

# vgosDbMake-0.6.2: User Guide

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May 9, 2023

# Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
1.1	Requirements . . . . .	2
1.2	Changes from previous versions . . . . .	2
1.2.1	Changes in version 0.6.2 . . . . .	2
1.2.2	Changes in version 0.6.1 . . . . .	2
1.2.3	Changes in version 0.6.0 . . . . .	2
1.2.4	Changes in version 0.5.6 . . . . .	2
1.2.5	Changes in version 0.5.5 . . . . .	3
1.2.6	Changes in version 0.5.4 . . . . .	3
1.2.7	Changes in version 0.5.3 . . . . .	3
1.2.8	Changes in version 0.5.2 . . . . .	3
1.2.9	Changes in version 0.5.1 . . . . .	3
1.2.10	Changes in version 0.5.0 . . . . .	3
1.2.11	Changes in version 0.4.4 . . . . .	3
1.2.12	Changes in version 0.4.3 . . . . .	4
1.2.13	Changes in version 0.4.2 . . . . .	4
1.2.14	Changes in version 0.4.1 . . . . .	4
1.2.15	Changes in version 0.4.0 . . . . .	4
1.2.16	Changes in version 0.3.0 . . . . .	4
<b>2</b>	<b>Installation</b>	<b>5</b>
<b>3</b>	<b>Invoking vgosDbMake</b>	<b>7</b>
<b>4</b>	<b>Configuring the software</b>	<b>10</b>
4.1	Using system-wide settings . . . . .	10
4.2	Setting paths to data . . . . .	10
4.3	Setting user identities . . . . .	12
4.4	Setting options of the logger . . . . .	12
<b>5</b>	<b>Concluding remark</b>	<b>14</b>

# Chapter 1

## Introduction

This document describes how to use the utility vgosDbMake.

The software is designed to read fringe files, extract data from the files and store it in vgosDb format.

The utility vgosDbMake 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 vgosDbMake-0.0.1 appeared in nusolve-0.2.10 package.

The guide covers 0.6.2 version of the software. Since the vgosDbMake 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 vgosDbMake user guide). It covers changes in the software and the user guide.

#### 1.2.1 Changes in version 0.6.2

The section *4.2 Setting paths to data* was updated to reflect changes in master file handling.

#### 1.2.2 Changes in version 0.6.1

Nothing essential was changed.

#### 1.2.3 Changes in version 0.6.0

Support of version 2 of masterfile and new database naming convention is added. See the chapter *3 Invoking vgosDbMake* for details.

#### 1.2.4 Changes in version 0.5.6

Nothing essential was changed.

### 1.2.5 Changes in version 0.5.5

Nothing essential was changed. Some corrections were made: If a correlator name is not found in a masterfile and is not specified with "-r" option, the utility will use analysis center abbreviated ID as a correlator name to prevent problems with creation of Head.nc file. The regular expression for a valid source name in the map for sources was modified: a dot was added as a valid char in a source name.

### 1.2.6 Changes in version 0.5.4

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

Processing of correlator name was reworked. If it is available from VEX files and not "difx" or "sfxc", the software will use it. Otherwise, it will use correlator name from a masterfile. A user can override the correlator name with "-r" option. Previously, this option worked only in combination with an alternative database name (option "-d").

### 1.2.7 Changes in version 0.5.3

The software checks for duplicate scan names and corrects them if found. Also, it checks for NaN in single band delays, group delays, delay rates, etc. and skips such observations (sometimes it happens with KOMB files).

For KOMB files input vgosDbMake is able to correct group delays and rates for reference station clock offset if a user provides a command line option "-x". Chapter 3 *Invoking vgosDbMake* was modified to reflect the change.

### 1.2.8 Changes in version 0.5.2

Nothing essential was changed.

### 1.2.9 Changes in version 0.5.1

Nothing essential was changed.

### 1.2.10 Changes in version 0.5.0

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.

### 1.2.11 Changes in version 0.4.4

A bug in creation vgosDb files has been fixed: values of the geocentric group delays and the geocentric rates were swapped in the netCDF file "CorrInfo-difx\_b?.nc". Software that use these data should check an attribute "Program", if it contains "vgosDbMake-0.4.3" or earlier versions, the values of the geocentric group delays and the geocentric rates need to be swapped back. The bug was reported by Minghui Xu from Shanghai Observatory, China (thanks!).

Processing of observations with non-empty error codes has been altered. The previous versions discarded all data that have non-empty fringe error codes (which mimics *dbedit* behavior). Starting with version 0.4.4 of vgosDbMake observations with all fringe error codes are accepted. In addition, the command line option **-e** is added, see the chapter 3 *Invoking vgosDbMake* for details.

### 1.2.12 Changes in version 0.4.3

This update contains bug fixes.

### 1.2.13 Changes in version 0.4.2

In this version behavior of `vgosDbMake` 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. 4.3 put an empty string instead of «GSFC»).

A warning about permanently increase of the log file size was added to the section 4.4 *Setting options of the logger*.

### 1.2.14 Changes in version 0.4.1

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

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

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

### 1.2.15 Changes in version 0.4.0

The software has been modified to read fringe files that have new naming convention.

A new option was introduced: mapping non-standard names of stations and sources. `vgosDbMake` can replace a non-standard station or source name with its conventional counterpart. This feature is described in the chapter 3 *Invoking vgosDbMake*.

### 1.2.16 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*.

A notion about locale configuration of the shell environment have been added to the chapter 3 *Invoking vgosDbMake*.

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 vgosDbMake 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.

Before installing the software you should check for three external packages which vgosDbMake depends on. The Qt library provides the graphical user interface. The netCDF library deals with I/O operations in Common Data Form format. The Haystack Observatory Postprocessing System, HOPS, is necessary to read fringe files.

Practically, all modern Linux distributions contain first two libraries. There is a good chance that Qt library is already installed on your computer (check your package manager or ask a system administrator). If, for some reason, you cannot or do not want to install these packages system-wide, you can download the sources and install them in your home directory. In this case (also, if the system installation put the library(ies) in non-standard places) you will need to provide paths to include files and libraries to the configure script.

The HOPS software should be installed manually, it is available from the ftp site of Haystack Observatory, `ftp://gemini.haystack.mit.edu/pub/hops`.

The first step in installing vgosDbMake is to extract the files in a temporary directory and `cd` to it. Run a configure script in the root directory of the package:

```
> ./configure <options>
```

Where a list of options of the configure script can be retrieved issuing

```
> ./configure --help
```

Several options are worth mentioning here. The place where to install the software:

```
--prefix=[PREFIX]
```

By default, it is `/usr/local`. If you do not have permissions to write there (which is a sign of a properly configured system), a user can install the software into his/her home or somewhere else. In this case, it is useful to add `PREFIX/bin` to your `PATH` environment variable. Also, you may need to add `PREFIX/lib` to your `LD_LIBRARY_PATH` variable.

Another option

```
--with-qt-dir=[PATH_TO_QT-4.8]
```

specifies where to look for Qt's files. The software is designed to work with Qt library of version 4.8.7, using older or newer versions of the library require modifying of the software sources or even change of its design. Qt library itself is a rapid developing product, so to get rid of versions race one can install a separate copy of Qt-4.8.7. In this case a directory where the library was installed will be an argument of `-with-qt-dir` option.

Some Linux distributions put Qt's files in a non-standard way. In this case the option splits into the two separate options:

```
--with-qt-include =[PATH_TO_QT-4.8 includes]
--with-qt-lib      =[PATH_TO_QT-4.8 libraries]
```

Where the first one specifies where to search for include files and the last one is for library files.

To point out on non-standard places of netCDF files, use the following options:

```
--with-netcdf-include =[PATH_TO_NETCDF includes]
--with-netcdf-lib      =[PATH_TO_NETCDF libraries]
```

to specify where the include file and the libraries are.

To trigger on the compilation of vgosDbMake, the configure script expects one of the following options:

```
--with-hops-dir=[PATH_TO_HOPS]
```

or

```
--with-hops-include=[PATH_TO_HOPS include files]
--with-hops-lib=[PATH_TO_HOPS libraries]
--with-hops-share=[PATH_TO_HOPS shared data]
```

Even if your HOPS library was configured with `--prefix=/usr/local` and all files are in standard places, you need to provide the option `--with-hops-dir=/usr/local` to turn on compiling vgosDbMake utility.

Another option, `--enable-vgosDbMake-only`, removes vSolve and other utilities but vgosDbMake from the list of software that should be build and installed. If you want to install only vgosDbMake utility, you need to invoke `configure` script as follow:

```
> ./configure --prefix=[...] --with-hops-dir=[PATH_TO_HOPS] --enable-vgosDbMake-only [other options]
```

Note, the option `--with-hops-dir=` is still necessary to turn on building of vgosDbMake.

In the file `INSTALL.local` in the root of the distributive tree one can find details about specifying configure's options to assemble the software with Qt and netCDF libraries.

If the `configure` script finished without errors, type the following commands:

```
> make
> make install
```

and the software will be installed in the `PREFIX` directory. The command `make check` is optional, it is a placeholder for checking suite that will be developed later.

## Chapter 3

# Invoking vgosDbMake

To invoke vgosDbMake type (specifying if necessary the full path to the executable) program name and path where fringe files of a VLBI session are:

```
> vgosDbMake <PATH_TO_DATA>
```

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

```
> vgosDbMake --help
```

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

### General options:

<code>-f, --mf-version=NUM</code>	Set the expected masterfile format version to NUM. The possible format versions are 1 and 2.
<code>-l, --std-locale</code>	Use the standard locale.
<code>-o, --output-dir=STRING</code>	Use an alternative path STRING to save files in vgosDb format.

### Configuration control:

<code>-a, --alt=STRING</code>	Use an alternative configuration STRING.
-------------------------------	--

### Database edit options:

<code>-d, --database=STRING</code>	Set database name to STRING.
<code>-r, --correlator=STRING</code>	Set correlator name to STRING.
<code>-s, --exp-sn=NUM</code>	Set experiment serial number to NUM.

### Data extraction control:

<code>-e, --exclude=CHAR</code>	exclude observations with fringe error code CHAR. If CHAR is "*" only observations that have no fringe error code will be extracted. There can be more than one "-e" option, e.g.: <code>-eA -eB</code> .
<code>-m, --map=STRING</code>	Set a name map file to STRING.
<code>-t, --report=STRING</code>	Set a correlator report file to STRING.
<code>-x, --adjust-ref-stn</code>	KOMB files input only: adjust delays and rates for a reference station clock offset (experimental mode).



	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.

Starting with version 0.6.0, vgosDbMake can use version 2 format of masterfiles and create a database with new naming convention. To specify what naming convention vgosDbMake should use, provide the option «-f "NUM"». Value of "NUM" can be either "1" (old naming convention) or "2" (new naming convention). For example, using

```
> vgosDbMake -f2 [...]
```

will create a database using new naming convention. It is necessary that the corresponding masterfile in the format of version 2 is exist in the proper directory (see Section 4.2 *Setting paths to data*). Masterfiles of old and new formats have different names and can co-exist in one directory. If the option «-f "NUM"» is not provided, current version of vgosDbMake will use the old format of a masterfile and old naming convention.

The option «-e "fringeErrorCode"» allows a user to filter out observations with the fringe error code "fringeErrorCode". For example,

```
> vgosDbMake -eA [...]
```

will exclude all observations that have the fringe error code "A". The options «-e» can be stacked, e.g..

```
> vgosDbMake -eA -eB -eC -eD [...]
```

will result in exclusion of observations with the fringe error codes "A" to "D". A special case «-e\*» suppress all observations with any non-empty fringe error codes (that mimics how *dbedit* process observations).

The option «-m» specifies an ASCII file with station and source names map that the software should use. This feature is designed to make possible to alter a non-common station or source name that appears in fringe files to its standard name. Also, it is possible to specify that an observation with some specific station or source should not be included in a session. The format of a map file is following:

```
stn:[input name] => [output name]
src:[input name] => [output name]
```

where «[input name]» is a name of a station or source as it appears in fringe or KOMB files and «[output name]» is how it should be translated. A special value for the output name «---» means that the object should be skipped from the session.

For example, using a map file *mapFile* of the following content:

```
#
#
# stations:
stn: VLBA_PT => PIETOWN
stn: VLBA_MK => MK-VLBA
```

```
stn: WETTDBBC => ---
```

```
# sources:
```

```
src: 0718+792 => 0718+793
```

```
src: 1228+126 => 3C274
```

```
src: 1637+826 => NGC6251
```

```
as
```

```
> vgosDbMake -m mapFile <path-to-fringe-files>
```

will override station names «VLBA\_PT» and «VLBA\_MK» as «PIETOWN» and «MK-VLBA», and exclude all observations on the station «WETTDBBC». Also, source names «0718+792», «1228+126» and «1637+826» will have the following names in the vgos database: «0718+793», «3C274» and «NGC6251».

The command line argument «-l» preserve altering of the locale. If you want to use this option, please check locale setting of your shell environment. The HOPS software that parses VEX files uses libC functions that are locale aware. Different languages have different rules for string comparison, representation of integer and real numbers and so on, so using locale other than standard "C", "POSIX" or "en" could cause incorrect work of the software. You can check your environment locale setting with command

```
> locale
```

Consult with your system administrator for details.

## Chapter 4

# Configuring the software

When `vgosDbMake` 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 `vgosDbMake` with `-w` option:

```
> vgosDbMake -w
```

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

```
> vgosDbMake -w -a IVS-R4
```

### 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 `vgosDbMake` is a place where all non-absolute paths refer to.

The path to input default locations of correlator files is in `Path to mark{3-4} files` field. If you specify an argument that is not an absolute path, `vgosDbMake` will search data counting from this directory. For example, if the fringe files are in a directory `/home/slb/500/correlator/3449`, then, according to set up shown on Fig. 4.1, I can run `vgosDbMake` as

```
> vgosDbMake 3449
```

Also, I can use absolute path and it will override the configuration:

Figure 4.1: Setting up paths.

```
> vgosDbMake /home/slb/500/correlator/3449
```

The path to output directory is specified by the field **Path to VgosDb files**. A user can override it with **-o** command line option. The data structure of vgosDb files would look 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. For the example of vgosDbMake invocation above and with standard master file, the output will be written in the directory

```
<VGOSDB_ROOT>/2015/15AUG03XA/
```

The software uses master files to figure out proper database name. If a session is not in master file, a user can specify the database name using **-d** command line option. The path to master files is a place where master files suppose to be. You can obtain the files from

<https://cddis.nasa.gov/archive/vlbi/ivscontrol/>

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.

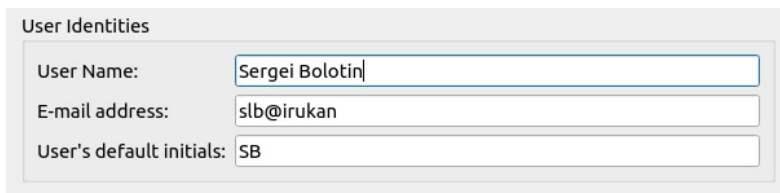
Starting with version 0.8.2 of the distribution, an option to explicitly set names for master files is added. If a user sets the check box *Use alternative masterfile extensions* to «on», then vgosDbMake will compose the masterfile names using a provided list of extensions. The list is a set of strings separated by comma (","), colon (":") or semicolon (";") char. The software adds the extension from the list to the basic name, "masterYY"

or "masterYYYY", and reads such a file. The order of files lookup is corresponding to the order of masterfile extensions in the list. The default list of masterfile extensions is "-loc.txt,.txt,-int.txt,-vgos.txt".

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

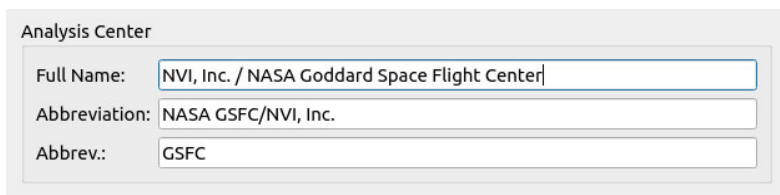
## 4.3 Setting user identities

The second and third pages of the wizard, Fig. 4.2-4.3, set up user identities.



User Identities	
User Name:	Sergei Bolotin
E-mail address:	slb@irukan
User's default initials:	SB

Figure 4.2: Setting up user ID.



Analysis Center	
Full Name:	NVI, Inc. / NASA Goddard Space Flight Center
Abbreviation:	NASA GSFC/NVI, Inc.
Abbrev.:	GSFC

Figure 4.3: Setting up affiliation.

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 vgosDbMake log file.

The short form of the abbreviated affiliation («Abbrev.» on the Fig. 4.3) 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.

## 4.4 Setting options of the logger

The last page of the start up wizard, Fig. 4.4, 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 vgosDbMake 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

**Logger**

Change parameters of the logging subsystem.

Main log options

Log file name: <input type="text" value="vgosDbMake.log"/>	<input type="checkbox"/> Save log to the file
Log capacity: <input type="text" value="400 lines"/>	<input checked="" type="checkbox"/> Put time stamps

Main log level

☐ Error  
☐ Warning  
☐ Info  
☒ Debug

Aux log options

Path to logs for each session: <input type="text" value="Logs"/>
<input checked="" type="checkbox"/> Save log file for each session

Figure 4.4: Setting up logger.

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.

## 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 ftp 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>`

# Bibliography

- [1] S. Bolotin, J. Gipson, D. MacMillan: "Development of a New VLBI Data Analysis Software". In: International VLBI Service for Geodesy and Astrometry 2010 General Meeting Proceedings, edited by D. Behrend and K. Baver, NASA/CP-2010-215864, 197-201, 2010.
- [2] S. Bolotin, J. Gipson, D. Gordon, D. MacMillan: "Current Status of Development of New VLBI Data Analysis Software". In: Proceedings of the 20th Meeting of the European VLBI Group for Geodesy and Astrometry, edited by W. Alef, S. Bernhart, A. Nothnagel, Schriftenreihe des Instituts für Geodäsie und Geoinformation der Universität Bonn, Nr. 22, ISSN 1864-1113, 86-88, 2011.
- [3] S. Bolotin, K. Baver, J. Gipson, D. Gordon, D. MacMillan: "The First Release of  $\nu$ Solve". In: International VLBI Service for Geodesy and Astrometry 2012 General Meeting Proceedings 'Launching the Next-Generation IVS Network', edited by D. Behrend and K. Baver, NASA/CP-2012-217504, 222-226, 2012.