
12       Input RINEX file(s). It can be:
13       1) a list file of the RINEX paths to process (generated with find
  ↳ or ls)
14       2) several RINEX file paths
15       3) a single RINEX file path (see -a/--alone for a single input
  ↳ file)
16
17   -o OUTPUTFOLDER, --outputfolder OUTPUTFOLDER
18       Output folder for modified RINEX files
19
20 optional arguments:
21   -s SITELOG, --sitelog SITELOG
22       Get the RINEX header values from a sitelog. Provide one file or a
  ↳ folder.
23
24   -k KEY=VALUE [KEY=VALUE ...], --modif_kw KEY=VALUE [KEY=VALUE ...]
25       Modification keywords for RINEX header fields and/or filename.
26       Format: -k keyword_1='value1' keyword2='value2'.
27       Overrides sitelog values. Acceptable keywords include: comment,
  ↳ marker_name, marker_number, receiver_serial, receiver_type,
  ↳ receiver_fw, antenna_serial, antenna_type, antenna_X_pos, an
  ↳ tenna_Y_pos, antenna_Z_pos, antenna_H_delta, antenna_E_delta,
  ↳ antenna_N_delta, operator, agency, sat_system, interval,
  ↳ filename_file_period (01H, 01D...), etc.
```

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28
29 -m MARKER, --marker MARKER
30     Four- or nine-character site code for renaming input files (also
    ↪ applies to the MARKER NAME header; overridden by -k
    ↪ marker_name='XXXX').
31
32 -co COUNTRY, --country COUNTRY
33     ISO 3166 three-letter country code for renaming input files.
    ↪ Overrides
34     other sources. See
    ↪ https://en.wikipedia.org/wiki/List\_of\_ISO\_3166\_country\_codes
35
36 -n NINECHARFILE, --ninecharfile NINECHARFILE
37     File with 9-char site names (e.g. from the M3G database).
38
39 -sti STATION_INFO, --station_info STATION_INFO
40     GAMIT station.info file with GNSS site metadata (requires -lfi).
41
42 -lfi LFILE_APRIORI, --lfile_apriori LFILE_APRIORI
43     GAMIT apriori apr/L-File for GNSS site position and DOMES info
    ↪ (requires -sti).
44
45 -r RELATIVE, --relative RELATIVE
46     Reconstruct relative subfolders. Provide the parent folder to be
    ↪ replaced with OUTPUTFOLDER.
47
48 -nh, --no_hatanaka
49     Skip Hatanaka compression. See also -c none.
50
51 -c {gz,Z,none}, --compression {gz,Z,none}
52     Low-level compression: 'gz' (default, IGS standard), 'Z', or
    ↪ 'none'.
53
54 -l, --longname
55     Force long RINEX filename convention (gzip). Exclusive with
    ↪ --shortname.
56
57 -sh, --shortname
58     Force short RINEX filename convention. Exclusive with --longname.
59
60 -fs, --force_sitelog
61     With a single sitelog: force sitelog values even if mismatch.
62     With multiple sitelogs: skip badly formatted ones.
63
64 -fc, --force_fake_coords

```

```

65     With GAMIT station.info but no L-File coords, assign fake
66     ↪ (0,0,0).
67
68 -fr, --force_rnx_load
69     Force load of RINEX even if filename is non-standard.
70
71 -ig, --ignore
72     Ignore firmware changes between instrumentation periods.
73
74 -a, --alone
75     Treat INPUT as a single RINEX file (not a list).
76
77 -ol OUTPUT_LOGS, --output_logs OUTPUT_LOGS
78     Output log folder. Defaults to OUTPUTFOLDER.
79
80 -w, --write
81     Write output lists (version, sample rate, file period).
82
83 -v, --verbose
84     Print file metadata before and after modification.
85
86 -t, --sort
87     Sort the RINEX input list.
88
89 -u, --full_history
90     Add full station history in RINEX header comments.
91
92 -fns {basic,flex,exact}, --filename_style {basic,flex,exact}
93     RINEX filename style (default: basic).
94     * basic: strict filename period (01H or 01D), IGS compatible.
95       e.g.: FNG000GLP_R_20242220000_01D_30S_M0.crx.gz
96     * flex: period matches data content, may be odd (e.g. 07H, 14H).
97       Rounded to the hour.
98       e.g.: FNG000GLP_R_20242221800_06H_30S_M0.crx.gz
99     * exact: start time = first epoch. For splicing.
100       e.g.: FNG000GLP_R_20242221829_06H_30S_M0.crx.gz
101
102 -mp MULTI_PROCESS, --multi_process MULTI_PROCESS
103     Number of parallel processes (default: 1).
104
105 -d, --debug
106     Debug mode. Stop on error.
107
108 -rm, --remove
109     Remove input RINEX if output was written correctly. (Dangerous)

```

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109
110     -krr, --keep_rnx_rec
111         Keep original receiver header record. External metadata not
           ↳ applied.
112
113 RinexMod 3.7.6 - GNU GPL v3 - P. Sakic et al. - IPGP-OVS -
           ↳ https://github.com/IPGP/rinexmod

```

2 autorino's main configuration file example

```

1  # Configuration file for the Autorino project.
2  # This YAML file defines the structure and settings for the
   ↳ environment, station, and sessions.
3
4  cfgfile_version: 20.2 # Version of the configuration file format.
5
6  ##### DEFINITION OF THE ENVIRONMENT
7  environment:
8    conv_software_paths:
9      convbin : "convbin" # Path to RTKLIB converter.
10     mdb2rinex : "mdb2rinex" # Path to Leica converter.
11     sbf2rin : "sbf2rin" # Path to Septentrio converter.
12     tps2rin : "tps2rin.exe" # Path to Topcon converter.
13     ### Trimble
14     t0xconvert : "t0xConvert" # Path to Trimble official converter
       ↳ (case-sensitive).
15     trm2rinex : "trm2rinex:cli-light" # Path to Trimble unofficial
       ↳ docker converter.
16     runpkr00 : "runpkr00" # Path to Trimble legacy converter for TEQC.
17     ### RINEX handling
18     convertto : "ConverttoCPP" # Path to ConverttoCPP tool.
19     gfzrnrx : "gfzrnrx" # Path to GFZRNX tool.
20     teqc : "teqc" # Path to TEQC tool.
21   general:
22     log_level: "DEBUG" # Logging level for the application.
23     trimble_default_software: "trm2rinex" # Default Trimble converter
       ↳ key (lowercase).
24     cfg_merge_strategy: "replace" # Strategy to merge configuration
       ↳ files ('replace' or 'additive').
25
26  ##### DEFINITION OF THE STATION COMMON INFORMATION FOR THE WHOLE
       ↳ NETWORK
27  station:
28    site:

```

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29 operator: "MY_OPERATOR_NAME" # Name of the site operator.
30 agency: "MY_AGENCY_NAME" # Name of the agency managing the site.
31 country: "France" # Country name in ISO 3166 format.
32 sitelog_path: <$HOME>/sitelogs/ # Path to site logs (file or
    ↳ directory).
33 sessions:
34 session_01D30S:
35     general:
36         active: True # Indicates if the session is active.
37         session_name: "01D30S" # Free name of the session (must be
    ↳ the same as the 'session_XXXXX' key suffix).
38         data_frequency: "30S" # RINEX convention (XXC - 100 Hertz,
    ↳ XXZ - Hertz, XXS - Seconds, XXM - Minutes, XXH - Hours,
    ↳ XXD - Days, XXU - Unspecified)
39         tmp_dir_parent: '/<$HOME>/autorino_workflow/tmp' # Parent
    ↳ directory for temporary files.
40         tmp_dir_structure: '' # Structure for temporary directories.
41         log_dir_parent: '/<$HOME>/autorino_workflow/log' # Parent
    ↳ directory for log files.
42         log_dir_structure: '' # Structure for log directories.
43     epoch_range:
44         epoch1: '10 days ago UTC' # Start of the epoch range.
45         epoch2: 'yesterday at 23:59 UTC' # End of the epoch range.
46         period: "1D" # Time period using Pandas offset aliases.
47         round_method: "floor" # Method to round timestamps.
48         tz: 'UTC' # Timezone for the session.
49     steps:
50         download: ##### DOWNLOAD STEP DEFINITION
51         active : True # Indicates if the download step is active.
52         # inp_dir_parent, inp_dir_structure & inp_file_regex are
    ↳ defined in sites cfg.
53         out_dir_parent: '/<$HOME>/autorino_workflow/raw' # Parent
    ↳ directory for output files.
54         out_dir_structure: '<SITE_ID9>/%Y/%j' # Structure for
    ↳ output directories.
55         epoch_range:
56             FROM_SESSION # Use the session's epoch range.
57         options:
58             force: False # Force re-download of files.
59             remote_find_method: ask # Method to find remote files
    ↳ ('ask' or 'guess').
60             # ask: Retrieve the actual remote file list (e.g., for
    ↳ FTP).
61             # guess: Pre-generate remote file paths (e.g., for
    ↳ HTTP).

```

```

62     invalidate_small_local_files: False # Invalidate small
        ↳ local files.
63     timeout: 30 # Timeout for remote connections in seconds.
64     max_try: 4 # Maximum number of retries for remote
        ↳ connections.
65     sleep_time: 5 # Sleep time between retries in seconds.
66     ping_disable: False # Disable preliminary ping on remote
        ↳ servers.
67     ping_timeout: 5 # Timeout for pinging remote servers in
        ↳ seconds.
68     ping_max_try: 4 # Maximum number of ping retries.
69 convert: ##### CONVERT STEP DEFINITION
70     active : True # Indicates if the convert step is active.
71     inp_dir_parent: '/<$HOME>/autorino_workflow/raw' # Parent
        ↳ directory for input files.
72     inp_dir_structure: '<SITE_ID9>/%Y/%j' # Structure for input
        ↳ directories.
73     inp_file_regex: ".*<SITE_ID4>.*" # Regular expression for
        ↳ input file names.
74     out_dir_parent: '/<$HOME>/autorino_workflow/rnx' # Parent
        ↳ directory for output files.
75     out_dir_structure: '<SITE_ID9>/%Y/%j' # Structure for
        ↳ output directories.
76 epoch_range:
77     FROM_SESSION # Use the session's epoch range.
78 options:
79     force: False # Force re-conversion of files.
80     converter: auto # Converter to use (auto-detect).
81     # Custom regex to catch converted temporary files,
        ↳ default (empty) is regular most-common patterns.
82     conv_regex_custom_main: "" # Custom regex to catch
        ↳ converted temporary main file.
83     conv_regex_custom_annex: "" # Custom regex to catch
        ↳ converted temporary annex files.
84 rinexmod_options:
85     compression: "gz" # Compression format for RINEX
        ↳ files.
86     longname: True # Use long file names.
87     force_rnx_load: True # Force loading of RINEX files.
88     verbose: False # Enable verbose output.
89     filename_style: basic # Style for file names.
90     full_history: True # Keep full history of operations.

```

3 autorino_cfgfile_run synopsis

```
1  usage: autorino_cfgfile_run [-h] -c CONFIG
2  [-i INCLUDE_CONFIG [INCLUDE_CONFIG ...]]
3  [-s START] [-e END] [-p PERIOD]
4  [-si SITES_LIST [SITES_LIST ...]] [-xsi]
5  [-sp {download,convert,split,splice,rinexmod}
6  [{download,convert,split,splice,rinexmod} ...]]
7  [-xsp] [-f]
8
9  Assisted Unloading, Treatment and Organization of RINEX observations
10
11  options:
12  -h, --help
13      show this help message and exit
14
15  -c CONFIG, --config CONFIG
16      Input site configuration file or directory of
17      configuration files. If a directory is provided,
18      all files ending with '.yaml' will be used.
19
20  -i INCLUDE_CONFIG [INCLUDE_CONFIG ...],
21      --include_config INCLUDE_CONFIG [INCLUDE_CONFIG ...]
22      Include configuration files (for dev/advanced use).
23      Overrides the `include` section of the main config.
24
25  -s START, --start START
26      Start date for the epoch range. Formats:
27      * 'yesterday', '10 days ago'
28      * YYYY-DDD (e.g. 2025-140)
29      * YYYY-MM-DD (e.g. 2025-05-20)
30      Also accepts lists or file paths.
31      Default: None.
32
33  -e END, --end END
34      End date for the epoch range. Formats:
35      * 'yesterday', '10 days ago'
36      * YYYY-DDD (e.g. 2025-140)
37      * YYYY-MM-DD (e.g. 2025-05-20)
38      Default: None.
39
40  -p PERIOD, --period PERIOD
41      Sampling period: '1D' (daily), '1H' (hourly),
42      '15M' (15 minutes). Default: '1D'.
43
```

```

44 -si SITES_LIST [SITES_LIST ...],
45     --sites_list SITES_LIST [SITES_LIST ...]
46     List of site identifiers to process. Default: None.
47
48 -xsi, --exclude_sites
49     Opposite of --sites_list. Default: False.
50
51 -sp {download,convert,split,splice,rinexmod}
52     [{download,convert,split,splice,rinexmod} ...],
53     --steps_list {download,convert,split,splice,rinexmod}
54     [{download,convert,split,splice,rinexmod} ...]
55     Steps to be executed. Default: all steps.
56
57 -xsp, --exclude_steps
58     Opposite of --steps_list. Default: False.
59
60 -f, --force
61     Execute steps even if outputs exist. Overrides
62     'force' in config. Default: False.
63
64 Examples:
65 * Run all config files in a directory:
66   autorino_cfgfile_run -c cfgfiles_dir
67
68 * Run a site config for 10 days starting 2025-01-01:
69   autorino_cfgfile_run -c site_cfg.yml \
70     -s 2025-01-01 -e '10 days ago'
71
72 * Run only download+convert for selected sites:
73   autorino_cfgfile_run -c cfgfiles_dir \
74     -si HOUZ00GLP BORG00REU \
75     -sp download convert

```

4 autorino_convert_rnx synopsis

```

1  usage: autorino_convert_rnx [-h] -i INP_RAWS [INP_RAWS ...] -o
   ↪  OUT_DIR
2    [-t OUT_STRUCTURE] [-m METADATA] [-frnx] [-fraw] [-l]
3    [-tmp TMP_DIR] [-log LOG_DIR] [-rimo RINEXMOD_OPTIONS]
4    [-ro RAW_OUT_DIR] [-rt RAW_OUT_STRUCTURE]
5    [-p PROCESSES] [-fpt]
6
7  Convert RAW files to RINEX.
8

```

```

9 options:
10 -h, --help
11     show this help message and exit
12
13 -i INP_RAWS [INP_RAWS ...],
14     --inp_raws INP_RAWS [INP_RAWS ...]
15     Input RAW files to convert. Possible inputs:
16     * single RAW file path
17     * comma-separated list of RAW paths
18     * text file with RAW paths (requires --list_file_input)
19     * directory containing RAW files
20
21 -o OUT_DIR, --out_dir OUT_DIR
22     Output directory for converted files.
23
24 -t OUT_STRUCTURE, --out_structure OUT_STRUCTURE
25     Subdirectory structure inside out_dir.
26     Examples: '<SITE_ID4>/%Y/', '%Y/%j/'.
27     Default: '%Y/%j/'.
28
29 -m METADATA, --metadata METADATA
30     Metadata for RINEX files. Can be:
31     * list of sitelog file paths
32     * single sitelog file path
33     * directory of sitelogs
34
35 -frnx, --force_rnx
36     Force RINEX conversion even if outputs exist.
37
38 -fraw, --force_raw
39     Force RAW archiving even if outputs exist.
40
41 -l, --list_file_input
42     Interpret input as a text file listing RAW paths.
43
44 -tmp TMP_DIR, --tmp_dir TMP_DIR
45     Temporary directory for conversion.
46     Default: <$HOME>/autorino_workflow/tmp.
47
48 -log LOG_DIR, --log_dir LOG_DIR
49     Directory for logs.
50     Default: <$HOME>/autorino_workflow/log.
51
52 -rimo RINEXMOD_OPTIONS,
53     --rinexmod_options RINEXMOD_OPTIONS

```

```
54     Options for modifying RINEX files (dict as string).
55     Example: '{longname: False, filename_style: basic}'.
56     Default: None.
57
58     -ro RAW_OUT_DIR, --raw_out_dir RAW_OUT_DIR
59         Directory where RAW files will be archived.
60         No deletion occurs.
61
62     -rt RAW_OUT_STRUCTURE, --raw_out_structure RAW_OUT_STRUCTURE
63         Structure for RAW archiving. Defaults to same as
64         output directory.
65
66     -p PROCESSES, --processes PROCESSES
67         Number of parallel processes. Default: 1.
68
69     -fpt, --filter_prev_tables
70         Skip files already converted (uses tmp tables).
```