# *GRANETA* – Instruction Guide

*A MATLAB-based Program for GRAvity NETwork Adjustmetn.*

The program performs the least squares adjustment of Scintrex CG-3/3M and CG-5 gravity measurements, according to procedures and adjustment model described in:

Repanić, M. 2019. Optimal Adjustment Models of Scintrex CG-3M Gravimeter Measurements with Respect to the Most Significant Instrumental Error Influences. Doctoral thesis. Ljubljana, University of Ljubljana: pp..

The program consists of the main program:

- *GRANETA* for adjustment of gravity networks

and two auxiliary programs:

- *GRANETA_drift* for analysis of the daily transportation drift and
- *GRANETA_ETC* for automated interpolation of tidal parameters from a grid of synthetic tidal parameters, prediction of the Earth, ocean and pole tide reductions using *PREDICT* software from *ETERNA* package (Wenzel, 1996) and creation of new data files based on the reductions from *PREDICT*.

The program is designed for adjustment of gravity networks, but it can also be used for the estimation of the corrections of calibration constants based on measurements on calibration line or system, as well as the estimation of the linear vertical gravity gradients.

## Before starting *GRANETA*

### Installation

*GRANETA* is a *MATLAB*-based program designed in version R2010b, which should be run from *MATLAB*'s Command Window. It can be simply copied to any location on a hard disk. The functions and script files of the main program are stored in the main folder ('GRANETA'), while functions of the auxiliary programs are stored in separate sub-folders ('GRANETA_drift' and 'GRANETA_ETC'). Since auxiliary programs also use the functions of the main program, the main program should be added to the MATLAB search path. Alternatively, the contents of the folders with auxiliary programs ('GRANETA_drift' and 'GRANETA_ETC') can be moved to the main folder (GRANETA) and all the programs can then be run from 'GRANETA' folder.

### Data organisation

Since the program is highly automated (e.g., it automatically assigns observations to specific campaigns and gravimeters, and determines observation scheme from the data itself), it is important to meet following requirements on data organisation:

1. Every observation file should contain the data of one measurement day only. In contrary, the data should be manually separated into several files. In fact, the observation file determines the time interval, over which the daily drift will be approximated. If one wishes to model, e.g. two separate daily drift polynomials for morning and afternoon sessions, two observation files should be created: one comprising the observations of the morning and another of the afternoon session.

2. Organisation of the observation files in folders should correspond to the division of data to campaigns and gravimeters, since for each folder separate correction of calibration coefficient will be determined. All observation files belonging to a specific gravimeter and campaign should be stored in the same folder. Observation files belonging to different campaigns or gravimeters should be stored in separate folders. Accordingly, every observation file from one folder should have the same serial number and calibration constant specified in the header. When running the program it is only necessary to define the path to the specific folder with observation files. The program will then automatically read the contents of the folder and assign all the files from the folder to specific gravimeter and campaign. Therefore, the folder should not contain any additional files besides observation files.
3. Within a campaign always the same internal numeric designators (IDs) for station names should be used by all gravimeters (with exception of the latitude-longitude-gravity format of CG-5). If for example, different station designators were used by one of the gravimeters from a specific campaign, the data from that gravimeter should be assigned to separate campaign (upon data input). In contrary, the observation files should be manually edited to meet the above requirement.
4. The name of the file with field records data should correspond to the name of the observation file. E.g., if the name of an observation file is 'name.txt' or 'name.dat', the file with field records data should be named 'name_FR.txt'.
5. The files with field records data should have three columns: the instrument height (in m), ambient pressure (in hPa) and difference between the instrument and sensor heights (in m, depending on the reference point up to which the instrument height is measured and the instrument type). Each line in the file with field records data should correspond to one occupation, regardless of how many readings is recorded during an occupation. There should be no header lines.
6. The files with field records data can be stored all in one folder (if their names do not repeat) or in separate folders, analogous to observation files.

## Auxiliary files

Before starting the program, several auxiliary text files should be created. Files under points 1 and 2 are mandatory, while files under points 3 – 5 should be created only if corresponding datum definition will be used. For all files, tab or space can be used as separator. One can find it convenient to edit the data in *MS Excel* and then to save it as a text (tab delimited) file.

1. File with data on stations.

   The file has two header lines (which are ignored upon input) and columns as follows:

   1) Station name;
   2) Gravity value in μm $s^{-2}$;
   3) Standard deviation of the gravity value in μm $s^{-2}$;
   4) Vertical gravity gradients in μm $s^{-2}$/m;
   5) Latitude in decimal degrees;
   6) Longitude in decimal degrees;
   7) Height above sea level in m;
   8) Altitude (ellipsoidal height) in m.

   The main *GRANETA* program uses values from columns 1, 2, 4 and 7. In case of the CG-5 'latitude-longitude-altitude-gravity' format, the main program also uses values from columns 5 and 6. Program *GRANETA_drift* uses values from the columns as the main program, apart from column 2. Program *GRANETA_ETC* uses values from columns 1, 2, 5, 6 and 8. In this version, values form column 3 are not used. It is recommended to fill the missing values with "–999".

2. Files with internal numeric designators (IDs) for station names used by gravimeters (one file for each campaign).

   The file should contain entries (lines) for all stations used within a campaign and only for those stations used within the campaign. The file has two header lines and columns as follows:

   1) Station name (should be identical to station name from the file with data on stations);
   2) Numeric designators (IDs) used by gravimeter.

   If identical IDs are used by gravimeter as station names from the file with data on station, the file should still be defined, but with two identical columns.

3. File with uncorrelated (absolute) gravity measurements (for datum definition with uncorrelated pseudo-observations).

   The file has two header lines and columns as follows:

   1) Station name (should be identical to station name from the file with data on stations);
   2) Gravity value that shall be introduced as pseudo-observation in μm $s^{-2}$;
   3) Standard deviation of the gravity value in μm $s^{-2}$.

4. File with correlated gravity values (for datum definition with correlated pseudo-observations).

   The first line of the file should contain only the number of correlated gravity values, which shall be introduced as observations. Then, two header lines (which are ignored upon input) follow. Finally, the file should contain following columns:

   1) Station name (should be identical to station name from the file with data on stations);
   2) Gravity value that shall be introduced as pseudo-observation in μm $s^{-2}$;
   3) Covariance matrix of gravity values given in column 2, whose elements are in (μm $s^{-2})^2$. (Columns from 3 to 2 + the number of the gravity values).

5. File with corrections of calibration coefficients determined from independent measurements on calibration line or system (for datum definition with pseudo-observations, if calibration coefficients shall be introduced as pseudo-observations along with gravity values).

   The file has two header lines and columns as follows:

   1) Name of the parameter, i.e. correction of calibration coefficient (it should be identical to the name of the parameter as created by the program in the course of adjustment with almost minimum constraint);

2) Value of the correction of calibration coefficient that shall be introduced as pseudo-observation times $10^4$;
3) Standard deviation of the correction of calibration coefficient times $10^4$.

## Input script file

The program offers two types of input definition: through a *MATLAB* script file or through the GUI (graphical user interface). It is recommended to use a script file, especially if the adjustment is going to be executed several times. The same script file can be defined and used for the main program and two auxiliary programs. The script defines following variables:

| Variable | Type | Dimensions | Description |
|---|---|---|---|
| dir_gl | string | | Path to the main directory of the project. |
| br_kamp | double | 1 x 1 | Number of campaigns within the project. |
| br_gpk | double | br_kamp x 1 | Vector that contain the number of gravimeters in each campaign. |
| i_CG5 | double | br_kmp x max(br_gpk) | Matrix of indexes of CG-5 gravimeters. Possible values of elements are:<br>0 for CG-3,<br>–2 for CG-5 with format line-station-altitude-gravity;<br>1 for CG-5 with old format (without date) latitude-longitude-gravity and<br>2 for CG-5 with new format (with date) latitude-longitude-gravity. |
| tocke_dat | string | | Path to the file with data on stations. |
| t_ID_dat | cell | br_kamp x 1 | Cell array with paths to the files with numerical station identifiers as used in gravimeter. |
| dir_m | cell | br_kamp x 1 | Cell array with paths to the directories with the data files (measurements) for each campaign and gravimeter. |
| dir_m{i} | cell | br_gpk(i) x 1 | Component of dir_m. |
| s_post | double | sum(br_gpk) x 1 | Vector with referent standard deviation for specific campaign and gravimeter. The standard deviations should be ordered first by campaign and then by gravimeter, respecting the order in dir_m variable. |
| dir_FR | cell | br_kamp x 1 | Cell array with paths to the directories with the field records for each campaign and gravimeter. |
| dir_FR{i} | cell | br_gpk(i) x 1 | Component of dir_FR. |
| dir_i | string | | Path to the directory where output files should be stored. |
| s_REL | double | 1 x 1 | A posteriori referent standard deviation of the relative observations only. |
| dat_po_g | string | | Path to the file with uncorrelated (absolute) gravity measurements (for datum definition with uncorrelated pseudo-observations). |
| dat_po_cg | string | | Path to the file with correlated gravity values (for datum definition with correlated pseudo-observations). |
| dat_y | string | | Path to the file with corrections of calibration coefficients determined from independent measurements on calibration line or system (for datum definition with pseudo-observations, if calibration coefficients shall be introduced as pseudo-observations as well). |

The last four variables can be set to the empty value. They are used only if network datum is going to be defined with pseudo-observations. In addition, they can be defined during program execution, as well.

### Input script file for *GRANETA_ETC* settings

The auxiliary program *GRANETA_ETC* offers two types of definition of *GRANETA_ETC* settings: through a *MATLAB* script file or through the GUI. It is recommended to use a script file, especially if the *GRANETA_ETC* is going to be executed several times. The script defines following variables:

| Variable | Type | Dimensions | Description |
|---|---|---|---|
| path_pr | string | | Path to the project file in *PREDICT*. |
| step | double | 1 x 1 | Step in seconds for ETC calculation using *PREDICT*. |
| grid_frmt | double | 1 x 1 | Grid format. Possible values are:<br>1 for 1x1° grid WPARM.DAT from Timnmen and Wenzel (1996) or<br>2 for 0.5x0.5° grid template used by Zahran et al. (2005) and ICET (2016) |
| grid_file | string | | Path to the grid file. |

## Running *GRANETA*

### The main program: *GRANETA*

The main program performs the least squares adjustment of Scintrex gravity observations. An observation in the adjustment is the reading, or more precise hte mean value of all readings taken during an occupation, (as opposed to reading differences as used by some programs). The functional model for the observations comprises the gravity values at all stations, corrections of calibration coefficients of every gravimeter and campaign, instrument levels and coefficients of the daily drift polynomials as parameters. The program offers several possibilities for datum definition and several stochastic models. Below, the main options are explained.

#### *Selection of the input definition*

The program offers two types of input definition: through a *MATLAB* script file or through the GUI. It is recommended to use a script file, especially if the adjustment is going to be executed several times. The content of the script file is described in section Input script file. If input mode through a script file is selected, the script file is selected through the GUI.

#### *Program settings*

After definition of the input, the following adjustment settings can be selected:

1. Observations

   Arithmetic or weighted mean of all readings from an occupation can be used as observation. In the latter case, the weights are inversely proportional to the squared standard deviations of individual readings (from the observation file).

2. Weights

   a. Standard deviation of gravimeters for campaigns

      The weights of observations belonging to one gravimeter within one campaign are equal. They are inversely proportional to the squared referent standard deviations of the specific gravimeter and campaign defined in the input script file. These standard deviations can be estimated by previously performing separate adjustments of observations belonging to only one gravimeter and campaign (as organised in the input script file). If one wishes to define the equal weights to all gravimeters and campaigns, the same values should be assigned to all elements of the variable 's_post' in the input script file (e.g. the values of all the elements should be set to one).

b. Standard deviations of observations

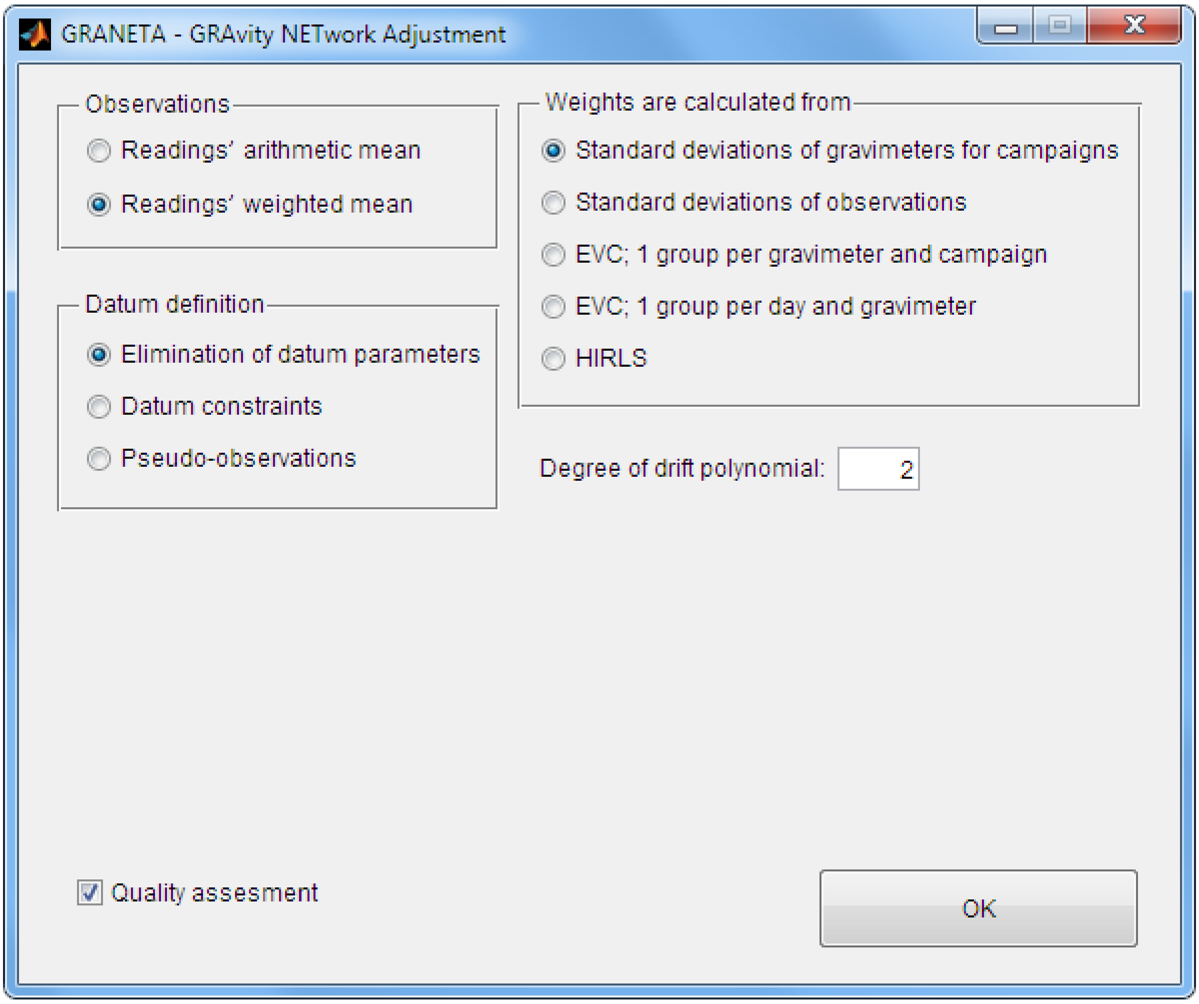
The weights are inversely proportional to observations' variances. Since the observations are arithmetic or weighted mean of all readings form one occupation, the weights are inversely proportional to variances of respective mean.

c. EVC, one group per gravimeter and campaign

The weights are defined according to the simplified algorithm of the estimation of variance components for the group effects (as described in Caspary, 2000). This option should provide the solution very similar to the option a, if for standard deviations of gravimeters and campaigns, a posteriori referent standard deviations are taken from adjustments of specific gravimeter and campaign.

d. EVC, one group per day and gravimeter

The option uses the same algorithms as the previous one, except that the groups of observation, for which the variances are estimated, now comprise the observations of one day belonging to one gravimeter.



e. HIRLS

The weights are determined according to the HIRLS (Hungarian iterative reweighted least squares algorithm) described in Csapó and Völgyesi (2002). Thus the weights are determined iteratively and separately for each observation, which can neutralise the gross-errors.

The options a or c are recommended and they yield similar results. For options c, d and e it is only possible to select the first option for the datum definition. However, after such adjustment, it is possible to perform the adjustment with pseudo-observations in the same program session with the same weight matrix as determined in the previous adjustment. Although options d and e can result in improvement in the precision estimates as compared to options a, b and c, they are not recommended since they are sensitive to systematic influences and could provide unrealistic (inaccurate) results.

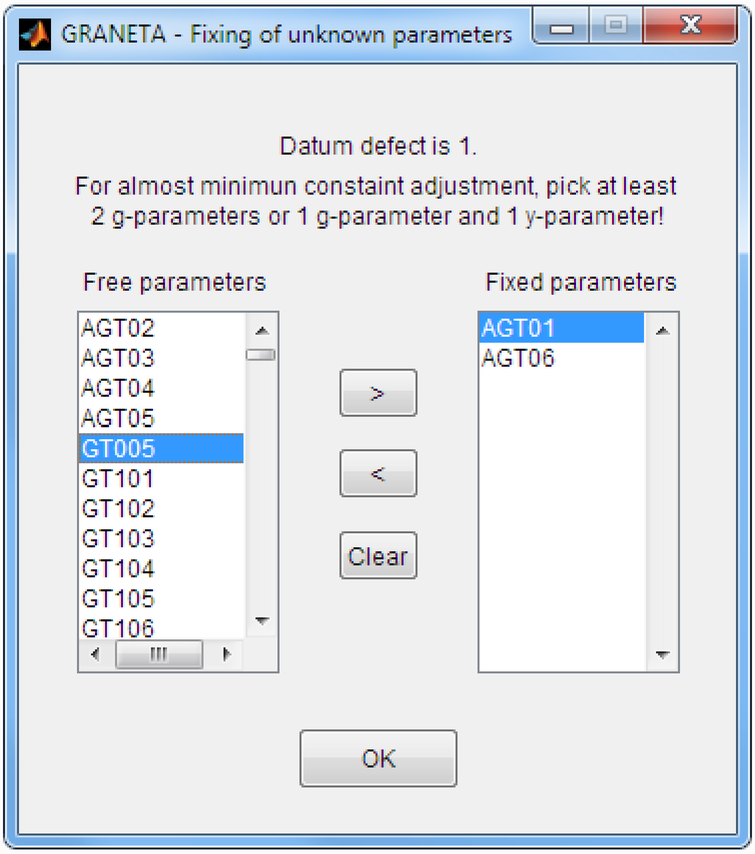
3. Degree of drift polynomial

There are no built-in limitations for the selection of the degree of daily drift polynomial. However, the user has to take care of limitations posed by the observation scheme.

4. Datum definition

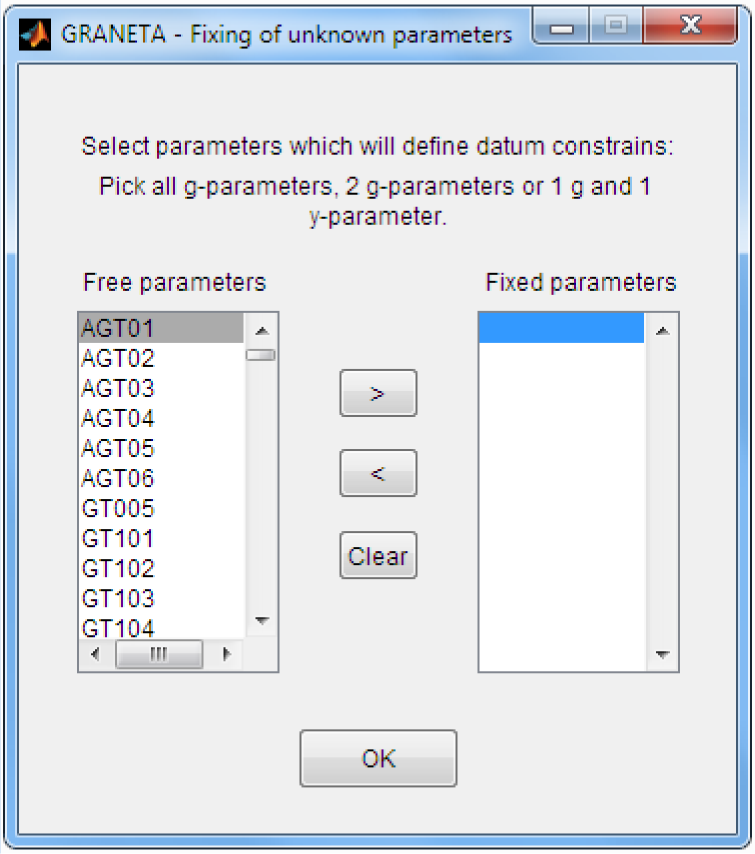
a. Elimination of datum parameters

Almost minimum constraint or over-constrained datum definition can be obtained simply by fixing the values of selected parameters to approximate gravity values from the file with data on stations or the zero value (for other parameters).



b. Datum constrains

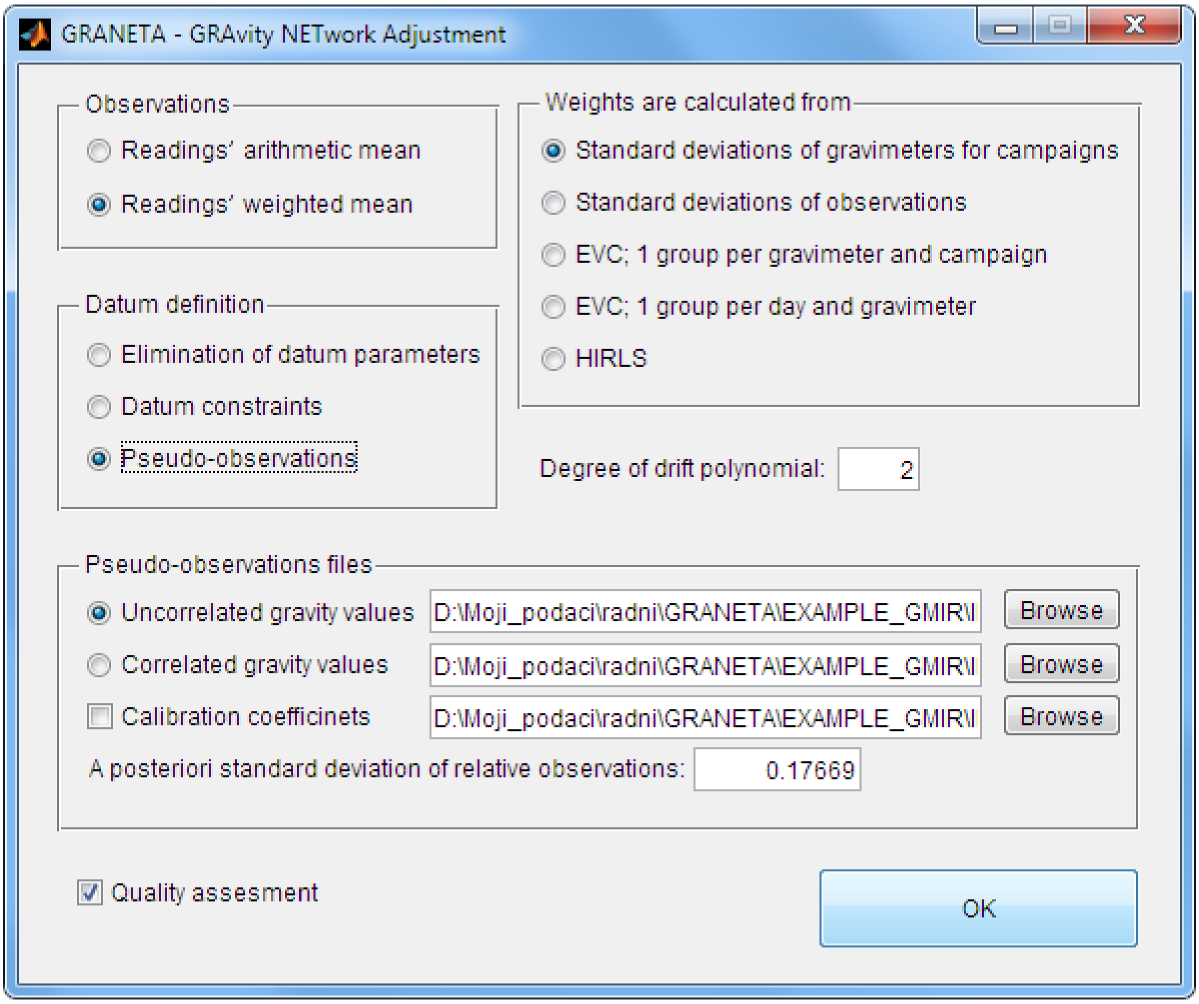
No matter how many parameters is selected to contribute the datum definition, almost minimum constraint will be accomplished by adding two datum constraints to normal equations: one, which defines an origin of the 1D network, and another, which defines a scale. It is recommended to select two gravity value parameters, one gravity value and one correction of calibration coefficients or all gravity values. However, if only two datum parameters shall be selected, it is recommended to use datum definition with elimination of datum parameters. If all gravity values are selected, the two conditions will ensure that the centre of gravity does not change and that the network scale remains the same. Only in the case of datum definition with datum constraints, the least squares adjustment is carried out through normal equitation, while for all other options, the adjustment is carried out by QR factorisation. For the datum definition with datum-constraints, only the first two options of weights definition are available.



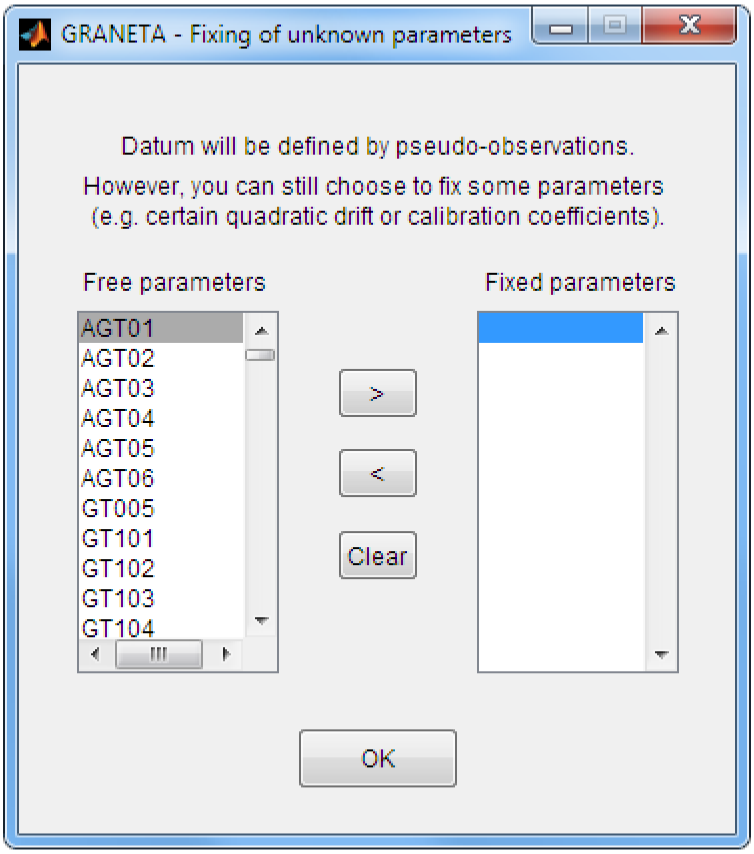

c. Pseudo-observations

The network datum is defined by gravity values introduced as pseudo-observations. Thereby, more than one pseudo-observation per station can be introduces as pseudo-observation. It is possible to introduce uncorrelated gravity values or correlated gravity values as observations. In addition to the gravity values, corrections of calibration coefficients can be introduced as pseudo-observations as well. All three types of pseudo-observations have specific file formats described in section Auxiliary files. The weights of the relative observations will be defined as selected, while for the pseudo-observations, the weights will be balanced with

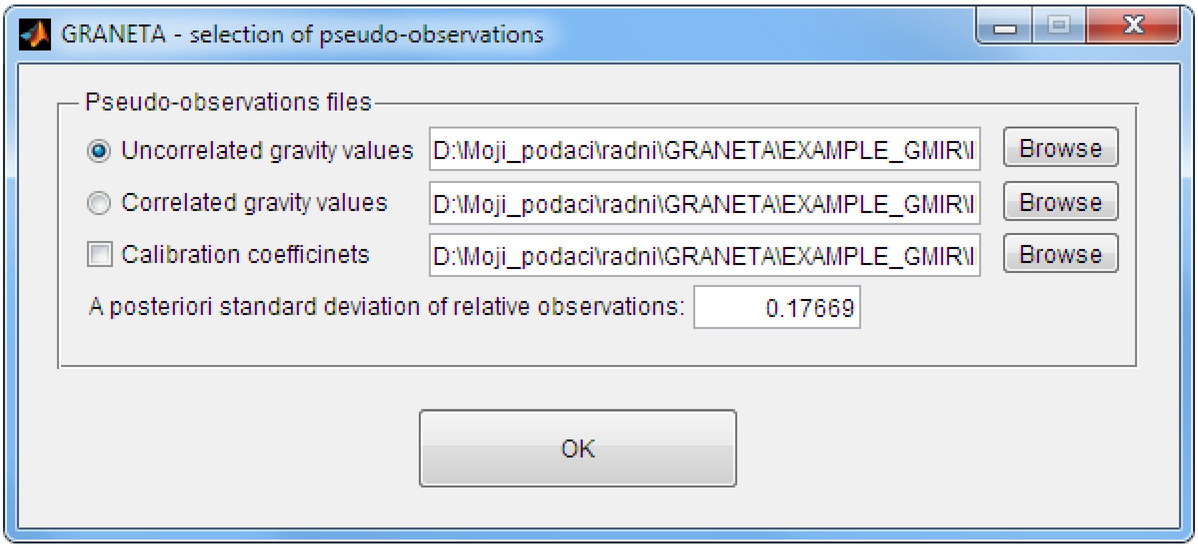
respect to the relative observations by the means of a posteriori referent standard deviation of relative observations ($\bar{\sigma}_0$). Specifically, in case of uncorrelated pseudo-observations, their weights are the squared quotients of the referent standard deviation of relative observations and standard deviations of pseudo-observations (from the file with pseudo-observations), while in case of correlated pseudo-observations, their weight matrix is a product of squared a posteriori referent standard deviation and the inverse of the covariance matrix of pseudo-observations (from the file with pseudo-observations).
If this option is selected, the user has to define paths to the file(s) with respective pseudo-observations and a posteriori referent standard deviation of relative observations. The a posteriori referent standard deviation is assumed to be a better estimation as compared to a priori referent standard deviation, although it is possible to enter any desired value. If these parameters are defined in the input script file, they will be automatically filled with values form the script file. The user can revised them now or change them, if needed.




Although the datum will be defined by pseudo-observations it is still possible to fix some parameters. This option can be useful, if e.g. the second degree drift polynomial is selected and for certain days the drift should be modelled with the first degree polynomial (e.g. because the profile method is used). Fixing the second order drift coefficients to approximate (zero) value will have the same effect as if for respective days, the drift is modelled with the first order polynomial.




Since the value of the referent standard deviation of the relative observations can be manually entered or read from the input script file, it is not necessary to perform the adjustment with almost minimum constraint in the same session as the adjustment with pseudo-observations. Though, the user should take precautions to select the same weight option and to eliminate the same observations as in the previous adjustment session. However, for the iterative weight definitions (EVC or HIRLS), the adjustment with almost minimum constraint should be carried out in the same session and before the adjustment with pseudo-observations. For that purpose, after the adjustment with one of the first two options for datum definition is finished, the user has the option to perform the adjustment again, but now with pseudo-observations. In that case, all the settings (or more precisely the observation equations) shall be retained form the previous adjustment, while only the pseudo-observations have to be defined or revised in the separate window. The a posteriori referent standard deviation will, in this case, be taken directly from the previous adjustment and not from the input script file. However, the user should take precautions to eliminate the same non-gravity parameters (e.g. drift coefficients) and the same observations, which will automatically be offered on the list of eliminated observations.

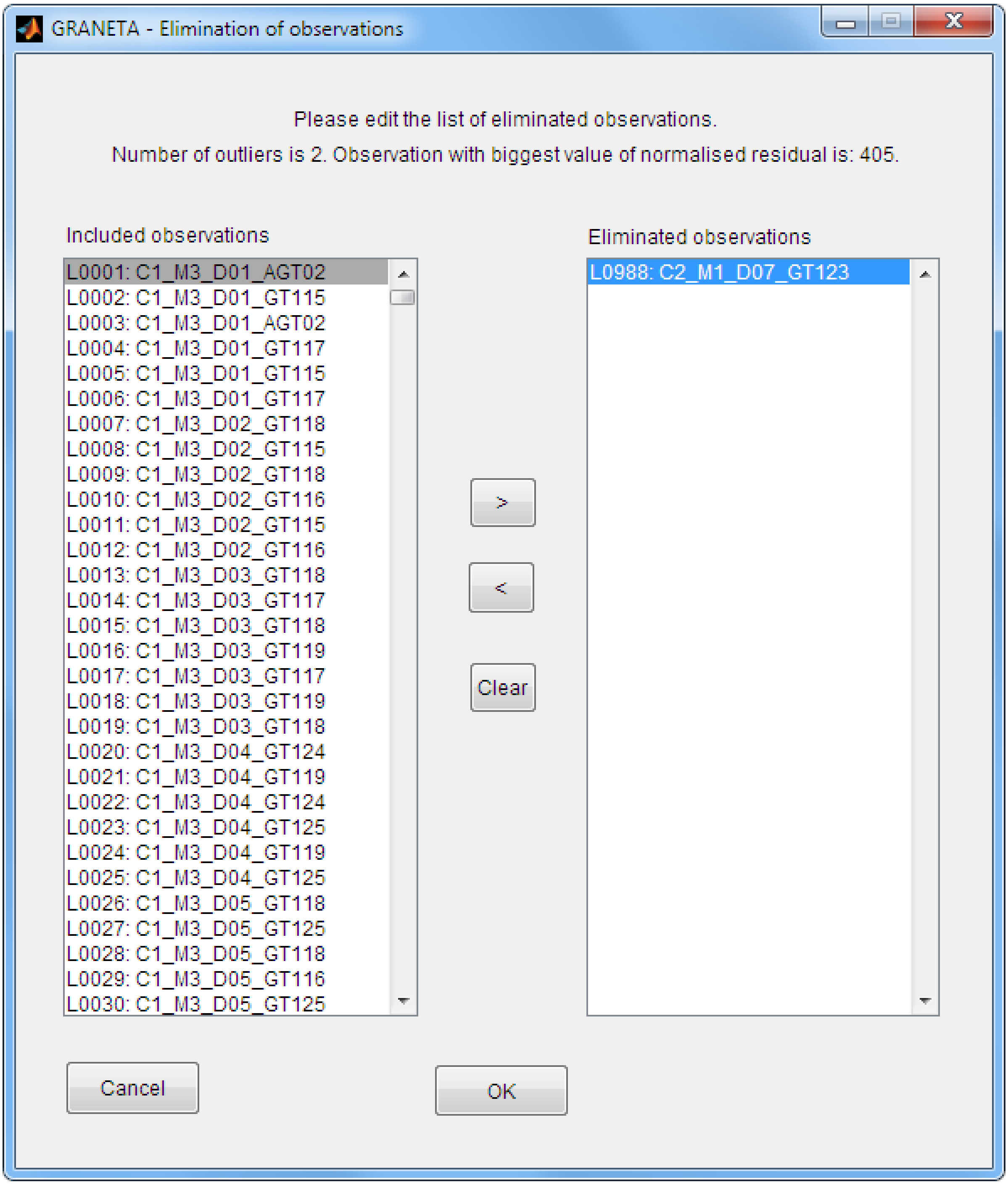



5. Quality assessment

   The user can chose to include or not the quality assessment (measures of precision and reliability) based on eigenvalue decomposition, which requires notably longer computation time. If quality assessment is not selected, only standard deviations of parameters and observation, as well as redundancy numbers, shall be included in the output file.

### *Eliminations of observations and Tau-test*

After definition of program settings and elimination (selection) of parameters, the program shall perform the Tau-test. Actually, even before the Tau-test, the program offers to eliminate certain observations. This is useful is erroneous observations are identified in previous program session. The program offers iterative gross error detection. If all least one residual failed the Tau-test, the GUI will provide the user with the number of the observation with the biggest value of normalised residual. However, it is recommendable to consult the output file of Tau-test 'test_GT_*.txt' to check whether the redundancy number of respective observation is the dominant one. If it is, the outlier will most probably be caused by the gross error in corresponding observation. In contrary, one should attempt to localise the gross errors by further inspection and iterative "trial and error" procedure, as advised by Kuang (1996). The program can be stopped at any iteration of gross-error detection by clicking the 'Cancel' button.




***Output files***
When the program finishes execution, it will display a message with the location of the output files. The files in the output folder will never be overwritten. The first free numerical suffix will be assigned to the new files. There are three types of output files:

1. preprocess*.txt

   The files contains the results of pre-processing: calculated mean readings and their standard deviation, reduction for the atmospheric pressure and height reduction, as well as the reduced mean observation and the value of total corrections and reductions. One file is created for each gravimeter and campaign. Besides intermediate results, these files contain the information useful for identification of specific observations or parameters from the names automatically assigned by the program and which contain the number of the respective campaign, gravimeter and day.

2. adjust_*.txt

   The file contains:

   - the observation equitation,
   - the results of adjustment: the parameter vector and its cofactor matrix,
   - the number of redundant observations and related data,
   - the adjusted parameters and their standard deviations,
   - the global measures of precision (if quality assessment option is selected),
   - the adjusted observations, their standard deviations, redundancy numbers and absorption numbers for all parameters and only for gravity-parameters (the latter if quality assessment option is selected),
   - the global measures of internal and external reliability for all parameters and for gravity-parameters only (if quality assessment option is selected).

   Because of its size, it is recommended to open the file with MS Excel. In the file, the gravity parameters are named according to the station name from the file with data on stations, while other parameters: corrections of the calibration coefficients (y), the level unknowns (N) and drift coefficients (d1, d2, …) are referred to respective campaign (C), gravimeter (M) and day (D). The indexes of the gravimeters used in the file are referred to the gravimeters serial numbers on top of the file. The observations are all indexed with ordinal numbers and are referred to respective campaign (C), gravimeter (M), day (D) and station. For identification of the specific observation or parameter it is useful to consult the respective file with results of pre-processing. An ordinary number of a day for a certain gravimeter within a certain campaign can in this way be related to respective date and observation file.
   If the datum definition with datum constraints is selected, the file will have a suffix 'DC', while in case of datum definition with pseudo-observation the suffix will be 'PO'.
   Only in case of correlated pseudo-observations, the respective block of the weight matrix will not be diagonal, but a full matrix. However, to save space, in all cases only the diagonal elements of the weight matrix are printed in the file. Since the user already disposes the covariance matrix of pseudo-observations and a posteriori reference standard deviation of the relative observation, he or she can easily calculate the full sub-matrix of pseudo-observations and check its diagonal elements.

3. test_GP_*.txt

   The file contains the information and results on performed Tau-test. The numerical suffix of this file does not necessarily correspond to the numerical suffix of the file with results of adjustment. If there are several files with the results of adjustment and the results of Tau-test, it is recommended to list the files according to the time of creation or modification for easier identification.

## The auxiliary program: *GRANETA_drift*

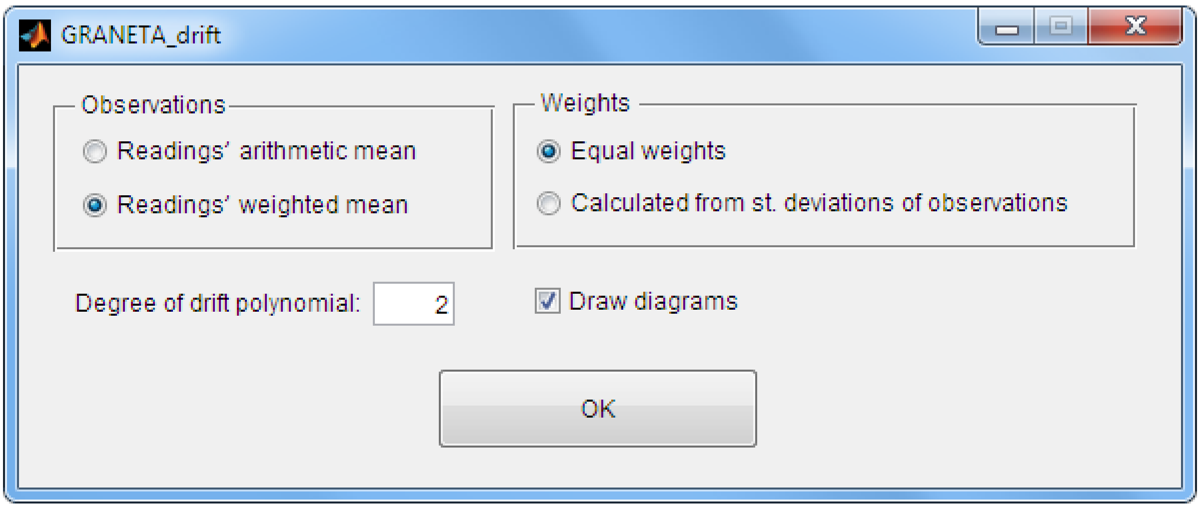
The program calculates the coefficients of the daily drift polynomials and their standard deviations from separate daily adjustment of observations from the drift polynomial of degree 1 up to defined degree. Before the calculation of the drift polynomial, the readings are pre-processed, which include calculation of the mean reading for each occupation and reductions for atmospheric pressure and height. In order to obtain a more accurate numerical solution, the reference time is set to the mean reading time in a day. Because the gravity values at specific stations are not of the interest for drift calculation and in order to remove the datum defect, the instrument level is fixed to zero. If there are no redundant observations for determination of the drift polynomial of specified degree, the program will determine the drift without adjustment, as a unique solution.

***Selection of the input definition***

The program offers two types of input definition: through a *MATLAB* script file or through the GUI. It is recommended to use a script file. The same input script file can be used as for the main program. The content of the script file is described in section Input script file. However, if the script file is going to be used for the auxiliary program *GRANETA_drift* only, the variable s_post and all the variables necessary for the adjustment with pseudo-observation do not have to be defined. If input mode through a script file is selected, the script file is selected through the GUI. The program uses the same GUI for the input definition as the main program. Although it is necessary to select all the required values through the GUI input definition, note that it is not relevant which values are set for the a priori referent standard deviation of respective campaign and gravimeter.

***Program settings for* GRANETA_drift**

It is required to select a few settings of the auxiliary program. Namely, the user should select the type of readings' mean, which shall be used as observation and the weights definition for the daily adjustments, as well as the degree of the drift polynomial. These settings corresponds to the settings of the main program *GRANETA* and one can refer to section Program settings in Running *GRANETA* for further information. One should note that the two options for the weights definition correspond to the first two options from the main program. In addition to these options, it is possible to enable or disable the plotting of the daily drift diagrams.

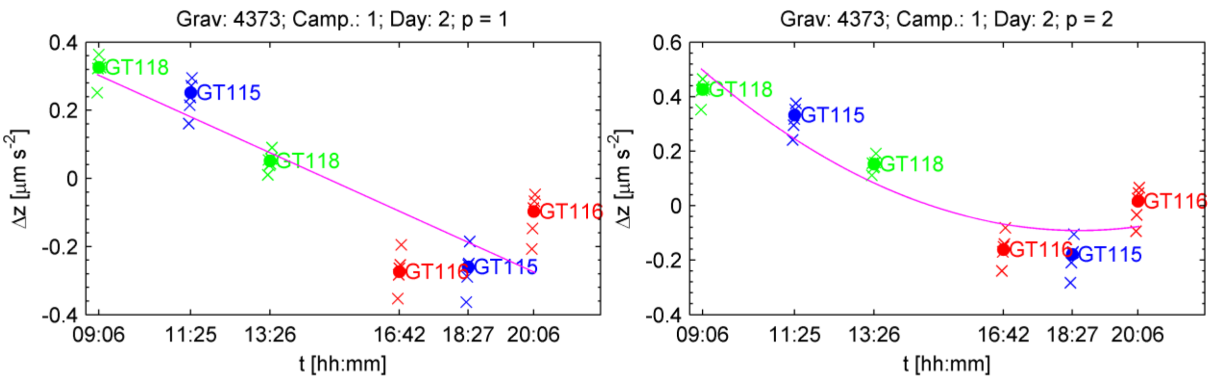



***Results of the auxiliary program:* GRANETA_drift**

When the program finishes execution, it will display a message with the location of the output files. The output consist of the 'drift.xls' file (with the coefficients of the daily drift polynomials and their standard deviations) and diagrams of the drift polynomials. Separate tabs in MS Excel file are created for the coefficients and standard deviations of each gravimeter, while drift coefficients and standard deviations of the same gravimeter that belong to different campaigns are stacked one after another. The order of columns with the drift coefficients or their standard deviations is the following:

c1_p1,c1_p2, c2_p2, c1_p3, c2_pr, c3_p3, …,

where c* denotes an order of coefficient and p* a degree of polynomial. The order of the gravimeters, according to which the tabs are created, and the order of campaigns for stacking within the same tab corresponds to the order used at input definition (in variable dir_m, or as specified through the GUI). If drift coefficients are determined without redundant observation, the values of the corresponding standard deviations will be set to –99. If the drift cannot be determined even as the unique solution, the values of drift coefficients will be set to 0 and of corresponding standard deviations to –999.
The diagrams of the daily drifts are stored in the sub-folder of the output folder named 'Diag_DRIFT'. For each gravimeter and campaign, separate sub-folders are created within this folder. For each determined daily drift, the drift diagram will be plotted with the mean readings reduced for determined gravity value at the corresponding station ($\Delta z_i = z_i - g_k$). It is important to emphasise that in this way, only the relative relation between different occupations of the same stations are relevant, while the relative relation between occupations of different stations are defined by the determined drift function, and can appear shifted along the ordinate for drift polynomials of different orders. If only one occupation is available for a station, it will not be plotted, since it is not relevant for drift determination. Besides the mean readings, complete observation series will be plotted. If the drift function is determined based on the adjustment of redundant observations, it will be plotted in magenta, and if determined as a unique solution without redundant measurement, in yellow. The header of the drift polynomial specifies the serial number of gravimeter, campaign, measuring day within the campaign and the degree of the drift polynomial.




While the contents of the drift file will be overwritten in new session of GRANETA_drift, the diagrams of the daily drifts will never be overwritten. The first free numerical suffix will be assigned to the new files.

## The auxiliary program: *GRANETA_ETC*

The program performs automated interpolation of tidal parameters from a grid of synthetic tidal parameters, prediction of the Earth, ocean and pole tide reductions using PREDICT software from ETERNA package (Wenzel, 1996) and creation of new data files based on the reductions from PREDICT.

### *Selection of the input definition*

The program offers two types of input definition: through a *MATLAB* script file or through the GUI. It is recommended to use a script file. The same input script file can be used as for the main program. The content of the script file is described in section Input script file. However, if the script file is going to be used for the auxiliary program *GRANETA_ETC* only, the variables s_post, dir_FR, dir_i, and all the variables necessary for the adjustment with pseudo-observation do not have to be defined. If input mode through a script file is selected, the script file is selected through the GUI. The program uses the same GUI for the input definition as the main program. Although it is necessary to select all the required values through the GUI input definition, note that it is not relevant which values are set for the output folder, folder with the field records and the a priori referent standard deviation of respective campaign and gravimeter.

### *Selection of the settings definition*

It is required to select a few settings of the auxiliary program. Again, it is recommended to define these settings through *MATLAB* script file, although it is possible to select it through the GUI as well. The content of the script file is described in section Input script file for *GRANETA_ETC* settings.

### *Results of the auxiliary program:* GRANETA_ETC

After the definition of the input and settings, the program automatically execute all the actions necessary to create the new observation files with the Earth, ocean and pole tide reductions from *PREDICT*. The results are the input and output files from *PREDICT* in folders 'ETC_PR_c*', where * denotes the number of the campaign, (in the main folder of the folder with the input data) and the new observation files (in the same main folder as the folder with original observation files). The names of the folders with the new observation files are the same as the folders with the original files, but with suffix '_ETC_PR'.

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