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Brief Description of GruanToolRs92 (gt92)

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Abstract

The tool *gt92* is a powerful Java-based command-line utility. It was developed at the GRUAN Lead Centre for the daily work and is actively maintained and further developed by the author. It provides possibilities for converting and extracting data-tables and meta-data from several file-types like DC3DB, GNC-RAW, GNC-DATA, MWX, GSFZ, STRATO-ZIP and IGNC-RAW. In addition to these base functionality the tool *gt92* has included some more features, e.g. handling and decoding of XData frames, gridding and merging of data tables, test and check files, identify supported file types. An internal batch processing mode is implemented for all main functions of the tool *gt92*. That means, the tool could e.g. convert hundreds of files with one run. Current version of this brief description is related to version 0.5.x of *gt92*.

Note: Please contact the author or the GRUAN Lead Centre (gruan.lc@dwd.de) if required file formats are not supported yet, if any functions are missed, or if a bug is found.

Note: Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement by the GRUAN.

Revision history

Version	Author / Editor	Description
1.0 (2020-10-01)	Michael Sommer	First published version as GRUAN-TN-11
0.8.0 (2019-04-04)	Michael Sommer	First draft version as GRUAN-TN using LaTeX
0.7.4 (2016-02-18)	Michael Sommer	Draft version as GRUAN-IN-4

Table of contents

Appendix

1 Installation

1.1 System requirements for running GruanToolRS92 (gt92)

For using the *gt92* following two requirements should be satisfied:

- a computer with any operating system (like Windows, Linux, Mac OS, . . .)
- installed Java 8 (newer versions are not tested yet)

1.2 Download and install Java

The latest JRE should be installed on the preferred operating system. If a JRE is not installed, the latest version is available for download from:

- Oracle: www.java.com/en/download (last free update from January 2019), or
- AdoptOpenJDK: adoptopenjdk.net (security updates until at least September 2023).

1.3 Download tool GruanToolRs92 (gt92)

The latest version of the *gt92* tool is available on the related page at the GRUAN website (www.gruan.org/data/software/gt92). The download option is visible after login only. Please register yourself at www.gruan.org/user/registration, if not yet registered.

1.4 Install tool GruanToolRs92 (gt92)

There are two types of files included in the packed zip-file. The main program file is a Java archive file (*".jar"*). All other files (*"gt92.*"*) are start scripts for the different operating systems, like *"gt92.bat"* for Windows.

Unpack all files to a folder of your choice. Then this program (or the folder) should be announced to the system. There are two options:

- Edit the *PATH* system variable and add the directory of installation.
- Edit the dedicated script and correct the (absolute) path to the jar file, than copy this script in a folder which is known for executable programs to the system (e.g. a bin folder).

2 Usage

Common usage is easy if the user is familiar with command-line tools. The tool can be specifically instructed with the available options.

```
1 gt92 [OPTION]... [FILE]...
```

2.1 Main purposes

The tool can be used in the following modes (*OPTION*):

- *Convert (-c)* – Convert the file to another file format (see section 3.1)
- *Extract (-x)* – Extract meta-data and/or data-tables as CSV (see section 3.2)
- *Checksum (-k)* – Compute the checksum of the file (see section 3.3)
- *Test (-t)* – Test the file for correctness (see section 3.4)
- *Distribute (-d)* – Prepare a MWX file for external distribution (see section 3.5)
- *Identify (-y)* – Identify file formats for all given files (see section 3.6)
- *Itemize (-z)* – Itemize all tables of given files (see section 3.7)
- *Info (-i)* – Print a specific part of information (see section 3.8)
- *Version (-v)* – Print a general information about this program version (see section 3.9)
- *Help (-h)* – Print full list of options and all other description texts (see appendix A)

2.2 File list

The tool command (*FILE*) is designed to be able to handle multiple files and directories. All of these files (or if a directory is given all included files) are processed step be step. That allows the conversion of a mass of data files with one command. *FILE* can be called with one of following options:

- one file,
- a list of files,
- one directory with all included files,
- a list of directories with all included files,
- a combination of the above.

2.3 Supported file formats

The tool *gt92* supports handling of several file formats used for storing radiosounding data. These file formats include: original raw data files from manufacturer (often proprietary), specific GRUAN formats (often NetCDF) and text files.

File formats which can be read by this tool (input):

- *DC3DB* – Vaisala sounding file of MW31 or MW21 (see 2.3.1)
- *MWX* – Vaisala sounding file of MW41 (see 2.3.2)
- *GSFZ* – Packed Graw sounding files of GrawMet v5 (see 2.3.3)
- *STRATO-ZIP* – Zipped Strato Sounding File (see 2.3.4)
- *GNC-DATA* – GRUAN product data file (see 2.3.5)
- *IGNC-RAW* – IPSL GRUAN NetCDF Radiosonde Raw Data File (see 2.3.6)
- *GNC-RAW* – GRUAN raw data file (see 2.3.7)

File formats which can be written by this tool (output):

- *GNC-RAW* – GRUAN raw data file (see 2.3.7)
- *LDF* – Lindenberg data file (see 2.3.8)
- *CSV* – Comma separated values file (see 2.3.9)
- *MD-TXT* – Meta-data text file (see 2.3.10)
- *TSV* – Special Vaisala text file (see 2.3.11)
- *DC3-DUMP* – Special Vaisala DUMP file (see 2.3.12)

2.3.1 DC3DB (input)

The Vaisala DigiCORA® 3 DataBase file format (*"*.dc3db"* or *"*.dc3"*) is referred to as *DC3DB*. These files could only be created by the outdated Vaisala DigiCORA® Sounding Systems MW31 and MW21. The DC3DB files are proprietary Microsoft DataBase files (MDB – *"*.mdb"*) of Jet version 4.0. DC3DB has a well defined internal structure, which is not openly documented by Vaisala. The format is partly described in the *Sommer* (2020b).

The DC3DB files contain data tables (raw data, intermediate results, product data) and a complex metadata tree. The format is used for the following Vaisala radiosondes: RS80, RS90, RS92. It may also contain data from additional sensors, such as ozone probes.

Some details of the tables and metadata included can be found in the following document *Vaisala* (2015).

2.3.2 MWX (input)

The data file format *MWX* is the default output format of the current Vaisala DigiCORA® Sounding System MW41. A MWX file is a ZIP file, containing single table XML files. Each table contains either metadata, or data, including raw data, intermediate results or product data. Data from both RS41 and RS92 radiosondes can be stored in the MWX format. In addition it can contain data from auxiliary sensors connected via XData, including ECC Ozone sonde, CFH, and others.

Some details of the tables and metadata included can be found in the following document *Vaisala* (2019).

The *gt92* tool can decode XData from some auxiliary sensors (see 2.4). In addition, a gridded multi-column table, including decoded XData, can be generated.

2.3.3 GSFZ (input)

The *GSFZ* data file format is a packed version of default output format of the Graw Sounding Software GRAWMET. Normally a series of Graw Sounding Files (GSF) is created during sounding (*"*.gsf"*, *"*.gsf1"*, *"*.gsf2"*, ...). All these files are XML files and packed together in a GSFZ. A detailed documentation of internal structure of these XML files is not freely available. The content of these XML files is self-explanatory. The files contain both raw data and meta-data.

2.3.4 STRATO-ZIP (input)

The data file format *STRATO-ZIP* is a ZIP file which contains all sounding output files of software Strato. Strato is employed in cases of CFH flights where the InterMet iMet-1 is used as telemetry sonde.

A detailed description of possible output files of Strato can be found in the "Cryogenic Frostpoint Hygrometer - Operations Manual" (*Vömel*, 2014a) and in the "Description of the Strato and Balloon - Data output" (*Vömel*, 2014b).

2.3.5 GNC-DATA (input)

The *GNC-DATA* data format is a specifc NetCDF file. It is used for various GRUAN data products for radiosounding. The original variant uses NetCDF version 3, newer variants use NetCDF version 4. The GNC-DATA data format is not standardised and varies between different data products and their versions. Nevertheless, all data products follow the following rules:

- All variables together form exactly one table (all have the same dimension).
- The CF Convention is supported, of course, different versions over the years.
- Additional metadata is integrated with special GRUAN prefixes: *g.* and *g_*) as global and local attributes, respectively.

The document "Brief Description of the RS92 GRUAN Data Product (RS92-GDP)" (*Sommer et al.*, 2016) can be used as one example for a detailed description.

2.3.6 IGNC-RAW (input)

The *gt92* tool recognises the "IPSL GRUAN Radiosonde Raw Data NetCDF File" data format under the *IGNC-RAW* name. The original name of this format is "Format of L1a GRUAN netCDF file for Meteomodem M10 radiosonde". The format is described in an internal SIRTA/IPSL document and is available at GRUAN Lead Centre.

The IGNC-RAW format uses the grouping variables functionality of NetCDF Version 4. Currently the following groups are incorporated:

- station – Meteorological station/site
- rs_station – Radiosounding launching station
- balloon – Balloon type
- chamber_100_rh – Chamber at 100% of relative humidity
- gc_shelter – Ground calibration shelter
- std_met_station – Standard meteorological ground measurements
- ground_station – Meteomodem ground check
- launch – Launch
- burst – Burst
- rs – Radiosounding

2.3.7 GNC-RAW (input, output)

The *GNC-RAW* data format is based upon NetCDF Version 4 files with a specially defined structure. Its full name is "GRUAN NetCDF Raw Data Format for Radiosounding" and is developed to store raw data files from radiosounding systems of different manufacturers, standardised for the GRUAN network. This data format is intended to simplify the work with data from multiple manufacturers and sondes within the GRUAN network. Currently the tool *gt92* supports the following original file formats: *DC3DB*, *MWX*, *GSFZ*, *STRATO-ZIP*.

> **Note:** It is possible to integrate support for additional file formats. However, this requires an exact description of these formats. Please contact the author or the GRUAN Lead Centre (gruan.lc@dwd.de), if another original data format should be integrated.

This file format is the only one that can be used as input, e.g. using option *extract (-x)* (see section 3.2) and can be created as output using option *convert (-c)* (see section 3.1). The tool provides one special option to choose between the current and an old version of GNC-RAW:

- *--nc-old* – Convert a file in a NetCDF3 file without compression. Only possible with DC3DB files. This converts to the old version of GNC-RAW.

> **Note:** This option is only available for compatibility reasons. Please use this option only, if you exactly know what the difference to newer GNC-RAW version 2 is. For example, such files are required as input files in case of *RS92-GDP.2* processing.

The data format *GNC-RAW* is described in detail in the *Sommer* (2020a).

2.3.8 LDF (output)

LDF is an ASCII text file with a header which includes meta-data and a body which contains a data table.

All header lines are marked as comment lines and are starting always with a hash sign #. Each header line can contain a key/value pair which is separated by an equal sign =. A long list of sounding-related meta-data are included. In addition all columns of the data table are defined using the following attributes:

- Name – short free name/title
- Unit – unit
- StandardName – standard name of CF convention
- LongName – free long name or comment
- FormatType – data type (e.g. FLT, DBL, BOL, INT, LNG, STR, ...)
- FormatWidth – width of formatted column
- FormatNaN – used not a number text
- FormatFormat – used Fortran format for formatting of column

The data table is similar to a *CSV* file with a semicolon *;* as default delimiter. All columns are formatted with a fixed width. The following preview shows a file content example:

```
#
# Product.ID                        = 559857
# Product.Code                      = RS-11G-GDP
# Product.Name                      = RS-11G GRUAN Data Product
# Product.Version                   = 1
[...]
# Ascent.ID                         = 122830
# Ascent.StandardTime               = 2020-06-08T00:00:00
# Ascent.StartTime                  = 2020-06-07T23:30:19
[...]
# Instrument.SerialNumber           = 930067
# Instrument.Type                   = RS-11G
# Instrument.Manufacturer           = Meisei
[...]
# Table.Columns                     = 4
#
# Table.Column(0).Name              = time
# Table.Column(0).Unit              = seconds since 2020-06-07T23:30:19
# Table.Column(0).StandardName      = time
# Table.Column(0).LongName          = Time
# Table.Column(0).FormatType        = FLT
# Table.Column(0).FormatWidth       = 8
# Table.Column(0).FormatNaN         = NaN
# Table.Column(0).FormatFormat      = F8.1
[...]
# Table.Column(3).Name              = alt
# Table.Column(3).Unit              = m
# Table.Column(3).StandardName      = altitude
# Table.Column(3).LongName          = Altitude
# Table.Column(3).FormatType        = FLT
# Table.Column(3).FormatWidth       = 7
# Table.Column(3).FormatNaN         = NaN
# Table.Column(3).FormatFormat      = F7.1
#
    time;       lat;        lon;      alt;
     0.0; -69.00393;   39.57866;    25.5;
     1.0; -69.00389;   39.57864;    26.2;
     2.0; -69.00385;   39.57862;    27.4;
     3.0; -69.00378;   39.57856;    29.7;
     4.0; -69.00369;   39.57850;    32.8;
     5.0; -69.00362;   39.57841;    36.4;
     6.0; -69.00356;   39.57830;    40.3;
     7.0; -69.00351;   39.57818;    44.8;
     8.0; -69.00348;   39.57811;    49.6;
     9.0; -69.00346;   39.57816;    54.7;
    10.0; -69.00343;   39.57824;    60.1;
```

2.3.9 CSV (output)

CSV is a comma separated values file in ASCII text.

The tool provides a couple of options to justify or permit the export:

- *--no-csv* – Extract no data tables as default csv files.
- *--no-csv-nan* – Do not print NaN values in csv files.

- *--csv-delimiter <DELIMITER>* – Use given delimiter within csv files.

The following example illustrates the CSV export options:

```
# original without any additional option
time [sec];P [hPa];T [K];U1 [%];U2 [%]
0.5625522136688232;996.571533203125;296.3365783691406;NaN;-0.01440700888633728
1.5625898838043213;996.5634155273438;296.38214111328125;NaN;-0.027024805545806885
2.5626277923583984;996.4644775390625;296.34832763671875;NaN;-0.026787370443344116
3.5626678466796875;996.5783081054688;296.3655090332031;NaN;-0.04264324903488159
4.562672138214111;996.5721435546875;296.36578369140625;NaN;-0.03854069113731384
5.562710285186768;996.4970092773438;296.3979797363281;NaN;-0.04685834050178528

# option --csv-delimiter ","
time [sec],P [hPa],T [K],U1 [%],U2 [%]
0.5625522136688232,996.571533203125,296.3365783691406,NaN,-0.01440700888633728
1.5625898838043213,996.5634155273438,296.38214111328125,NaN,-0.027024805545806885

# option --no-csv-nan
time [sec];P [hPa];T [K];U1 [%];U2 [%]
0.5625522136688232;996.571533203125;296.3365783691406;-32768.0;-0.014407008886337
1.5625898838043213;996.5634155273438;296.38214111328125;-32768.0;-0.0270248055458
```

2.3.10 MD-TXT (output)

Most original data files include both meta-data and data tables. During extraction meta-data is exported as meta-data text file *MD-TXT*. This meta-data text file has a very simple format. Each meta-data item is exported on separate line with an unique key and a value separated by "=". The meta-data key is often like a path in a directory tree using a specific separator. This separator char depends on the original file format (e.g. "." or "\" or "/").

The tool provides a lot of options to justify, filter or permit the meta-data export:

- *--no-meta* – Extract no meta-data.
- *--meta-regex <REG-EX>* – Extract meta-data only if it matches the regEx.
- *--meta-sep <SEPARATOR>* – Extract meta-data using this separator for names (not default or original one).
- *--meta-osep* – Extract meta-data items using original separator in names (not default one).
- *--no-meta-group* – Extract no group items of meta-data.
- *--no-meta-name* – Extract only values of meta-data (not the names).
- *--no-meta-root* – Extract meta-data items without root.
- *--no-meta-valid* – Extract meta-data items using original names (not valid one).

Following example is a part of an extracted meta-data file of a *DC3DB*:

```
E4211940!00=2010-05-26T16:33:27.859 (00|03)
E4211940!00\OperatorName=ozon
[...]
E4211940!00\RsGroundCheck=2010-05-26T16:50:16.593 (00|03)
E4211940!00\RsGroundCheck\Corrections=2010-05-26T16:50:16.609 (00|03)
E4211940!00\RsGroundCheck\Corrections\Humidity1=-0.275725
E4211940!00\RsGroundCheck\Corrections\Humidity2=-0.295809
```

```
E4211940!00\RsGroundCheck\Corrections\Pressure=0.083704
E4211940!00\RsGroundCheck\Corrections\Temperature=-0.272957
[...]
E4211940!00\RsNumber=E4211940
[...]
E4211940!00\TimingOfSounding=2010-05-26T17:18:10.968 (00|03)
E4211940!00\TimingOfSounding\RsActualLaunchDateAsc=2010-05-26
E4211940!00\TimingOfSounding\RsActualLaunchTime=2010-05-26T17:08:15.000Z
E4211940!00\TimingOfSounding\RsActualLaunchTimeAsc=17:08:15
E4211940!00\TimingOfSounding\RsActualLaunchTimeNilu=17.137500
E4211940!00\TimingOfSounding\RsElapsedTimeToStart=1074.327516
E4211940!00\TimingOfSounding\RsStartDetection=AutoStart
E4211940!00\TimingOfSounding\RsTimeResetBase=2010-05-26T16:50:21.000Z
```

The following example shows the influence of different options:

```
# original without any additional option
E4211940!00=2010-05-26T16:33:27.859 (00|03)
E4211940!00\OperatorName=ozon
E4211940!00\RsGroundCheck=2010-05-26T16:50:16.593 (00|03)
E4211940!00\RsGroundCheck\Corrections=2010-05-26T16:50:16.609 (00|03)
E4211940!00\RsGroundCheck\Corrections\Temperature=-0.272957
E4211940!00\RsNumber=E4211940

# option --no-meta-root
=2010-05-26T16:33:27.859 (00|03)
OperatorName=ozon
RsGroundCheck=2010-05-26T16:50:16.593 (00|03)
RsGroundCheck\Corrections=2010-05-26T16:50:16.609 (00|03)
RsGroundCheck\Corrections\Temperature=-0.272957
RsNumber=E4211940

# option --no-meta-group
E4211940!00\OperatorName=ozon
E4211940!00\RsGroundCheck\Corrections\Temperature=-0.272957
E4211940!00\RsNumber=E4211940

# option --no-meta-name
2010-05-26T16:33:27.859 (00|03)
ozon
2010-05-26T16:50:16.593 (00|03)
2010-05-26T16:50:16.609 (00|03)
-0.272957
E4211940

# option --meta-sep "."
E4211940!00.RsGroundCheck.Corrections.Temperature=-0.272957

# option --meta-regex ".*(RsNumber).*"
E4211940!00\RsNumber=E4211940
E4211940!00\SOUNDING_DATA\RsNumber=E4211940!00
```

2.3.11 TSV (output)

A *TSV* file is a converted version of a binary data table which is included in *DC3DB* files (see section 2.3.1). The binary data table itself can also extracted as a dump (see next section 2.3.12).

During extraction, *TSV* can be actiavted and fraction of numbers in data table can be optimised:

- *--tsv* – Extract data tables in addition as tsv files. Only possible with *DC3DB* files.
- *--tsv-frac <FRACTION>* – Formatted numbers in tsv files use this fraction. Only expedient with option tsv.

Following example of a *TSV* file includes the header lines and some lines of data table:

```

Information about map: FRAWPTU
==================================

Map name (internal)     : FRAWPTU000
Sounding set (internal) : 0
RS-Number               : E4211940!00
Data record length      : 20 bytes
Number of data records  : 11640
Max filemap size        : 327680 bytes
Data header size        : 12504 bytes
Free space in map       : 94880 bytes (4744 records)
Status flag (not used)  : 2


   Record name:    Unit:           Data type:          Divisor: Offset:
   ------------------------------------------------------------------------
    time            sec             float (4)          1        0
    P               hPa             float (4)          1        0
    T               K               float (4)          1        0
    U1              %               float (4)          1        0
    U2              %               float (4)          1        0

*******************************************************************************

   503.95    996.87    293.17 -32768.00     35.46
   504.95    997.05    293.11 -32768.00     35.53
   505.95    996.83    292.92 -32768.00     36.28
   506.95    996.86    292.88     32.94 -32768.00
   507.95    996.86    292.87     33.60 -32768.00
   508.95    996.95    292.87     34.10 -32768.00
```

2.3.12 DC3-DUMP (output)

The data format *DC3-DUMP* is a proprietary binary file of one data table which is included in the *DC3DB* file (see section 2.3.1). Such files are rarely used, because the tool decodes the content anyway. The format is further explained in the document *Sommer* (2020b).

2.4 Supported XData decoding

The tool *gt92* supports decoding of XData frames which might be part of raw data files.

XData frames of following instruments can be decode:

- *V7* – Innovative System Designs V7 Ozone interface board (id=01)
- *OIF411* – Vaisala Ozone interface board (id=05)
- *CFH* – Cryogen Frostpoint Hygrometer (id=08)
- *FPH* – Frost Point Hygrometer (id=10)
- *COBALD* – Compact Optical Backscatter and AerosoL Detector (id=18)
- *PCFH* – Peltier Cooled Frost point Hygrometer (id=3C)
- *FLASH-B* – Fluorescence Lyman-Alpha Stratospheric Hygrometer for Balloon (id=3D)
- *SKYDEW* – Peltier-based chilled-mirror hygrometer "SKYDEW" (id=3F)

Note: Please see tables included in appendix C.

3 Options

3.1 Option convert (-c, --convert)

Option *-c* is a very powerful option to convert a list of *FILE*s to another file format. The result format is currently pre-defined:

- Original raw data file
  - *DC3DB* (see 2.3.1) ⇒ to *GNC-RAW* (see 2.3.7)
  - *MWX* (see 2.3.2) ⇒ to *GNC-RAW* (see 2.3.7)
  - *GSFZ* (see 2.3.3) ⇒ to *GNC-RAW* (see 2.3.7)
  - *STRATO-ZIP* (see 2.3.4) ⇒ to *GNC-RAW* (see 2.3.7)
- NetCDF files
  - *GNC-DATA* (see 2.3.5) ⇒ to *LDF* (see 2.3.8)
  - *GNC-RAW* (see 2.3.7) ⇒ *not possible at moment*
  - *IGNC-RAW* (see 2.3.6) ⇒ *not possible at moment*

Note: To get more information about supported file formats see section 2.3.

Relevant options to parametrise convert mode:

- Directories
  - *-w, --work-dir <DIR>* – The working directory for all temporary files. If not given the current working directory where the tool is installed is used as default.
  - *-o, --out-dir <DIR>* – The output directory for all converted files. The working directory is used as default, if not specified.

  - *--corrupt-dir <DIR>* – The directory to copy all corrupt source files.

- Batch processing
  - *--separate-dir* – Separate all output files for every input directory.
  - *--skip-convert* – Skip converting file if output file already exists.
  - *--copy-corrupt* – Copy all corrupt source files which cannot be converted.
  - *--no-file-type-check* – Skip default file type check before converting.

    Note: This option forces critical errors in case of wrong/corrupt files.

- Result file
  - *--nc-old* – Convert a file in a NetCDF3 file without compression. Only possible with DC3DB files. This converts to the old version of *GNC-RAW*.

    Note: This option is only available for compatibility reasons. Please use this option only, if you exactly know what the difference to newer *GNC-RAW* version 2 is. For example, such files are required as input files in case of *RS92-GDP.2* processing.
  - *--import-table-filter <REG-EX>* – Import (read) tables only if they match the regEx filter.
  - *--export-table-filter <REG-EX>* – Export (write) tables only if they match the regEx filter.
  - *--reverse-table-filter* – Reverse given table filter.
  - *--export-col-filter <REG-EX>* – Export (write) columns only if they match the regEx filter.
  - *--reverse-col-filter* – Reverse given column filter.
  - *--no-xdata* – Do not decode xdata frames.
  - *--include-source* – Include source file during converting a file in a NetCDF4 file (version 2) with compression. Only possible with *DC3DB*, *MWX*, *STRATO-ZIP* and *GSFZ* files.

Note: Please find several examples which are related to option *-c* in following sections 4.1, 4.6 and 4.7.

3.2 Option extract (-x, --extract)

Option *-x* is a very powerful option to extract data tables and/or meta-data from a list of *FILE* and save as ASCII text files, e.g. *CSV* or *TSV*:

- *MWX*, *GSFZ*, *STRATO-ZIP*, *GNC-RAW*, *IGNC-RAW* ⇒ possible result files are: *"*.csv"*, *"*_metadata.txt"*, *"<source-file-name>"* (if included)
- *DC3DB* ⇒ possible result files are: *"*.csv"*, *"*_metadata.txt"*, *"*.tsv"*, *"*.dump"*
- *GNC-DATA* ⇒ possible result files are: *"*.csv"*, *"*_metadata.txt"*

Note: To get more information about supported file formats see section 2.3.

Relevant options to parametrise extract mode:

- Directories
  - *-w,--work-dir <DIR>* – The working directory for all temporary files. If not given the current working directory of program is used as default.
  - *-o,--out-dir <DIR>* – The output directory for all extracted files. If not given the working directory is used as default.
  - *-s,--separate* – Separate all extracted output files for every input file.
- Export file formats
  - *--no-csv* – Extract no data tables as default csv files.
  - *--no-csv-nan* – Do not print NaN values in csv files.
  - *--csv-delimiter <DELIMITER>* – Use given delimiter within csv files.
  - *--dump* – Extract data tables in addition as binary dump files. Only possible with DC3DB files.
  - *--tsv* – Extract data tables in addition as tsv files. Only possible with *DC3DB* files.
  - *--tsv-frac <FRACTION>* – Formatted numbers in tsv files use this fraction. Only expedient with option tsv.
  - *--no-source* – Do not extract an included source file during extracting a file. Only possible with *GNC-RAW* files.
- Meta-data
  - *--no-meta* – Extract no meta-data.
  - *--meta-regex <REG-EX>* – Extract meta-data only if it matches the regEx.
  - *--meta-sep <SEPARATOR>* – Extract meta-data using this separator for names (not default or original one).
  - *--meta-osep* – Extract meta-data items using original separator in names (not default one).
  - *--no-meta-group* – Extract no group items of meta-data.
  - *--no-meta-name* – Extract only values of meta-data (not the names).
  - *--no-meta-root* – Extract meta-data items without root.
  - *--no-meta-valid* – Extract meta-data items using original names (not valid one).
  - *--meta-out-delimiter <DELIMITER>* – Extract meta-data using this delimiter (file name, meta-data name, meta-data value) for general output file.
  - *--meta-out-file <FILE>* – Extract all meta-data of all files to this general meta-data output file.
  - *--no-meta-out-units* – Extract meta-data items without units (if available) to general output file.
- Data tables
  - *--no-tables* – Extract no data tables.

  - *--import-table-filter <REG-EX>* – Import (read) tables only if they matches the regEx filter.
  - *--export-table-filter <REG-EX>* – Export (write) tables only if they matches the regEx filter.
  - *--reverse-table-filter* – Reverse given table filter.
  - *--no-xdata* – Do not decode xdata frames.
- Columns in data tables
  - *--export-col-filter <REG-EX>* – Export (write) columns only if they matches the regEx filter.
  - *--reverse-col-filter* – Reverse given column filter.

Note: Please find several examples which are related to option *-x* in following sections 4.2, 4.3, 4.4, 4.5, 4.8, 4.9.

3.3 Option checksum (-k, --checksum)

Compute checksums for all given file(s). CRC-32 is used if option *--checksum-type* is not specified.

- *--checksum-type <TYPE>* – The type of checksum, digest or hash to calculate. Possible types are CRC-32, MD2, MD5, SHA-1, SHA-224, SHA-256, SHA-384, SHA-512.

The result can be adjusted using following option:

- *--json-result* – Get result on standard output (STDOUT) as JSON. (see section 3.9)

3.4 Option test (-t, --test)

Test all given file(s) for correctness. Under this option, the file (or files) are opened and read according to the file type. If the test does not detect any problems, then the result is *OK*, otherwise *CORRUPT*.

There is also the possibility to test the internal structure in more detail. This is currently only possible for the file type *GNC-DATA* (see 2.3.5). This requires an additional file description, which is tested against. Such a file description is a special XML file (see an example in appendix D).

- *--test-description <FILE>* – The file description to use during test.

Currently the following file descriptions are included in the tool:

- *"Rs11Gv1GdpFileDescription.xml"* – to check a RS-11G-GDP.1 file
- *"Rs41v1EdtFileDescription.xml"* – to check a RS41-EDT.1 file
- *"Rs92v1EdtFileDescription.xml"* – to check a RS92-EDT.1 file
- *"Rs92v2GdpFileDescription.xml"* – to check a RS92-GDP.2 file

The result can be adjusted using the following option:

- *--json-result* – Get result on standard output (STDOUT) as JSON. (see section 3.9)

3.5 Option distribute (-d, --distribute)

Prepare all given file(s) for distribution. Currently only an *MWX* can be subject to this option. The preparation of a MWX file for external distribution consists of the removal of some internal XML files.

3.6 Option identify (-y,--identify)

The tool *gt92* can identify supported file formats.

```
gt92 -y
# result lines, e.g.
d:\Temp\LIN-Test\Lindenberg_20170321_104624.dc3db = DC3DB
d:\Temp\LIN-Test\Lindenberg_20170321_104624.nc = GNC-RAW_0.3
```

The result can be adjusted using following option:

- *--json-result* – Get result on standard output (STDOUT) as JSON. (see section 3.9)

3.7 Option itemize (-z,--itemize)

The tool *gt92* can itemize all tables of given file(s).

```
gt92 -z -f DC3DB
# result line, e.g.
EDT,STD,FLEDT,FLSTD,FRAWPTU,GPS_ORB,GPSCCLOC,GPSCCREM,GPSDCC_RESULT,RAWPTUPOS,
    RS92SONDEID,RSSTATUS,SENS9FRQ
```

The result can be adjusted using following option:

- *--json-result* – Get result on standard output (STDOUT) as JSON. (see section 3.9)

3.8 Option info (-i, --info)

The tool provides an interface to get information about the tool itself, e.g. version and change history. Using option *-i,--info <KEY>*, specific information can be acquired.

Print a specific information (default is *VERSION*) and exit. The possibilities of *<KEY>* are:

- *VERSION* – full version text
- *VERSION_NUMBER* – version number
- *VERSION_DATE* – version date
- *NAME* – name of tool
- *NAME_SHORT* – short name of tool
- *NAME_LONG* – long name of tool
- *COPYRIGHT* – copyright paragraph of tool

- *AUTHOR* – full author text of tool
- *AUTHOR _NAME* – name of author
- *AUTHOR_EMAIL* – email address of author
- *FILE_TYPES* – list of implemented file types
- *HISTORY_LAST* – information about changes from last version
- *HISTORY* – list of change history
- *HISTORY_FULL* – full list of change history

The result can be adjusted using following options:

- *--json-result* – Get result on standard output (STDOUT) as JSON. (see section 3.9)
- *--no-info-key* – Do not print the key of an info in case of one requested info.

3.9 General options

Similar to other tools, the *-h,--help* option prints a full list of options with description texts (see appendix A).

Using the option *-v,--version* is the easily way to check which version a current gt92 installation has. It prints a general information about this program version, e.g.

```
gt92 -v
# Printed result to console starts with following line:
gt92 (GruanToolRS92) 0.4.11_03 (2019-04-02)
```

Sometimes it is easier if all answers or results on console would have a well defined structure like JSON. Using option *--json-result* activate such behaviour, so that all results will be printed on standard output (STDOUT) as JSON.

```
# without JSON result
gt92 -t
# Following lines are printed to console:
d:\Temp\LIN-Test\Lindenberg_20170321_104624.dc3db = OK
d:\Temp\LIN-Test\Lindenberg_20170321_104624.nc = OK

# with JSON result
gt92 -t --json-result
# Following lines are printed to console:
{
  "function" : "test",
  "timestamp" : "2019-04-12T19:12:18.985Z",
  "results" : [
    {
      "name" : "d:\\Temp\\LIN-Test\\Lindenberg_20170321_104624.dc3db",
      "result" : "OK"
    },
    {
      "name" : "d:\\Temp\\LIN-Test\\Lindenberg_20170321_104624.nc",
      "result" : "OK"
    }
  ]
}
```

4 Examples

4.1 Example 1 – Convert GNC-DATA files to LDF format

Convert all files of type *GNC-DATA* in directory *"~/gruan-data"* to the possible target format (in this case *LDF*). The result files are written in the local working directory.

```
gt92 -c -f GNC-DATA ~/gruan-data
```

4.2 Example 2 – Extract all data tables from DC3DB as TSV files

Extract all data-tables of *DC3DB* file *"D:\Data\gruan-test\test1.dc3db"* only as Vaisala *TSV* formatted text-files in local working directory.

```
gt92 -x --no-meta --no-csv --tsv -f DC3DB "D:\Data\gruan-test\test1.dc3db"
```

4.3 Example 3 – Extract meta-data only from GNC-RAW

Extract only the meta-data from all files of type *GNC-RAW* in both directories *"/data/test1"* and *"/data/test2"* and write these meta-data files in output directory *"/data/meta"*.

```
gt92 -x --no-tables -o "/data/meta" -f GNC-RAW "/data/test1" "/data/test2"
```

4.4 Example 4 – Extract a filtered part of meta-data from DC3DB

Extract only a filtered part of meta-data from all files of type *DC3DB* in current directory. Result meta-data file will only include parameter lines with adequate names.

```
gt92 -x --no-tables --meta-regex ".*(RsGroundCheck).*" -f DC3DB

# Example of result lines:
# F0123456!00\RsGroundCheck\Sonde\Pressure=1024.1
```

4.5 Example 5 – Extract a filtered part of data tables from DC3DB

Extract only data tables which match given filter (start with "Gps") from all files of type *DC3DB* in current directory.

```
# import (and extract) all tables stating with "Gps"
gt92 -x --no-meta --import-table-filter "Gps.*" -f DC3DB
```

4.6 Example 6 – Convert DC3DB files to GNC-RAW files

Convert all files of type *DC3DB* in local working directory to the possible target format (in this case *GNC-RAW*). The result files are written in local working directory.

```
# convert to GNC-RAW (version 2: NetCDF4 with compressing)
gt92 -c -f DC3DB

# convert to old GNC-RAW (version 1: NetCDF3)
gt92 -c -f DC3DB --nc-old
```

4.7 Example 7 – Convert MWX files to GNC-RAW files

Convert all files of type *MWX* in local working directory to the possible target format (in this case *GNC-RAW*). The result files are written in local working directory.

```
gt92 -cf MWX
```

4.8 Example 8 – Extract all data tables and meta-data from MWX files

Extract all data tables and meta-data from all files of type *MWX* in local working directory. The result files are written in separate sub-directories ("*<file_name>_<extension>*") in local working directory.

```
gt92 -xsf MWX

# following files are found:
Lindenberg_20190401_104537.mwx
Lindenberg_20190403_165401.mwx
Lindenberg_20190405_045647.mwx

# following sub-directories are created:
Lindenberg_20190401_104537_mwx/
Lindenberg_20190403_165401_mwx/
Lindenberg_20190405_045647_mwx/

# amongst others following files are created in first sub-directory:
Lindenberg_20190401_104537_GCCORRECTIONS.csv
Lindenberg_20190401_104537_GpsResults.csv
Lindenberg_20190401_104537_metadata.txt
Lindenberg_20190401_104537_Soundings.csv
Lindenberg_20190401_104537_SurfaceObservations.csv
Lindenberg_20190401_104537_SynchronizedSoundingData.csv
Lindenberg_20190401_104537_WindResults.csv
...
```

4.9 Example 9 – Extract and collect a filtered part of meta-data to store in one general file

Extract and filter meta-data of all input files. But store all collected meta-data in one general meta-data file instead of one meta-data file for each input file. That allows to extract and store meta-data of files from e.g. a time series.

```
gt92 -xf GNC-DATA \
--no-csv --no-tables --no-meta-root \
--meta-out-file="md-all-v1.txt" --no-meta-out-units \
--meta-regex "Ascent\.(BurstpointPressure|StartTime)" \
RS92-GDP.2/SOD/*

# following general meta-data file will be created:
md-all-v1.txt

# with this content:
"FileTitle","Ascent.BurstpointPressure","Ascent.StartTime"
"SOD-RS-02_2_RS92-GDP_002_20110116T113000_1-000-001","27710.5","2011-01-16T11
    :30:08.000Z"
"SOD-RS-02_2_RS92-GDP_002_20121123T110000_1-001-001","28890.0","2012-11-23T11
    :30:20.000Z"
"SOD-RS-02_2_RS92-GDP_002_20131104T105200_1-001-001","31448.0","2013-11-04T10
    :52:57.000Z"
```

Appendix

A Full list of options

The tool gt92 has a lot of options to help to customise regarding user requirements.

```
List of options:
 -c,--convert                        Convert all given file(s) to another file
                                     format. The possibilities are: DC3DB, MWX,
                                     GSFZ, STRATO-ZIP to GNC-RAW; GNC-DATA to
                                     LDF.
    --checksum-type <TYPE>           The type of checksum, digest or hash to
                                     calculate. Possible types are CRC-32, MD2,
                                     MD5, SHA-1, SHA-224, SHA-256, SHA-384,
                                     SHA-512. If this option is not set, CRC-32
                                     is used as default.
    --copy-corrupt                   Copy all corrupt source files which cannot
                                     be converted.
    --corrupt-dir <DIR>              The directory to copy all corrupt source
                                     files.
    --csv-delimiter <DELIMITER>      Use given delimiter within csv files.
 -d,--distribute                     Prepare all given file(s) for distribution.
                                     The possibilities are: MWX.
    --dump                           Extract data tables in addition as binary
                                     dump files. Only possible with DC3DB files.
    --export-col-filter <REG-EX>     Export (write) columns only if they match
                                     the regEx filter.
    --export-table-filter <REG-EX>   Export (write) tables only if they match
                                     the regEx filter.
 -f,--file-type <FILE-TYPE>          Read only file(s) with this specified file
                                     type. If this option is not set,
                                     GNC-DATA is used as default. The
                                     possibilities are: DC3DB, GNC-RAW, GNC-DATA,
                                     MWX, GSFZ, STRATO-ZIP, IGNC-RAW.
 -h,--help                           Print the help information and exit.
 -i,--info <KEY>                     Print a specific information (default is
                                     VERSION) and exit.  The possibilities are:
                                     VERSION, VERSION_NUMBER, VERSION_DATE,
                                     NAME, NAME_SHORT, NAME_LONG, COPYRIGHT,
                                     AUTHOR, AUTHOR_NAME, AUTHOR_EMAIL,
                                     FILE_TYPES, HISTORY_LAST, HISTORY,
                                     HISTORY_FULL
    --import-table-filter <REG-EX>   Import (read) tables only if they match
                                     the regEx filter.
    --include-source                 Include source file during converting a
                                     file in a NetCDF4 file (version 2) with
                                     compression. Only possible with DC3DB, MWX,
                                     GSFZ and STRATO-ZIP files.
    --json-result                    Get result on standard output (STDOUT) as
                                     JSON.
 -k,--checksum                       Compute checksums for all given file(s).
                                     CRC-32 is used if option --checksum-type
                                     is not specified.
 -l,--logging <LOG-LEVEL>            Set the logging level to an other than
```

```
                                    default (INFO). The possibilities are:
                                    SEVERE, WARNING, INFO, CONFIG, FINE, FINER,
                                    FINEST.
   --meta-osep                      Extract meta-data items using original
                                    separator in names (not default one).
   --meta-out-delimiter <DELIMITER> Extract meta-data using this delimiter
                                    (file name, meta-data name, meta-data
                                    value) for general output file.
   --meta-out-file <FILE>           Extract all meta-data of all files to this
                                    general meta-data output file.
   --meta-regex <REG-EX>            Extract meta-data only if it matches the
                                    regEx.
   --meta-sep <SEPARATOR>           Extract meta-data using specified separator
                                    for names (not default or original one).
   --nc-old                         Convert a file in a NetCDF3 file without
                                    compression. Only possible with DC3DB
                                    files. This converts to the old version of
                                    GNC-RAW.
   --no-csv                         Extract no data tables as default csv files.
   --no-csv-nan                     Do not print NaN values in csv files.
   --no-file-type-check             Skip default file type check before
                                    converting or extracting. This option
                                    forces critical errors in case of wrong/
                                    corrupt files.
   --no-info-key                    Do not print the key of an info in case of
                                    one requested info.
   --no-meta                        Extract no meta-data.
   --no-meta-group                  Extract no group items of meta-data.
   --no-meta-name                   Extract only values of meta-data (not the
                                    names).
   --no-meta-out-units              Extract meta-data items without units (if
                                    available) to general output file.
   --no-meta-root                   Extract meta-data items without root.
   --no-meta-valid                  Extract meta-data items using original
                                    names (not valid one).
   --no-msg-error                   Print no default error messages.
   --no-msg-header                  Print no default header messages.
   --no-msg-info                    Print no default information messages.
   --no-silent                      Print messages also if silent mode is
                                    active.
   --no-source                      Do not extract an included source file
                                    during extracting a file. Only possible
                                    with GNC-RAW files.
   --no-tables                      Extract no data tables.
   --no-xdata                       Do not decode xdata frames.
-o,--out-dir <DIR>                  The output directory for all exported and
                                    converted files. If not given the working
                                    directory is used as default.
   --reverse-col-filter             Reverse given column filter.
   --reverse-table-filter           Reverse given table filter.
-s,--separate                       Separate all extracted output files for
                                    every input file.
   --separate-dir                   Separate all output files for every input
                                    directory.
   --skip-convert                   Skip converting file if output file already
                                    exists.
```

```
 -t,--test                           Test all given file(s).
    --table-filter <REG-EX>          Deprecated! Import (read) & export (write)
                                     tables only if they match the regEx
                                     filter.
    --test-description <FILE>        The file description to use during test.
    --tsv                            Extract data tables in addition as tsv
                                     files. Only possible with DC3DB files.
    --tsv-frac <FRACTION>            Formatted numbers in tsv files use this
                                     fraction. Only expedient with option 'tsv'.
 -v,--version                        Print the version information and exit.
 -w,--work-dir <DIR>                 The working directory for all temporary
                                     files. If not given the current working
                                     directory of program is used as default.
 -x,--extract                        Extract all data tables (as csv) and/or
                                     meta-data from all given file(s).
 -y,--identify                       Identify file formats for all given file(s).
 -z,--itemize                        Itemize all tables of given file(s). Not
                                     implemented yet!
```

B History of development of gt92

The *gt92* is in constant development. This chapter briefly describes all software changes back to first functional version (v0.3).

B.1 History of Version 0.5.x

```
* 0.5.1_01  (2020-08-18) - change: improve MWX file definition for MW41 v2.15
* 0.5.1     (2020-08-04) - change: update file format GSFZ to GrawMet v5.15.02.02
                         - add handling of DFM-17 within GSFZ
* 0.5.0_05  (2020-04-29) - change: update file format IGNC-RAW to v1.2.0
* 0.5.0_04  (2020-04-28) - bug fixed: crash using MwxFile because not inited
                           localConfigMap in AbstractBaseDataFile
* 0.5.0_03  (2020-04-22) - optimised and restructured 'DataFile' classes which
                           allows easier adding of new config properties
                         - add option --no-meta-out-units
* 0.5.0_02  (2020-04-20) - add options --meta-out-file and --meta-out-delimiter
                           # implemented for MWX, GNC-RAW (v1, v2), GNC-DATA,
                             DC3DB, IGNC-RAW, STRATO-ZIP, GSFZ
* 0.5.0_01  (2019-12-11) - bug fixed: wrong calculation of OIF411 PumpTemperature
* 0.5.0     (2019-11-06) - new compiled only
                         - first release version 0.5
```

B.2 History of Version 0.4.x

```
* 0.4.11_08 (2019-10-23) - bug fixed: skip gridding part of DC3DB in case of
                           --itemize
                         - change: extract SystemEvents as meta-data using last
                           value in case of multiple events of same type
* 0.4.11_07 (2019-09-12) - bug fixed: crash during CSV export
* 0.4.11_06 (2019-08-28) - add options --export-col-filter and --reverse-col-
                           filter and --csv-delimiter
```

```
* 0.4.11_05 (2019-07-31) - change: update MWX file definition for MW41 v2.15
* 0.4.11_04 (2019-05-07) - bug fixed: handling of wrong date format in GSFZ files
* 0.4.11_03 (2019-04-02) - bug fixed: add 'missing_value' to several columns of
                           XDATA type 'SKYDEW_3F'
* 0.4.11_02 (2019-03-29) - bug fixed: repaired column names of XDATA type
                           'SKYDEW_3F'
                         - rename file type SGNC-RAW to IGNC-RAW
* 0.4.11_01 (2019-03-28) - bug fixed: decode abnormal package length 35 of XDATA
                           type 'SKYDEW_3F'
* 0.4.11    (2019-03-28) - add handling of XDATA type 'SKYDEW_3F' (SKYDEW)
                           packets
                         - compiled with Java 8
* 0.4.10_09 (2019-03-19) - add handling of file type SGNC-RAW
* 0.4.10_08 (2019-02-07) - better handling of maybe corrupt system-wide installed
                           netcdf libraries (print messages)
                         - compiled with Java SE 11
* 0.4.10_07 (2018-12-17) - bug fixed: wrong XDATA match if both PCFH and CFH are
                           flight together using one data stream (MWX file)
* 0.4.10_06 (2018-09-27) - change: update MWX file definition for MW41 v2.11
* 0.4.10_05 (2018-09-27) - change: SYNC_* columns added/activated for table
                           EDT_XDATA_GRIDDED of file type MWX
* 0.4.10_04 (2018-07-24) - bug fixed: correct global attribute key 'g.Instrument.
                           PCFH.MirNum' to '...SerialNo' in case of handling of
                           XDATA type 'PCFH_3C' (PCFH)
                         - bug fixed: add columns PCFH_Trsurf1, PCFH_Trsurf2,
                           PCFH_2_Trsurf1, PCFH_2_Trsurf2 to table
                           'EDT_XDATA_GRIDDED' in case of handling of XDATA type
                           'PCFH_3C' (PCFH)
* 0.4.10_03 (2018-07-13) - change: handling of XDATA type 'PCFH_3C' (PCFH)
                           packets 0x01 to 0x07, add TimestampXX columns
* 0.4.10_02 (2018-05-31) - add option --checksum-type
                           # with following possibilities: CRC-32, MD2, MD5,
                             SHA-1, SHA-224, SHA-256, SHA-384, SHA-512
                           # with CRC-32 as default (like before)
* 0.4.10_01 (2018-05-31) - change: update MWX file definition for MW41 v2.9
* 0.4.10    (2018-05-19) - change: handling of XDATA type 'PCFH_3C' (PCFH)
                           packets 0x00 to 0x07 (follow doc v1.2, 2018-04-05)
* 0.4.9_02  (2018-04-16) - bug fixed: handle 'NULL' value in column DataSrvTime,
                           table AdditionalSensorData of MWX file
* 0.4.9_01  (2018-03-06) - add two hidden options for MWX
* 0.4.9     (2018-02-28) - add handling of XDATA type 'PCFH_3C' (PCFH) packets
                           0x00 to 0x07
* 0.4.8_03  (2018-01-05) - change: option --no-info-key is now also related to
                           test messages (use of -t)
                         - change: option --no-info-key is now also related to
                           identify messages (use of -y)
                         - change: option --no-info-key is now also related to
                           checksum messages (use of -k)
                         - add option --no-source for combination with -x
                           (extract) and file type GNC-RAW
* 0.4.8_02  (2017-12-08) - change: improved file check possibilities (value
                           options added to attribute description)
                         - bug fixed: test messages with file path now (instead
                           'null')
* 0.4.8_01  (2017-11-01) - bug fixed: better error handling during identify DC3DB
                           (in case of corrupt files)
```

```
* 0.4.8     (2017-10-23) - change: enable options --no-meta-root and --meta-sep
                           for file type DC3DB
* 0.4.7_03  (2017-03-17) - bug fixed: CFH optics temperature fixed
* 0.4.7_02  (2017-02-15) - bug fixed: using attribute 'g_format_format' if type
                           BYTE or SHORT during converting GNC-DATA to LDF (crash
                           fixed)
* 0.4.7_01  (2016-11-24) - bug fixed: decoding TINT and ILAMP of XDATA type
                           'FLASH_3D_0' (FLASH-B)
                         - add option --no-csv-nan for MWX, DC3DB, GNC-RAW,
                           GNC-DATA
* 0.4.7     (2016-11-23) - add handling of non-valid xml-chars (e.g. &#x0;) for
                           internal XML file 'AdditionalSensorData.xml' of MWX
                           file
* 0.4.6_13  (2016-11-23) - bug fixed: wrong frame length of XDATA type
                           'FLASH_3D_0' (FLASH-B)
* 0.4.6_12  (2016-11-22) - change handling of XDATA type 'FLASH_3D_0' (FLASH-B)
* 0.4.6_11  (2016-11-16) - add handling of XDATA type 'FLASH_3D_0' (FLASH-B)
* 0.4.6_10  (2016-11-16) - add handling of XDATA type 'FLASH_3D' (FLASH-B)
* 0.4.6_09  (2016-11-10) - bug fixed: handling of data type BYTE with file type
                           MWX
                         - change: update MWX file definition for MW41 v2.5
                         - add option --no-info-key
* 0.4.6_08  (2016-11-09) - bug fixed: handling of XDATA with file type STRATO-ZIP
* 0.4.6_07  (2016-11-08) - bug fixed: wrong results with a list of INFO keys in
                           combination with HISTORY, HISTORY_LAST, HISTORY_FULL
                         - bug fixed: wrong results with -y in case of file types
                           without version
                         - change: include tool version in converted GNC-RAW
                           files (gatts: history, g.Product.ProducerTool)
                         - add handling of XDATA type 'COVRAD_05_0110' (Cover of
                           radiation chamber)
                         - change: improved automatical detection of number type
                           for MWX columns (FLOAT, DOUBLE, LONG)
* 0.4.6_06  (2016-09-21) - bug fixed: always add global attribute 'g.Aliases'
                           during converting to GNC-RAW
                         - add new INFO keys: HISTORY_LAST, HISTORY, HISTORY_FULL
                         - bug fixed: convert STRATO-ZIP (SkySonde) to GNC-RAW
                         - bug fixed: use correct data type INT for COBALD
                           counters
                         - add additional meta-data (time) for STRATO RAW
                           decoding & gidding
* 0.4.6_05  (2016-09-13) - bug fixed: handling GSFZ files with extension *.zip
                         - bug fixed: handling GNC-DATA files with missing
                           ALIASES
* 0.4.6_04  (2016-09-12) - bug fixed: handling several XData sensors of same type
                           with MWX (CFH, CFH_2, ...)
* 0.4.6_03  (2016-09-07) - bug fixed: handling GSFZ files
* 0.4.6_02  (2016-08-29) - add BOM handling for internal XML files of MWX file
* 0.4.6_01  (2016-08-01) - bug fixed: extract first 'correct' value with
                           calculation
* 0.4.6     (2016-08-01) - change options
                           # add --nc-old (enable old version, default before)
                           # remove --nc4, --nc4-v2 (--nc4-v2 is default now)
                           # add --no-meta-valid, --meta-osep, --no-meta-root,
                             --no-meta-group (use defaults for each file type)
* 0.4.5_11  (2016-07-29) - add calculation to table columns (-> store result as
```

```
                              attribute)
                            - change gridded table of MWX
                              # add additional columns for GPS
                              # remove 'meta-data' columns, e.g. CFH, OIF411
                              # add calc to gridded table, e.g. CFH, OIF411
                                (-> store result as global attributes)
* 0.4.5_10  (2016-07-26) - bug fixed: use XML version 1.1 for parsing internal
                              MWX files
* 0.4.5_09  (2016-06-28) - bug fixed: use correct base time for all columns to
                              grid (DC3DB and MWX)
                            - add a gridded table to DC3DB
* 0.4.5_08  (2016-06-22) - bug fixed: use correct path to write LDF files
                            - bug fixed: first try to handle too short formats for
                              LDF converting (negative ascent speed)
* 0.4.5_07  (2016-06-10) - bug fixed: static reading of file descriptions of MWX,
                              DC3DB, STRATO, GSFZ
* 0.4.5_06  (2016-05-23) - new compiled
* 0.4.5_05  (2016-02-26) - add XData specific meta-data (MWX only)
                              # g.Instrument.XData, g.Instrument.XDataSensors
                            - rename XData instrument RSA411 to OIF411
* 0.4.5_04  (2016-02-25) - change some internal MWX things
                              # e.g. add correct positions to a couple of tables
                            - change base of gridded table of MWX to RawPtu
* 0.4.5_03  (2016-02-23) - change column names of XDATA columns of MWX
                              # Cfh_... to CFH_...
                              # several identical instruments possible, like
                                CFH_..., CFH_2_...
                            - bug fixed: rename meta-data keys correctly to original
                              once (if required)
* 0.4.5_02  (2016-02-23) - add functionality of '--json-result' to option
                              --info / -i
                            - change print result (without --json-result) to
                              <file/name> = <result>
                            - add result line for option --extract / -x (EXTRACTED
                              or NOT_EXTRACTED)
* 0.4.5_01  (2016-02-22) - bug fixed: data type changed from BYTE to SHORT of
                              column 'PumpCurrent' of map 'RawOzone' of format 'MWX'
                            - bug fixed: unit 'seconds since ...' of column
                              'RadioRxTimePk' is now correct in case of converting
                              MWX to GNC-RAW
                            - add argument --export-table-filter
                            - add argument --import-table-filter
                            - add argument --reverse-table-filter
                            - mark argument --table-filter as 'deprecated'
* 0.4.5     (2016-02-18) - some changes at file descriptions (MWX, DC3DB,
                              STRATO-ZIP)
                            - with option -t (--test) a file can be tested against a
                              file description
                              # this is very helpful to test created GDP files
                                (GRUAN data product NetCDF file)
                              # all test result messages are printed like other
                                results (at console 'out' without/with JSON format)
* 0.4.4_05  (2016-02-16) - add automatically extracting of relevant native
                              libraries to sub-dir 'gt92-native-libs' of temp dir of
                              system
                              # in case of no rights to write in own program folder
```

```
* 0.4.4_04  (2016-02-16) - add argument --test-description=<FILE> (for -t)
                         - bug fixed: use now argument --no-xdata (true/false)
                           with --convert
* 0.4.4_03  (2016-02-03) - optimization of messages (reading MWX)
                         - add new table 'StabilityIndex' to MWX file description
                         - change start time for gridded MWX tables to Soundings.
                           BeginTime or if not available Soundings.RadioResetTime
                         - bug fixed: wrong name of one V7 value
* 0.4.4_02  (2016-02-02) - bug fixed: optimize gridded data map EDT_XDATA_GRIDDED
                           of MWX file
                           # set grid base to AdditionalSensors
                           # add columns from RawPtu, GSupport,
                             SynchronizedSoundingData
                           # optimize messages if columns/maps are missing
* 0.4.4_01  (2016-02-01) - add gridded data map EDT_XDATA_GRIDDED to MWX
                           extracting (including data from PtuResults &
                           GpsResults & AdditionalSensors)
                         - bug fixed: wrong decoding of XDATA instrument type
                           (use HEX decoding now)
* 0.4.4     (2016-01-13) - include native netcdf libraries
                           # for os-arch: linux-x86, linux-x86-64, win32-x86,
                             win32-x86-64
                           # automatically extracting of relevant native
                             libraries to sub-dir 'lib' (in case of bin to
                             '../lib')
                         - optimise netcdf logging (bind to log4j)
* 0.4.3     (2016-01-06) - add argument --itemize / -z
                         - add argument --identify / -y
                         - add argument --no-msg-header
                         - add argument --no-silent (for -t, -z, -k, -y)
                         - add argument --json-result
                         - improved automatically silent mode for -t, -z, -k, -y
                         - restructured code of processing routines
* 0.4.2     (2015-12-16) - add argument --corrupt-dir=<DIR>
                         - add argument --copy-corrupt
                         - add argument --no-msg-error
                         - add argument --no-msg-info
* 0.4.1_01  (2015-12-15) - improve source documentation
                         - bug fixed: remove tmp file in case of an error
                         - add final info about corrupt files
* 0.4.1     (2015-12-14) - add argument --skip-convert
                         - add argument -i <KEY> / --info=<KEY> with a couple of
                           possible keys:
                           # VERSION, VERSION_NUMBER, VERSION_DATE,
                           # NAME, NAME_SHORT, NAME_LONG,
                           # COPYRIGHT,
                           # AUTHOR, AUTHOR_NAME, AUTHOR_EMAIL,
                           # FILE_TYPES
                         - new error message in case of missing required option
                         - add argument -w <DIR> / --work-dir=<DIR>
                         - add argument --no-file-type-check
* 0.4.0     (2015-12-11) - add argument --separate-dir
                         - improve handling with DC3DB files (e.g. wrong SN,
                           additional log info, ...)
                         - use working directory to create NC files
```

B.3 History of Version 0.3.x

```
* 0.3.24_11 (2015-10-14) - bug fixed: read/use all metadata also with MWX source
* 0.3.24_10 (2015-10-07) - new compiled only (?)
* 0.3.24_09 (2015-09-30) - new compiled only
* 0.3.24_08 (2015-09-21) - new compiled only
* 0.3.24_07 (2015-09-11) - kleine Optimierung zu GSFZ
* 0.3.24_06 (2015-08-31) - kleine Optimierung GNC-RAW (v1+v2)
* 0.3.24_05 (2015-08-28) - Weiterentwicklung bezueglich GNC-RAW
* 0.3.24_04 (2015-08-25) - NetCDF-Bibliotheken angepasst
* 0.3.24_03 (2015-08-14) - Datentyp STRATO-ZIP nun moeglich
                          - add file converter for STRATO-ZIP to GNC-RAW (using
                            GenericFileConverter)
* 0.3.24_02 (2015-07-20) - test version 2
                          - Datentyp GSFZ nun moeglich
                          - add file converter for GSFZ to GNC-RAW (using
                            GenericFileConverter)
* 0.3.24_01 (2015-07-02) - test version 1
* 0.3.24    (2015-06-10) - add file converter for MWX to GNC-RAW (using
                            GenericFileConverter)
* 0.3.23    (2015-06-09) - changed file converter for DC3DB to GNC-RAW v2 (now
                            using GenericFileConverter)
* 0.3.22    (2015-06-05) - now with new NetCDF library v4.6
* 0.3.21_02 (2015-05-26) - Bug fixed?
* 0.3.21_01 (2015-05-21) - try option --nc4-v2
* 0.3.21    (2015-05-15) - add option --table-filter REG-EXT to filter data
                            tables
* 0.3.20    (2015-05-08) - better handling of corrupt DC3DB files
* 0.3.19    (2015-05-07) - Bug fixed: crash if wrong xdata row
                          - updated MWX file description
                          - lesser error messages in case of undefined NaN values
* 0.3.18    (2015-04-24) - compiled with java-1.8.0-openjdk-1.8.0 (to JRE 1.7
                            features)
                          - Add JEval library to jar
* 0.3.17    (2015-04-16) - Bug fixed: meta-data in converted LDF are 'null'
* 0.3.16    (2015-04-09) - MWX meta-data extraction includes full table
                            'SoundingParameters' now
                          - new option -d --distribute for MWX files (remove
                            internal data maps)
* 0.3.15    (2015-03-06) - print MWX meta-data name without ROOT
* 0.3.14    (2015-01-13) - bug repaired
* 0.3.13    (2015-01-12) - add option --no-xdata
* 0.3.12    (2015-01-09) - MWX mit decodeXData=true
* 0.3.11    (2014-11-19) - Datentyp MWX nun moeglich (z.Z. nur bei -x)
* 0.3.10    (2014-01-24) - mit Moeglichkeit fr netCDF4
* 0.3.9     (2014-01-22) - mit neuer netCDF-Bibliothek v4.3
* 0.3.8     (2013-09-05) - besserer Umgang mit fehlendem Output-Verzeichnis
* 0.3.7     (2013-08-30) - einheitliche interne Config-Properties
                          - Dc3DbFile kann nun mit RS80 umgehen
* 0.3.6     (2013-07-10) - Weniger Fehlermeldungen mit DC3DB
* 0.3.5     (2013-07-08) - Bug behoben, dass auch Binaer-Spalten aus den
                            DAT-Tabellen (DC3DB) korrekt ausgelesen werden
* 0.3.4     (2012-10-02) - good release version
```

C Collection of tables describing XData columns

Definition of all additional data columns related to specific XData instrument are described in tables which are included in this chapter. These columns can appear as part of several tables:

- tables *AdditionalSensorData* and *EDT_XDATA_GRIDDED* of file type *MWX*

Table 1: Definition of all additional data columns related to Xdata instrument V7, the Innovative System Designs V7 Ozone interface board (id=01). Column names follow naming 'V7_<Name>' (first instrument) or 'V7_2_<Name>' (second instrument).

Name	Unit	Timeres.	Description
OzoneCurrent	µA	1 s	Ozone current
PumpTemperature	C	1 s	Temperature of pump
PumpCurrent	mA	1 s	Current of pump
PumpBatteryVoltage	V	1 s	Battery voltage of pump

Table 2: Definition of all additional data columns related to Xdata instrument OIF411, the Vaisala Ozone interface board (id=05). Column names follow naming 'OIF411_<Name>' (first instrument) or 'OIF411_2_<Name>' (second instrument).

Name	Unit	Timeres.	Description
PumpTemperature	°C	1 s	Temperature of pump
OzoneCurrent	µA	1 s	Ozone current
PumpBatteryVoltage	V	1 s	Battery voltage of pump
PumpCurrent	A	1 s	Current of pump
ExternalBatteryVoltage	V	1 s	External battery voltage
Parameter			
SerialNumber		*sporadic*	Serial number of OIF411 interface card (in addition stored as meta-data 'g.Instrument.OIF411.SerialNumber' or 'g.Instrument.OIF411_2.SerialNumber')
OifVersion		*sporadic*	(in addition stored as meta-data 'g.Instrument.OIF411.OifVersion' or 'g.Instrument.OIF411_2.OifVersion')

This table is continued on the next page.

Table 2 – *Continued from previous page*

Name	Unit	Timeres.	Description
UnknownValue		*sporadic*	(in addition stored as meta-data 'g.Instrument.OIF411.UnknownValue' or 'g.Instrument.OIF411_2.UnknownValue')
Interface		*sporadic*	(in addition stored as meta-data 'g.Instrument.OIF411.Interface' or 'g.Instrument.OIF411_2.Interface')

Table 3: Definition of all additional data columns related to Xdata instrument CFH, the Cryogen Frostpoint Hygrometer (id=08). Column names follow naming 'CFH_<Name>' (first instrument) or 'CFH_2_<Name>' (second instrument).

Name	Unit	Timeres.	Description
FrostPoint	°C	1 s	Frost point temperature (maybe better would be "MirrorTemperature")
TuningVoltage	V	1 s	Tuning or alignment voltage of photodiodes
OpticTemperature	°C	1 s	Temperature of optics (will be changed in "OpticsTemperature" in future)
BatteryVoltage	V	1 s	Battery voltage
Parameter			
Cfg1Key		*sporadic*	Parameter key 1 (possible keys are: *PicVersion*, *CalD*, *CalC*, *CalB*, *CalA*, *CfhSerialNumber*)
Cfg1Value		*sporadic*	Parameter value 1 (in addition stored as meta-data 'g.Instrument.CFH.<Cfg1Key>' or 'g.Instrument.CFH_2.<Cfg1Key>')
Cfg2Key		*sporadic*	Parameter key 2 (possible keys are: *SetpointTemperature*, *DetectorSignal*, *AD630Offset*, *Specular*, *CodeVersion*)
Cfg2Value		*sporadic*	Parameter value 2 (in addition stored as meta-data 'g.Instrument.CFH.<Cfg2Key>' or 'g.Instrument.CFH_2.<Cfg2Key>')

Table 4: Definition of all additional data columns related to Xdata instrument FPH, the Frost Point Hygrometer (id=10). Column names follow naming 'FPH_<Name>' (first instrument) or 'FPH_2_<Name>' (second instrument).

Name	**Unit**	**Timeres.**	**Description**
Frst		1 s	Frost coverage of the chilled mirror
FiltFrst		1 s	Frost coverage after sunlight removal filtering is applied
Sun		1 s	The ambient sunlight measured in the sensor housing
LowSun		1 s	Lowest sunlight measured over a short timespan
FptAdc		1 s	ADC measurement of the frostpoint thermistor
Opt		1 s	Optics block temperature, controlled to a stable level above room temperature at surface
OptHeat		1 s	PWM value used to heat the optics block
MirrHeat		1 s	PWM value used to heat the chilled mirror
Pres	mbar	1 s	Pressure
PresTemp	°C	1 s	Pressure sensor temperature
AvgFpt	°C	1 s	A long exponential moving average of the frostpoint temperature calculated onboard the hygrometer
VBat	V	1 s	Battery voltage
Parameter			
MirNum		*sporadic*	Serial number of mirror (in addition stored as meta-data 'g.Instrument.FPH.MirNum' or 'g.Instrument.FPH_2.MirNum')
Cal0		*sporadic*	The thermistor resistance at 0 °C (in addition stored as meta-data 'g.Instrument.FPH.Cal0' or 'g.Instrument.FPH_2.Cal0')

This table is continued on the next page.

Table 4 – *Continued from previous page*

Name	Unit	Timeres.	Description
Cal45		*sporadic*	The thermistor resistance at $-45\,°C$ (in addition stored as meta-data 'g.Instrument.FPH.Cal45' or 'g.Instrument.FPH_2.Cal45')
Cal79		*sporadic*	The thermistor resistance at $-79\,°C$ (in addition stored as meta-data 'g.Instrument.FPH.Cal79' or 'g.Instrument.FPH_2.Cal79')
HygFirm		*sporadic*	Version of firmware (in addition stored as meta-data 'g.Instrument.FPH.HygFirm' or 'g.Instrument.FPH_2.HygFirm')

Table 5: Definition of all additional data columns related to Xdata instrument COBALD, the Compact Optical Backscatter and AerosoL Detector (id=18). Column names follow naming 'COBALD_<Name>' (first instrument) or 'COBALD_2_<Name>' (second instrument).

Name	Unit	Timeres.	Description
SN		1 s	Serial number of COBALD instrument (in addition stored as meta-data 'g.Instrument.COBALD.SN' or 'g.Instrument.COBALD_2.SN')
InternalTemperature	°C	1 s	Internal temperature of instrument
SignalRed		1 s	Signal of channel red
SignalBlue		1 s	Signal of channel blue
MonitorRed		1 s	Monitor of channel red
MonitorBlue		1 s	Monitor of channel blue
IntegrationTime			*(old)* Integration time
Counter			*(old)* Counter

Table 6: Definition of all additional data columns related to Xdata instrument PCFH, the (id=). Column names follow naming 'PCFH_<Name>' (first instrument) or 'PCFH_2_<Name>' (second instrument).

Name	Unit	Timeres.	Description
PCFH package 00 (configuration)			
SerialNo			Serial number of PCFH
Hardware			Version of hardware (month & year)
TempPCB			Version of "temp" PCB (month & year)
ContrPCB			Version of "contr" PCB (month & year)
ReflexPCB			Version of "reflex" PCB (month & year)
ContrFW			Version of "contr" firmware (month & year)
ReflexFW			Version of "reflex" firmware (month & year)
PCFH package 01 (sub-sensor 1)			
Timestamp01		1 s	Timestamp (0..249), incremented at a rate of 10 Hz
Tmirr1	°C	1 s	Sub-sensor 1 frost point mirror temperature
Thot1	°C	1 s	Sub-sensor 1 Peltier hot side temperature
Tair1	°C	1 s	Sub-sensor 1 air temperature
Ttarg1	°C	1 s	Sub-sensor 1 anticipated frost point mirror temperature
Rmirr1	% FS	1 s	Sub-sensor 1 frost point mirror reflectance
Rrefr1	% FS	1 s	Sub-sensor 1 reference surface reflectance
Iheat1	% FS	1 s	Sub-sensor 1 warm side heating current
IPelt1	% FS	1 s	Sub-sensor 1 Peltier current
PCFH package 02 (sub-sensor 2)			
Timestamp02		1 s	Timestamp (0..249), incremented at a rate of 10 Hz

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Table 6 – *Continued from previous page*

Name	Unit	Timeres.	Description
Tmirr2	°C	1 s	Sub-sensor 2 frost point mirror temperature
Thot2	°C	1 s	Sub-sensor 2 Peltier hot side temperature
Tair2	°C	1 s	Sub-sensor 2 air temperature
Ttarg2	°C	1 s	Sub-sensor 2 anticipated frost point mirror temperature
Rmirr2	% FS	1 s	Sub-sensor 2 frost point mirror reflectance
Rrefr2	% FS	1 s	Sub-sensor 2 reference surface reflectance
Iheat2	% FS	1 s	Sub-sensor 2 warm side heating current
IPelt2	% FS	1 s	Sub-sensor 2 Peltier current
PCFH package 03 (slow sensor and housekeeping)			
Timestamp03		5 s	Timestamp (0..249), incremented at a rate of 10 Hz
Tsink1	°C	5 s	Sub-sensor 1 heat sink temperature
Trsurf1	°C	5 s	Sub-sensor 1 reference surface temperature
Tsink2	°C	5 s	Sub-sensor 2 heat sink temperature
Trsurf2	°C	5 s	Sub-sensor 2 reference surface temperature
Tref	°C	5 s	Thermocouple reference temperature
Tres	°C	5 s	Reserved temperature
Ubat60	V	5 s	6V supply battery voltage
Ubat45	V	5 s	4.5V supply battery voltage
PCFH package 04 (experimental 1)			
Timestamp04			Timestamp (0..249), incremented at a rate of 10 Hz
Exp01			Experimental test data value 1. The meaning of these placeholders is defined according to experimental requirements.
Exp02			Experimental test data value 2

This table is continued on the next page.

Table 6 – *Continued from previous page*

Name	Unit	Timeres.	Description
Exp03			Experimental test data value 3
Exp04			Experimental test data value 4
Exp05			Experimental test data value 5
Exp06			Experimental test data value 6
PCFH package 05 (experimental 2)			
Timestamp05			Timestamp (0..249), incremented at a rate of 10 Hz
Exp07			Experimental test data value 7
Exp08			Experimental test data value 8
Exp09			Experimental test data value 9
Exp10			Experimental test data value 10
Exp11			Experimental test data value 11
Exp12			Experimental test data value 12
PCFH package 06 (experimental 3)			
Timestamp06			Timestamp (0..249), incremented at a rate of 10 Hz
Exp13			Experimental test data value 13
Exp14			Experimental test data value 14
Exp15			Experimental test data value 15
Exp16			Experimental test data value 16
Exp17			Experimental test data value 17
Exp18			Experimental test data value 18
PCFH package 07 (experimental 4)			
Timestamp07			Timestamp (0..249), incremented at a rate of 10 Hz
Exp19			Experimental test data value 19
Exp20			Experimental test data value 20
Exp21			Experimental test data value 21
Exp22			Experimental test data value 22

This table is continued on the next page.

Table 6 – *Continued from previous page*

Name	Unit	Timeres.	Description
Exp23			Experimental test data value 23
Exp24			Experimental test data value 24

Table 7: Definition of all additional data columns related to Xdata instrument FLASH-B, the Fluorescence Lyman-Alpha Stratospheric Hygrometer for Balloon (id=3D). Column names follow naming 'FLASH_<Name>' (first instrument) or 'FLASH_2_<Name>' (second instrument).

Name	Unit	Timeres.	Description
VER		1 s	Version of xdata frame definition
SIG		1 s	Photomultiplier counts
BKG		1 s	Photomultiplier background counts
TINT	°C	1 s	Temperatur of photomultiplier
UBAT	V	1 s	Battery voltage
ILAMP	mA	1 s	Current of VUV lamp
UPMT	V	1 s	PMT voltage
SN		1 s	Individual instrument (serial) number
ULAMP			(old)
AUX1			(old)
AUX2			(old)

Table 8: Definition of all additional data columns related to Xdata instrument SKYDEW, the Peltier-based chilled-mirror hygrometer "SKYDEW" (id=3F). Column names follow naming 'SKYDEW_<Name>' (first instrument) or 'SKYDEW_2_<Name>' (second instrument).

Name	Unit	Timeres.	Description
Raw data			
PTAD		1 s	AD value for calculating a mirror temperature
DewAD		1 s	AD value for calculating scattered light level

This table is continued on the next page.

Table 8 – *Continued from previous page*

Name	**Unit**	**Timeres.**	**Description**
RefAD		1 s	Reference resistance, which is used for calculating a mirror temperature
BaseAD		1 s	Offset value, which is used for calculating a mirror temperature
PeltierAD		1 s	AD value for calculating Peltier current
HSAD		1 s	AD value for calculating heatsink temperature
CBAD		1 s	AD value for calculating Circuit board temperature
BattAD		1 s	AD value for calculating Battery voltage
PID		1 s	PID (unknown)
Coeff		1 s	Current parameter (0 to 9)
Cnt		1 s	Counter of parameter (0 to 9)
Calculated values			
Temp	°C	1 s	Mirror temperature
Dew	V	1 s	Detector signal (scattered light level)
Peltier	A	1 s	Peltier current
Batt	V	1 s	Battery voltage
HS	°C	1 s	Heatsink temperature (optional)
CB	°C	1 s	Circuit board temperature (optional)
Parameter			
SN		*sporadic*	Serial number
FwVer		*sporadic*	Firmware version
CoeffB		*sporadic*	Coefficient B
CoeffC		*sporadic*	Coefficient C
CoeffD		*sporadic*	Coefficient D
CoeffE		*sporadic*	Coefficient E

D Example of file description

Here an example of a file description of *GNC-DATA* file of data product "RS92-GDP.2" to use during test is given. Presented are some parts of these file to demonstrate the structure and possibilities:

```
<?xml version="1.0" encoding="UTF-8"?>
<fileDescription name="GNC-DATA" createdOn="2016-01-26T15:10:00Z" version="2.0"
    createdBy="Michael Sommer, GRUAN Lead Centre, DWD"
  description="GRUAN Data Product NetCDF of RS92-GDP.2"
  defaultDataMap="DEFAULT" defaultBaseCol="time" defaultBaseColContentType="TIME"
  defaultBaseColCfStdName="time" defaultBaseColCfUnits="seconds since %1$s"
  defaultBaseColCfAxis="T">

  <!-- global CF attributes -->
  <attribute name="Conventions" dataType="STRING" cf="true" required="true"
      global="true" value="CF-1.4" />
  <attribute name="title"       dataType="STRING" cf="true" required="true"
      global="true" value="RS92 GRUAN Data Product (Version 2)" />

  <!-- global GRUAN attributes -->
  <!-- part Product -->
  <attribute name="g.Product.ID" dataType="STRING" required="true"
      gruan="true" global="true" />
  <attribute name="g.Product.Code" dataType="STRING" required="true"
      gruan="true" global="true" />
  <attribute name="g.Product.Version" dataType="STRING" required="true"
      gruan="true" global="true" />
  <!-- part MeasuringSystem -->
  <attribute name="g.MeasuringSystem.ID" dataType="STRING" required="true"
      gruan="true" global="true" />
  <attribute name="g.MeasuringSystem.Altitude" dataType="STRING" required="true"
      gruan="true" global="true" />
  <!-- part Ascent -->
  <attribute name="g.Ascent.ID" dataType="STRING" required="true"
      gruan="true" global="true" />
  <attribute name="g.Ascent.StandardTime" dataType="STRING" required="true"
      gruan="true" global="true" />
  <!-- part Instrument -->
  <attribute name="g.Instrument.SerialNumber" dataType="STRING" required="true"
      gruan="true" global="true" />
  <attribute name="g.Instrument.Type" dataType="STRING" required="true"
      gruan="true" global="true" />

  <!-- column CF attributes -->
  <attribute name="standard_name"   dataType="STRING" required="true" cf="true"
      column="true" />
  <attribute name="units"           dataType="STRING" required="true" cf="true"
      column="true" />
  <attribute name="long_name"       dataType="STRING" required="true" cf="true"
      column="true" />
  <attribute name="comment"         dataType="STRING" required="true" cf="true"
      column="true" columnExp="(?!time).*" />
  <attribute name="related_columns" dataType="STRING" required="true" cf="true"
      column="true" columnExp="(?!time).*" />
  <attribute name="coordinates"     dataType="STRING" required="true" cf="true"
```

```
      column="true" columnExp="(?!time).*" defaultValue="lon lat alt" />

  <!-- column GRUAN attributes -->
  <attribute name="g_column_type"     dataType="STRING" required="true"
      gruan="true" column="true" />
  <attribute name="g_processing_flag" dataType="STRING" required="true"
      gruan="true" column="true" columnExp="(?!time).*" >
    <valueOption value="raw" />
    <valueOption value="raw, smoothed" />
    <valueOption value="raw, smoothed, internal QC passed" />
    <valueOption value="raw, internal QC passed" />
    <valueOption value="raw, internal QC passed, additional QC passed" />
    <valueOption value="uncertainy calculated, smoothed" />
    <valueOption value="smoothed" />
  </attribute>

  <!-- only data map DEFAULT -->
  <dataMap name="DEFAULT" lastChange="2016-01-26T15:11:00Z" data="true"
    description="" baseCol="time">

    <!-- time --><!-- contentType="TIME"  -->
    <column name="time" dataType="DOUBLE" unit="s"
      cfStdName="time" cfLongName="Time" cfUnits="seconds since %1$s"
      cfAxis="T" cfCalendar="gregorian"
      gFmtType="FLT" gFmtWidth="8" gFmtFormat="F8.1" gFmtNaN="NaN"
      gSrcDesc="FRAWPTU" gResolution="1.0 s (time)" gColType="original data"
      testValues="true" tvMin="0.0" tvMax="10000.0" tvLimitNaN="0"
      tvLimitZero="1" >
    </column>

    <!-- rh -->
    <column name="rh" dataType="DOUBLE" unit="-"
      cfStdName="relative_humidity" cfLongName="Relative Humidity" cfUnits="1"
      cfRelCols="u_std_rh u_cor_rh u_rh " cfCoords="lon lat alt"
      gFmtType="FLT" gFmtWidth="6" gFmtFormat="F6.2" gFmtNaN="NaN"
      gSrcDesc="FRAWPTU_U1-U2_cc_RC_TL" gResolution="see column res_rh"
      gColType="original data" testValues="true" tvMin="-0.050" tvMax="1.250"
      tvLimitNaN="100" tvLimitZero="10" >
      <!-- CF attributes -->
      <attribute name="comment" value="Relative humidity collated from U1 and U2
    based on the water vapor pressure fomula of HylandWexler, corrected by GRUAN
    correction scheme" />
      <!-- GRUAN attributes -->
    </column>

    <!-- cor_rh -->
    <column name="cor_rh" dataType="DOUBLE" unit="-"
      cfStdName="relative_humidity correction" cfUnits="1"
      cfLongName="Correction of relative_humidity" cfCoords="lon lat alt"
      gFmtType="FLT" gFmtWidth="6" gFmtFormat="F6.2" gFmtNaN="NaN"
      gSrcDesc="FRAWPTU_U1-U2_cc_RC_TL" gColType="correction applied to the data"
      testValues="true" tvMin="-0.5" tvMax="0.5" tvLimitNaN="100"
      tvLimitZero="10" >
      <!-- CF attributes -->
      <attribute name="comment" value="Bias corrections applied to
    relative_humidity by the GRUAN correction scheme" />
```

```
      <!-- GRUAN attributes -->
      <attribute name="g_processing_flag" required="false" />
      <attribute name="g_resolution" required="false" />
    </column>

    <!-- u_rh -->
    <column name="u_rh" dataType="DOUBLE" unit="-"
      cfStdName="relative_humidity standard_error" cfUnits="1"
      cfLongName="Uncertainty of relative_humidity" cfCoords="lon lat alt"
      gFmtType="FLT" gFmtWidth="6" gFmtFormat="F6.2" gFmtNaN="NaN"
      gSrcDesc="FRAWPTU_U1-U2_cc_RC_TL" gColType="total uncertainty"
      testValues="true" tvMin="0.0" tvMax="0.1"
      tvLimitNaN="100" tvLimitZero="10" >
      <!-- CF attributes -->
      <attribute name="comment" value="Standard uncertainty (k=1) of
    relative_humidity calculated by the geometric sum of the correlated and
    random uncertainties" />
      <attribute name="related_columns" required="false" />
      <!-- GRUAN attributes -->
      <attribute name="g_processing_flag" required="false" />
      <attribute name="g_resolution" required="false" />
    </column>

  </dataMap>
</fileDescription>
```

Acronyms

GRUAN	GCOS Upper-Air Network
gt92	GruanToolRs92
JRE	Java Runtime Environment

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