

vgosDbProcLogs-0.6.6: User Guide

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Chapter 1

Introduction

This document describes how to use the utility `vgosDbProcLog`.

The utility extracts from station log files cable calibration data and meteorological parameters and stores them in `vgosDb` format.

The utility `vgosDbProcLog` is distributed in `nusolve` package that contains `vSolve` software and utilities `vgosDbMake`, `vgosDbCalc` and `vgosDbProcLogs`. Each of the utilities has its own version number that can differ from distribution version, e.g., the first release of `vgosDbProcLogs-0.1.0` appeared in `nusolve-0.2.11` package.

The guide covers 0.6.6 version of the software. Since the `vgosDbProcLog` is a simple utility we do not expect large modifications of the User Guide version from version.

1.1 Requirements

See *vSolve User Guide* for the requirements.

1.2 Changes from previous versions

This section was added in 0.5.0 version of the `nusolve` distribution (version 0.3.0 of the `vgosDbProcLogs` user guide). It covers changes in the software and the user guide.

1.2.1 Changes in version 0.6.6

Few bug fixes in handling of cable calibration data.

1.2.2 Changes in version 0.6.5

The utility collects all available cable calibration corrections from various sources: FS log file, CDMS and PCMT. It accumulates these data in a separate `netCDF` files.

1.2.3 Changes in version 0.6.4

The command line arguments parser has switched to `ARGP` from `GNU C Library`.

A command line option ("`-o`") was added to set an order of meteorological parameters in a log file. An obsolete option "`-f`" was removed. See chapter 3 *Invoking `vgosDbMake`* for details.

Parsing `tsys` records for legacy stations currently is disabled (`log2ant` should be used instead), the command line options that control `tsys` processing are ignored.

Few misprints were fixed.

1.2.4 Changes in version 0.6.3

A command line option `-d` is added to alter a directory with input files. It could be useful to specify path to log or PCMT files that are not in standard place. Chapter 3 *Invoking vgosDbMake* was modified to reflect the changes.

1.2.5 Changes in version 0.6.2

Nothing essential was changed.

1.2.6 Changes in version 0.6.1

Nothing essential was changed.

1.2.7 Changes in version 0.6.0

New command line arguments were added, see the chapter 3 *Invoking vgosDbMake* for details.

A dry mode has been implemented, the software reads input files, creates and fills all internal structures, but nothing is written.

Dealing with locale has been altered. Unfortunately, people do not read the manuals, as a result their locale set up conflicts with HOPS parsing of fringe files. Now, by default the locale is set to "C" after the utility is started. There are options to configure this feature in the wizard as well as a command line argument.

Version of the utility jumped from 0.4.4. to 0.6.0.

1.2.8 Changes in version 0.4.4

Nothing essential was modified.

1.2.9 Changes in version 0.4.3

This update contains bug fixes.

1.2.10 Changes in version 0.4.2

In this version behavior of `vgosDbProcLogs` has been modified: if the environment variable «`$DISPLAY`» is not set, calls to pop up windows with error messages are suppressed. Also, during creation of the wrapper file name, the attribute «`_i[Institution]`» will be added. To suppress the last option, the short abbreviation of the affiliation should not be set (e.g., on the Fig. 4.7 put an empty string instead of «`GSFC`»).

A warning about permanently increase of the log file size was added to the section 4.6 *Setting options of the logger*.

The order of processing input files has been changed from log files, CDMS, PCMT and meteo data to CDMS, PCMT, meteo data and log files; see 3.1 *Command line arguments*.

A Section 4.3 *Setting default cable calibration signs* was added to describe set up of the default cable calibration signs.

Configuration of use meteo data in RINEX format is added and is described in the Section 4.4 *Setting RINEX files*.

1.2.11 Changes in version 0.4.1

The command line options `-p` and `-W` are added in this version, see the chapter *3 Invoking vgosDbProcLog*.

A section *4.1 Using system-wide settings* is added.

Description how to use RINEX files with meteorological data for some VLBI stations is added as a section *3.2 Using RINEX files*.

The URL of software distribution has been updated in the chapter *5 Concluding remark*.

1.2.12 Changes in version 0.4.0

The software is capable to process external files with cable calibration and meteorological data, also, a user can specify what station(s) it should process. These changes are covered in the chapter *3 Invoking vgosDbProcLog*.

1.2.13 Changes in version 0.3.0

The utility is able to read an alternative version of master files. The use of the local master files is described in the section *4.2 Setting paths to data*.

The sections *1.1 Requirements* and *1.2 Changes from previous versions* were added to the chapter *1 Introductions*.

Chapter 2

Installation

The source codes of `vgosDbProcLog` is distributed along with `vSolve` software. The latest stable version of the software one can find at <https://sourceforge.net/projects/nusolve> with a name like `nusolve-1.2.3.tar.gz`. Since the software is still in an active development phase, we recommend you use the latest version.

The utility is compiled during compilation of `vSolve` software, there is no any additional option to turn its compilation on or modify somehow. Please, refer to `vSolve` User Guide how to configure, compile and install the software.

Chapter 3

Invoking vgosDbProcLog

To invoke vgosDbProcLog just type (specifying if necessary the full path to the executable) program name and a wrapper file of a VLBI session:

```
> vgosDbProcLog <wrapper file>
```

Where *<wrapper file>* is a path and name of the session wrapper file. The wrapper file path can be in absolute (i.e., starting with «/» char) or relative form. If the relative form is used, then the software searches for files starting from a directory which is specified in *Path to VgosDb files* field of the setup wizard (see Section 4.2).

For example, to extract information from station log files of a VLBI session *eur136* and store it in vgosDb format I can execute vgosDbProcLog in the following way:

```
> vgosDbProcLog /home/slb/500/vgosDb/2015/15AUG03XA/15AUG03XA_V002_kall.wrp
```

or

```
> vgosDbProcLog 2015/15AUG03XA/15AUG03XA_V002_kall.wrp
```

assuming vgosDb files are stored in */home/slb/500/vgosDb* directory.

Also, I can invoke it just providing a database name:

```
> vgosDbProcLog 15AUG03XA
```

In this case the utility will use a wrapper file of the last version. Database version identifier can be provided explicitly to the utility:

```
> vgosDbProcLog 15AUG03XA_V002
```

Such form of invocation is suitable for routine data processing.

3.1 Command line arguments

The utility also accepts command line arguments. The arguments consist of two groups of options and a name of alternative configuration. The first group of options is related to Qt library and controls how the application will appear and behave. See Qt documentation about details, (e.g., <https://doc.qt.io/qt-5.14/qguiapplication.html>). The another group of options is used by itself. To get the list of these arguments, type

```
> vgosDbProcLog --help
```

Here are command line arguments that are available at the time of writing:

General options:	
-d, --input-dir=STRING	Use an alternative path STRING to search for input files.
-l, --std-locale	Use the standard locale.
Configuration control:	
-a, --alt=STRING	Use an alternative configuration STRING.
Data processing control:	
-k, --kind=STRING	Use only the specified by STRING kind of input. Known kinds are: log (FS log files), cdms (files with CDMS values), pcmt (files with PCMT values), met (files with meteorological data). There can be more than one "-k" option.
-o, --meteo-order=STRING	An order of meteo parameters in /wx/ record of a log file. STRING is a string with at least 3 characters: T (temperature), P (pressure) and H (relative humidity). The order of the chars in STRING determines the order of data in a log file. The default is TPH. The values are case insensitive. The argument is supposed to be used with "-s" option, otherwise change of the order will affect all stations.
-s, --station=STRING	Use only station STRING (STRING can be either two-char station code or 8-chars station name). There can be more than one "-s" option.
-z, --zerofy=CHAR	Reset data type CHAR. CHAR can be "c" (cable calibration), "m" (meteorological data) or "t" (tsys). There can be more than one "-z" option.
Invocation of startup wizard:	
-w, --wizard	Force call of the startup wizard.
-W, --sys-wide-wizard	Run startup wizard for the system-wide settings.
Operation modes:	
-, --help	Give this help list.
-p, --print-setup	Print set up and exit.
-q, --dry-mode	Process in a "dry run" mode: files will not be created, instead names of the files will be printed.
--usage	Give a short usage message.
-V, --version	Print program version.

Most of these options are used either to override the current software configuration or for the debug purposes. The options -k, -s and -z alternate the software behavior.

When the software processes log files, first, it checks for existing cable calibration and meteorological data in a database. If a station already has this information, then it will not be modified. And if a station contains both cable calcs and meteo parameters, the log file will not be parsed at all. The options -zc and -zm cause the software to reset (set to zero) cable calibration and meteorological data (if they are exist).

The software reads existing log files, also it is capable to extract data from external files that contain cable calibration or meteorological data. The cable calibrations could be of two different types, *cdms* and *pcmt*, and are generated by VGOS stations. The CDMS file names are expected in the format:

<session code><station ID>.cdms.dat

where *session code* is a IVS session code (as it is in a correspondent master file) in lower cases and *station ID* is a two-char station ID (as it in ns-codes.txt file¹) in lower cases also. For example, the station KOKEE12M that has two-char ID «K2» participated in the VGOS session VGOS16-105 with IVS session code «KB6105». Its CDMS file should be «kb6105k2.cdms.dat». The PCMT file names have the similar template:

`<session code><station ID>.pcmt.*.*.dat`

For example: «vt7254gs.pcmt.BCD.XY.dat» or «vt7254gs.pcmt.C.Y.dat». If the software found several PCMT files, the last modified will be used.

The content of *cdms* and *pcmt* files is following: all fields should be separated by one or more space chars. First six fields are integers that specify an epoch of cable calibration: year, month, day, minute and seconds. The seventh field is a value of the cable calibration, then, a source and a scan name are expected. For example:

2017	09	11	18	00	0	0.0	2229+695	254-1800
2017	09	11	18	01	26	5.91e-12	1040+244	254-1801
2017	09	11	18	02	38	9.03e-12	0823+033	254-1802
2017	09	11	18	03	46	7.93e-12	0552+398	254-1803
2017	09	11	18	05	8	5e-13	1300+580	254-1805

A note about scan names: the scan names are composed from the epoch of start of a scan – day of a year (DOY), hours (HR) and minutes (MI):

`<DOY>-<HR><MI>`

However, if a session has two different scans that started observing at the same time (without counting seconds), the correlator adds char letters to distinguish the scans. For example: «012-3456a» and «012-3456b». In this case, the proper scan name can be unknown at the time of creation a *cdms* or *pcmt* file and the last char in a scan name can be omitted in these types of files.

The file names of external data with meteorological parameters are similar to CDMS files:

`<session code><station ID>.met.dat`

The format of a «met» file is similar to the *cdms* or *pcmt* files, except no source name or scan name is necessary. The order of meteorological parameters is the following: atmospheric pressure (mbar), ambient temperature (°C) and relative humidity (percent):

#Yr	Mo	Dy	Hr	Mi	Sc	P	T	Rh
#								
17	9	11	0	0	0	1010.0	26.5	80.9
17	9	11	0	1	0	1010.0	26.4	80.8
17	9	11	0	2	0	1010.0	26.4	80.8
17	9	11	0	3	0	1010.0	26.4	80.7

By default, the software searches for all types of files and use all available information: first, checks existence of CDMS files and if they are present, extracts data from them. If no cable calibration data found, vgosDbProcLogs checks PCMT files, then – external meteo data files. At the end, if no cable calibration measurements or meteorological data were found, the utility parses station log files. The option *-k* tells the software to search only the user specified type of files. The option can be stacked:

`> vgosDbProcLog -kcdms -kmet 2017/17SEP11VG/17SEP11VG_V003_kall.wrp`

¹master files and ns-codes.txt file are available on IVS ftp site, <ftp://ivsc.gsfc.nasa.gov/pub/control>

tells the software to try to read CDMS and external meteo files (if they exist) only. The combination *-klog -kcdms -kpcmt -kmet* is equal to the default software behavior (i.e., without applying the option *-k*). The order of options is irrelevant.

Using the option *-s* a user can specify a station that should be processed by the software. The «station» can be either a name of the station (e.g., «KOKEE») or a two-char ID («Kk»). This option can be stacked too. Listing all stations that participated in a session is the same as do not use the option at all.

A user can freely combine the options *-k*, *-s* and *-z* to have flexibility in data processing.

The command line argument *-l* preserve altering of the locale.

Documentation of Field System states that the order of meteorological parameters in a log file is temperature, pressure, humidity. Sometimes, the meteorological parameters appear in a log file in incorrect order. For example, log file «t2p144nt.log» (generated by station NOTO during session T2P144) contains meteorological parameters in the following order: temperature, humidity, pressure. To read data correctly, an option *-o* should be applied. Assuming that the first execution of the utility is:

```
> vgosDbProcLog 21JAN12XH
```

the second run should be:

```
> vgosDbProcLog -sNt -zm -oTHP 21JAN12XH
```

in this example the argument *-sNt* limits all operations to station «Nt» (NOTO), the argument *-zm* reset meteo parameters and the argument *-oTHP* specifies an alternative order of the meteo data.

3.2 Using RINEX files

Some stations do not have the proper equipment to record the meteorological parameters, on the other hands, at the same site there could be a GPS receiver with a meteo station. In such cases, the meteo data are available in RINEX files and distributed by the IGS services.

A user can configure reading RINEX files for each station, see Sect. 4.4 *Setting RINEX files*. By default, two VLBI stations, FORTLEZA and WESTFORD, are configured to use RINEX files.

If a file system log file does not contain meteo records and the RINEX files are available in the same directory where the log files are, vgosDbProcLogs will read the RINEX files and use meteorological data from such files.

For the station FORTLEZA the near-by GPS station is CEEU and the corresponding RINEX files can be downloaded from

```
ftp://geofftp.ibge.gov.br/informacoes_sobre_posicionamento_geodesico/rbmc/dados/<YYYY>/<DDD>/
```

Where <YYYY> is a year and <DDD> is a number of a day of the observations.

For example, to add meteo data for the station FORTLEZA that participated in the VLBI session **r4845** (observations were conducted in 2018, started on 158th day of the year and finished on 159th), one should download two archive files

```
ftp://geofftp.ibge.gov.br/informacoes_sobre_posicionamento_geodesico/rbmc/dados/2018/158/ceeu1581.zip
ftp://geofftp.ibge.gov.br/informacoes_sobre_posicionamento_geodesico/rbmc/dados/2018/159/ceeu1591.zip
```

and to extract a file ceeu1581.18m from the first archive and ceeu1591.18m from the second one. This two files should be placed in the directory where the log files are and vgosDbProcLogs will extract meteorological data for the station FORTLEZA.

Chapter 4

Configuring the software

When `vgosDbProcLog` is invoked the first time or new alternative configuration name has been provided, it calls a setup wizard. The wizard is a small application that asks a user few questions about the configuration.

If you want to change your current configuration, run `vgosDbProcLog` with `-w` option:

```
> vgosDbProcLog -w
```

If you want to set up (or change) the configuration of alternative setup, invoke `vgosDbProcLog` with `-a AltCfg` option, e.g.:

```
> vgosDbProcLog -w -a Tests
```

4.1 Using system-wide settings

On a system with several users it is useful to set up common software settings, like path to observations, data files, and so on. To set up such settings, invoke the utility with `-W` option. Obviously, you have to have write access to the directory with system-wide settings. By default, the system-wide settings directory is derived from `${prefix}` variable of the `configure` script and is set to `${prefix}/etc/xdg`. It can be overwritten using `--sysconfdir` option of the `configure` script.

The system-wide settings take an effect if user settings do not exist (e.g., first run of the software), they do not change existing user's settings.

Combination of the option `-W` with the option `-a AltCfg` discards using the system-wide settings, the setup wizard will use the alternative setup instead.

Due to a problem in implementation of `QSettings` object, the system-wide settings option is available only if you have Qt library of version 4.8.0 or newer.

4.2 Setting paths to data

On the first after introduction wizard's page, "Home directory", user can set up paths to the default directories. The home directory of `vgosDbProcLog` is a place where all non-absolute paths refer to.

The path to input default locations of station log files is in *Path to session files* filed. The data structure of the session files reflects the data structure of the auxiliary files of the IVS ftp site

```
ftp://cddis.gsfc.nasa.gov/pub/vlbi/ivsdata/aux/
```

The software expects in *session* directory sub directories of the format

```
<SESSION>/YYYY/<SessionCode>/
```

vgosDbProcLogs Home Directory

Please, specify the software's home directory.

All paths that are not absolute will be counted from this directory. The software home directory have to be writable for a user and should be different from user's home directory.

vgosDbProcLogs home directory

Path to the software home directory:

Essential directories

Path to session files:

Path to vgosDb files:

Path to Master files:

General options

☒ Do not alternate locale set up

Figure 4.1: Setting up paths.

Where *<SessionCode>* is a code of a VLBI session as it appears in corresponding master file.

The path to output directory is specified by the field *Path to VgosDb files*. The data structure of vgosDb files would looks like

```
<VGOSDB_ROOT>/YYYY/YMMMDDBL/<data files>
```

Where *VGOSDB_ROOT* is a directory specified in the wizard, *YYYY* is a year and *YMMMDDBL* is a database name.

The software uses master files to figure out proper database name. Also, the file *ns-codes.txt* contains information on stations participated in the observations. The path to master files is a place where these files suppose to be. You can obtain the fresh copies of master files and *ns-codes.txt* file from

```
ftp://cddis.gsfc.nasa.gov/pub/vlbi/ivscontrol/
or
https://ivsc.gsfc.nasa.gov/program/master.html
```

Time from time the files need to be updated. In addition to the standard master files, a user can use its own "local" master file. The format of the local master file should be the same as the standard one, its name have to be in the form "masterYY-loc.txt", where "YY" – two digits of the year. This feature is designed for testing purposes or processing non-standard VLBI sessions. The software first checks for the local master files, if it found a record there it stops the search, so records in the canonical master files can be overwritten using the local master file.

The check box `Do not alternate locale set up` controls how the utility deals with locale set up. By default it is «off».

4.3 Setting default cable calibration signs

On the second page of the wizard a user can set up default cable calibration sign for a station.

To determine a sign of obtained cable calibration measurements personnel of a station performs the following operation: first, a cable calibration measurement is performed. Then, an additional cable is inserted into cable

system of the antenna and the measurement is made again. Increase in cable calibration reading with added piece of cable means that the sign of the measurements is positive, otherwise it is negative. Such operation usually is performed before begin and after end of a VLBI session and is recorded into field system log of a station as *cablelong* measurement.

Sometimes, for different reasons, such measurements are not conducted. In this case vgosDbProcLogs use default cable calibration signs. A user can set up the default sign for each station, see Fig. 4.2. If a station is not configured, a positive sign will be used.

Default cable calibration sign set up

Set up a cable calibration sign, this sign will be used if a station did not make *cablelong* measurement during observations.

List of Clock Break Events

Station	Default sign
WETTZELL	+

Buttons: Add, Edit, Delete

Figure 4.2: Setting up default cable calibration sign.

By default, the station WETTZELL with the positive value for the cable calibration sign is predefined.

Default Cable Cal Sign

Station key: WETTZELL

Sign: +1

Buttons: OK, Cancel

Figure 4.3: Editor of the default cable calibration sign.

A user can edit existing station by clicking on the button «Edit», see Fig. 4.3, add more stations (the button «Add») or remove existing stations from the configuration with the button «Delete».

4.4 Setting RINEX files

The third page of the wizard allows a user to configure reading of RINEX files with meteorological data.

The use of RINEX files as a source of meteorological data are described in the Section 3.2 *Using RINEX files*. A user can set up for each VLBI station its GPS counterpart and, if necessary, pressure offset. The pressure offset could be necessary if meteo station and VLBI antenna have difference in height and this difference is significant. Units for the pressure offset are *mbar*, the value will be added to the atmospheric pressure extracted from RINEX files.

Meteorological data in RINEX format

Some VLBI stations do not provide meteo data in their FS log files, however there is a nearby GPS station with meteo sensors. The software is capable to read such data in RINEX format. Set up GPS station name and (if necessary) pressure offset.

List of Clock Break Events

Station	GPS station	Pressure offset
FORTLEZA	ceeu	0.00
WESTFORD	sa01	1.90

Add Edit Delete

Figure 4.4: Setting up reading RINEX files.

By default two stations are predefined: FORTLEZA with its nearby GPS station «ceeu» and WESTFORD with the GPS station «sa01» and 1.90 mbar pressure offset.

A user can edit existing station by clicking on the button «Edit», see Fig. 4.5, add more stations (the button «Add») or remove existing stations from the configuration with the button «Delete».

4.5 Setting user identities

The fourth and fifth pages of the wizard, Fig. 4.6-4.7, set up user identities.

We strongly encourage users to provide, at least, a working e-mail address.

Information collected by these two pages are used only for composing the history part of vgosDb files and in vgosDbProcLog log file.

The short form of the abbreviated affiliation («Abbrev.» on the Fig. 4.7) is used in wrapper file names as an attribute *_i<Institution>*. If the field is empty, the attribute will not be added to a name of a wrapper file.

Import a RINEX file:

Station key:

GPS station:

Pressure offset:

Figure 4.5: Editor of the using meteo data from RINEX files.

User Identities

User Name:

E-mail address:

User's default initials:

Figure 4.6: Setting up user ID.

Analysis Center

Full Name:

Abbreviation:

Abbrev.:

Figure 4.7: Setting up affiliation.

4.6 Setting options of the logger

The last page of the start up wizard, Fig. 4.8, sets up properties of the logging subsystem. The field *Log file name* is a name of a file where the log messages will be saved if the checkbox *Save log to the file* is checked «on». The file will appear in vgosDbProcLog home directory, Fig. 4.1. The *Log capacity* is an amount of log records that are kept in internal structure before send them to a file. The checkbox *Put time stamps* turns on adding time tags to the log messages.

The *Log level* determines how verbose the log output will be. The *Debug* level, as shown on the figure, could be useful for debugging purposes. For routine operations the *Info* level will be preferred.

Another log file will be created on a per session basis if the checkbox *Save log file for each session* is turned «on». The aux log file will be saved in *Path to logs for each session* directory and its name will be the same as the database name plus ".log" extension.

WARNING: If the logger is instructed to save data in the log file, the size of the file will grow up. The software does not check the size of the file (it does not know about your intentions), and eventually the file could take all free space on your computer! If you do not need the log output from previous runs, please, remove the file on a regular basis.

Logger

Change parameters of the logging subsystem.

Main log options

Log file name: ☒ Save log to the file

Log capacity: ☒ Put time stamps

Main log levels

☐ Error

☐ Warning

☐ Info

☒ Debug

Aux log options

Path to logs for each session: ☒ Save log file for each session

Figure 4.8: Setting up logger.

Chapter 5

Concluding remark

Currently, this document is in the developmental stage, its content could change time from time. Check for new versions at the site:

`https://sourceforge.net/projects/nusolve`

If you have questions or suggestions that will improve the software or the User Guide, please e-mail us at:

`<mailto:sergei.bolotin@nasa.gov>`

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