

**ETERNA-x et34-x-v80-\***

**Program Systems  
for  
Earth and Ocean Tide Analysis and Prediction**

**Release Notes**

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## 0. Graphic support for GNU-based Eterna program systems

In the previous release, 3 different Eterna systems have been defined to meet the users requirements in a most flexible way. However, there are some disadvantages to be admitted:

- 1 Eterna system with graphic support, but developed on a proprietary, commercial platform (Silverfrost FTN95),
- 2 Eterna systems based on (free) GNU Fortran, but without graphic support (\*wingnu, \*Inxgnu).

With this release **et34-x-v80 \***, we found a way out : an Eterna system can now be provided

- **on a free GNU gFortran basis** like the already released **wingnu** system
- +  
- **comprehensive graphics support** known from \*winsil, based on the free GUI **Simdem64**.

Hence, a new Eterna system **et34-x-v80 – gnusim** has been built which can be characterized by the simple formula:

$$\text{wingnu} + \text{Simdem64} = \text{gnusim}$$

Since Simdem64 is compiled on a MINGW64-platform (Minimalist **GNU** for Windows), wingnu had to be migrated from CYGWIN64 to mingw64 as well. **MinGW 64** is an *open source* C/C++ compiler based on the popular **gcc** intending to generate executables for **Windows 64 bit**. Compared to **MinGW 32**, **MinGW 64** is more or less the same, but simply acting as a cross-compiler because a **Windows 64** platform requires a 64 bit program to be executed. But one has to keep in mind that the restrictions of the 32-bit architecture in address space are still in effect for the Eterna **gnusim** system. However, that does not mean serious practical limitations to tidal analysis (see section 2.2). It should further be noted that **gnusim** is basically a 64-bit application and cannot be executed on 32-bit computers.

**Simdem64** itself incorporates a collections of dlls , i.e.

- salflibc64.dll
- clearwin64.dll
- x64\_clearwin.dll
- x64\_graphics.dll
- x64\_menus.dll

which have to be linked to the Eterna Fortran source code. The migration from CYGWIN64 to mingw64 requires a different collection of dlls, namely.

- libgcc\_s\_sjlj-1.dll
- libgfortran-3.dll
- libquadmath-0.dll.

These 8 dlls have to be present in the Eterna analyse-directory as described in detail in the installation guides and will therefore be provided in the distribution kit of download section 4a,4b.

For LINUX users the encouraging message is that, in principle, **gnusim** can be executed **on a WINE - platform**. Presently, this system is under development and will be released shortly. For the time being, LINUX users are referred to the existing Eterna system **et34-x-v74-linxgnu** without graphic.

Since Silverfrost FTN95 with Plato and checkmate option is one of the most powerful Fortran development tools, we shall further deploy it for Eterna development. However, as run time system, the (proprietary) Eterna \*winsil system will become superfluous and will no longer be supported and distributed.

From this release on, **a single Eterna system et34-x-v80 -gnusim** is sufficient for all purposes with the following properties:

- **et34-x-v80 -gnusim** is based on mingw64 under the MINGW copyright conditions,
- **et34-x-v80 -gnusim** provides graphic support by **Simdem64** under GNU AFFERO GENERAL PUBLIC LICENSE,
- **et34-x-v80 -gnusim** is the resulting (native) Eterna system developed on MS WINDOWS 10,
- **et34-x-v80 -gnusim** (unchanged) will also be available for Linux by means of WINE in the near future.

Practically, the MINGW copyright conditions guarantee the free use of the MINGW software. Similarly, the GNU Affero General Public License for Simdem64 is a free, copyleft license for software and other kinds of works.

In the future, the Eterna source code and Simdem64 are essential for presenting Eterna as free software.

The user has to get familiar with the new Eterna structure which is reflected in the “Download section” on the Eterna webpage.

# 1. Download section

- [1. System Architecture Overview](#)
- 
- [2. Import to read prior to installation: Release Notes et34-x-v80](#)
- 
- [3. Complete set of System Manuals for Windows und LINUX et34-docu-v80](#)
- [4a. System et34-x-v80-gnusim](#)
- [4b. System et34-x-v74-lnxgnu \(to be updated later on\)](#)
- 
- [5. simfit-v80-Configuration-Files only for system 4a](#)
- 
- [6. The DUT1, Polar Motion and LOD file ETPOLUT1-NEW.dat](#)
- 
- [7. Time difference catalogue ETDDT.dat](#)
- 
- [8. BIM 150 containing: Ducarme,B., Schueller,K. : Canonical wave grouping as the key to optimal tidal analysis \(34 downloads\)](#)

First , the user should download and unpack the complete set of manuals of item 3. on his computer. Then, the relevant installation guide(s) has (have) to be selected. From there, the user will proceed with the rules presented in the installation guide(s) to be applied like cook book recipes for installing /updating his Eterna system(s). It has to be emphasized that the manuals “Theory” and “Users Guide” apply to both Eterna systems while the “Installation Guides” are specific to each system.

After having successfully installed Eterna, the user should move the Eterna manuals into the foreseen docu- directories as described in the installation guides.

## 2. Source code revisions and enhancements

### 2.1 Eterna bug fixes

All bugs and inconveniences reported from release v74 have been fixed by now. Several source code revisions and optimizations have been performed. Several minor flaws have also removed so that now

- In the \*.ini files, rows beginning with an hashtag # are always ignored.
- Error messages concerning the already deleted parameter AMTRUNCATE will no longer appear.
- Inconsistencies of time windows for observations and residuals will no longer occur.
- Result tables A10 and A15.1 are now consistent in common content and format.
- Parameter syntax errors will be detected on input.

### 2.2 Virtual memory management

Prior to this release, the memory allocations of the program depending on record lengths have statically been declared by dimensions of predefined constant values. The maximum record length was restricted for the Eterna system to 10.512.000 observations of any sampling interval.

From this release on, the program has become more flexible : instead of static memory allocation, (virtual) memory is now dynamically allocated (and released) at run time. Hence, the program determines first the maximum available virtual memory for a specific analysis. The subsequent results will be presented on screen and in the screen protocol as follows:

```
Checking computer resources first
```

```
=====
```

```
Virtual Memory/Address Space Overflow on this system at:
```

```
2**30 =          1073741824 observations
```

```
Resources available:
```

```
=====
```

```
- maximum no of observations to be analysed = 2**29 =          536870912.
```

```
- sampling interval 1 h          ->          61245. years
```

```
- sampling interval 1 min        ->          1021. Years
```

These resources are compared to the actual observation data provided for analysis. In case of lacking memory the program will stop with and error message.

## 2.3 Extention of file projectdir for allowing central data archive access

The projectdir file is extended by an optional 3<sup>rd</sup> row, defining the absolute path to a file with observation data residing in a central data archive. This archive can be organized for instance like the IGETS database. Using such a data archive avoids redundant storage of the observations.

**Example for Windows: :**

Let the archive be defined by directory **C:\users\public\documents\et-data-archive** with data file **test-pred-3600-otl.dat**.

The example for the associated projectdir will be :

```
projects\test\  
pred\3600\otl\  
C:\users\public\documents\et-data-archive\test-pred-3600-otl.dat
```

## 2.4 Unrestricted multi channel analysis for minute data transformed to hourly samples (CHANGETOHI=1)

Prior to this release minutely sampled data with minutely sampled channels could only be modelled with 1 regression coefficient even when transformed to hourly samples by setting \*.ini parameter CHANGETOHI=1. This restriction is no longer in effect so that arbitrary impulse response functions can be modelled from now on.

For minute data the restriction remains in effect because it would required an excessive number of filter weights to model the IRF adequately.

## 2.5 Consistent error propagation for analysis with filtered and then resampled observations (NUMHIGPASS $\neq$ 0, CHANGETO1H>0)

In prior releases, LS error propagation was performed straight forward, not taking into account the impact of resampling. As filtering is done with the original smaller sampling interval, the resampled data will exhibit the filter effect on the original observations and not of the resampled ones. This effect is now accounted for.

## 2.6 Processing of frequency dependent instrumental corrections

The WAVEGROUPI as well as the NL+ADCONST parameters allow to define (instrumental) frequency dependent gain and phase corrections for the associated wave group or constituent respectively. From the former Eterna 3.40 on, these corrections have been a posteriori applied to the estimated tidal amplitude factors and phase shifts.

In proceeding this way, there is a slight theoretical problem of how to thoroughly calculating the exact RMSEs of the corrected parameters. Therefore, the procedure has been changed so that these corrections are treated like the numerical filter corrections, i.e. by consistently changing the model functions. Then, the corrected tidal parameters are directly estimated and so the problems of how to consistently do the error propagation is avoided.

## 2.7 Automatically generated filters

In case of seldomly used sampling intervals like 5 min or 24h, no filter is available in the commdat directory. Therefore, an option is provided to generate it automatically by the program. The user only has to specify the appropriate filter length for which a formula is given. Parameter **NUMFILNAME** has to be looked up for further details.

## 2.8 Simdem64 fixes

It was noted in the Users Guides that there are problems in plot file generation with the “Windows” button on the Simfit-pop-up-menu. Moreover, it was not possible to plot curves with more than 100.000 data points.

All these problems are fixed with Simdem64, so that there are no further restrictions in this respect.

## 2.9 New system directory for the Simfit configuration files

Note that with Simdem64, the Simfit configuration files have changed their locations.

They are now placed in WINDOWS system directory :

- C:\Program Data\Simfit\user\cfg

Similarly, the res and usr directories moved as well:

- C:\Program Data\Simfit\user\res
- C:\Program Data\Simfit\user\usr

If the user does not set up these directories in advance, Simdem64 will generate a default configuration by itself. Afterwards the user can overwrite this default configuration the configuration files from the downloaded Simfit-distribution kit.

## 3. Tables and file updates

All tables have been updated as demanded by program enhancements and maintenance. Therefore, it is compulsory to always use the newest version, represented by the delivered commdat-v80 directory instead of keeping former ones.

### 3.1 File projectdir with additional link to a data archive

In case that the same data have to be analysed with different programs (for example due to new releases) they had to be redundantly present in the project directories or sub-directories. To avoid this redundancy the user can set up a data archive anywhere on his computer and store the data there only once.

In a 3<sup>rd</sup> row of file projectdir, he can specify the absolute path to the data archive.

### 3.2 Splitting up file \*-nl+adconst.dat

As the tidal non-linear constituents are of the same frequencies at each location on the Earth, the \*-nl+adconst.dat file is split into 2 separate file types

- Project independent type as a single file "nonlinear.dat" now residing in the commdat directory containing all major non-linear tidal constituents.
- The project dependant part \*-nl+adconst.dat as before but now only containing the additional harmonics, e.g. out of an analysis of the residuals in an iteration process.

If no additional harmonics are known, the files \*-nl+adconst.dat can be omitted which simplifies the set up for analysis and saves a lot of redundancy.

#### ATTENTION:

**Please, remove the non-linear tidal constituents from your project dependant \*-nl+adconst.dat files because they are already defined in ..\commdat-v80\nonlinear.dat.**

### 3.3 Data definition file \*.ini

#### 3.3.1 Adjustment of parameters PRINTBYTES, CURVEBYTES, ONLGRAPHIC

Over release history, the 3 result presentation definition parameters PRINTBYTES, CURVEBYTES, ONLGRAPHIC as bit masks have become inconsistent to each other. Therefore, they were adjusted in such a way that the positions of the bits in all 3 parameters denote the same objects to be presented:

```
PRINTBYTES= 1111 1121 # : 1,2 = print, 0=no print: 1.pred.values, 2.FIR-filter coeff. 3.spectral windows, 2=diff.spec windows, 4.SCV,
# 5,
CURVEBYTES= 1 1 1111 # : 1 = curve, 0=no curve : 1.gain, 2.undef.,7.autocov.,8. autocov spectrum, 9.HRSA, 10. regr. amp.transf fct
# 6.undef.,3.spectral windows, 2=diff.spec windows, 4.undef,
ONLGRAPHIC= 1000121121 # : 1,2 = graphic, 0=no graphic: 1.gain, 2.time-, 3.spectral windows, 2=diff.spec windows, 4.SCV,
# 5.observ.,drift,6.resid.,7.Autocov.,8.spectrum, 9.HRSA, 10. regr. spectra
# pos.1 = 9 # = no graphic at all
```



It has to be emphasized that 3 bits can carry the value 2 in the following way:

Bit 3: =2, all 3 parameters : - > additional presentation of the difference spectral window between rectangular and Hanning window

Bit 6: =2, ONLGRAPHIC : -> additional presentation of the probability density and cumulative probability functions

Bit 9: =2, PRINTBYTES, : -> additional table of the HRSA-peaks

ONLGRAPHIC : -> Maximum scale for each HRSA-domain

The user should update their \*.ini files likewise to obtain the desired presentation results.

### 3.3.2 Deletion of parameter CUTOFFRPS

This parameter has become superfluous as the Nyquist frequency and spectra cut-off frequencies will be calculated from the data set. This was known long before but finally it was accounted for.

## 4. Documentation file updates

All documentation files have been revised and updated .

Due to different operating system and compiler platforms, 2 different installation guides are offered, while the theory and users guide document parts remain the same for all platforms.

The manuals are referred to as :

- For all Eterna systems independent of the operation systems and compilers :
  - Theory : manual-01-et34-x-v80-theory.pdf
    - See new section 4.7
  - Users Guide : manual-02- et34-x-v80-usersguide.pdf
    - See revised section section 9
- Dependent on a specific Eterna system are the Installation Guides:
  - Installation : manual-03-et34-x-v80-gnusim-installationguide.pdf  
manual-03-et34-x-v80-lnxgnu-installationguide.pdf
- Release notes

It is highly recommended to study the complete documentation prior to installation.

## 5. Contents of the distribution kits for the Eterna systems

All files of this release can be downloaded from

<http://ggp.bkg.bund.de/eterna/>

### 5.1 Documentation manuals et34-docu-v80.7z

This zip file contains all Eterna documentation as pdf-files. It should be downloaded prior to installation because it contains valuable information how to set up the Eterna system under consideration. All files have been updated for more exact descriptions and explanations.

It is recommended to study the section 9, "Prediction of tides", in the users guide (manual 02). There, some important aspects and proposals of how to treat ocean attraction and loading in the prediction procedure.

### 5.2 Eterna Systems et34-x-V80-\*.7z

The installation procedure is explained in detail in the Installation Guides in et34-docu-v80.7z (see section 4.).

#### 5.2.1 Eterna system et34-x-v80-gnusim.7z

- commdat-v80
- et34-ana-v80-gnusim

#### 5.2.2 Eterna system et34-x-v80-lnxgnu.7z (no graphics)

- commdat-v80
- et34-ana-v80-lnxgnu

#### 5.2.3 Simfit configuration directory files simfit-v80.7z

The following directories are delivered

- cfg : containing the Simfit configuration files.
- res : empty
- usr : empty