

Scheduling - Simulation - Analysis

Exercise for VieVS Workshop 2014

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Tasks:

- Create observation schedules for given stations for two consecutive days in October 2002.
- According to these schedules simulate the time delays which would be measured in such a network and create in this way NGS files with artificial observations.
- Take these two NGS files as input for an analysis of VLBI observations with VieVS. Plot the calculated baseline length repeatabilities with the VieVS plotting tool.
- In a global solution (of both sessions) compute the station coordinates.

Scheduling

A Continuous VLBI Campaign CONT02 was scheduled with the NASA sked program to be observed in the second half of October 2002. The plan for the CONT02 campaign was to acquire the best possible state of the art VLBI data over a two-week period to demonstrate the highest accuracy of which VLBI is capable. The stations participated in the CONT02 are shown in Figure 1. In our exercise we will not schedule the station GILCREEK.

CONT02 Stations



Figure 1: Stations of the original CONT02 campaign.

Scheduling with VieVS software

In our exercise you should make 24-hour schedules for the first two days of the original CONT02 campaign, i.e. **October 16 and 17, 2002 starting at 6 pm UTC**. In the scheduled network following 7 stations should be included:

ALGOPARK, HARTRAO, KOKEE, NYALES20, ONSALA60, WESTFORD and WETTZELL.

1. Open Matlab, change the current folder to VieVS/WORK and type *views*
2. In the GUI go to Scheduling --> Parameters
 1. Select the 7 stations which will participate in the session (Fig. 2).
 2. Choose the start of the session (16.10.2002, 6 pm UTC) and the duration (24 hours). (Each session has to be planned separately.) (Fig. 2).
 3. Check the settings for the minimum SNR for the X-Band und S-Band (20, 15) (Fig. 2).
 4. We will apply the source-based strategy with 2 sources observed simultaneously (Fig. 2).
 5. In the GUI menu bar change to „Run“ and choose the module *vie_sched*. The scheduling software can be now started with the „Save + Run“ button (Fig. 3).

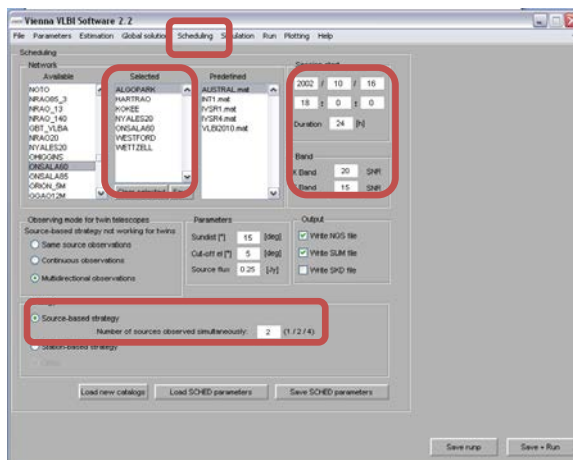


Figure 2.

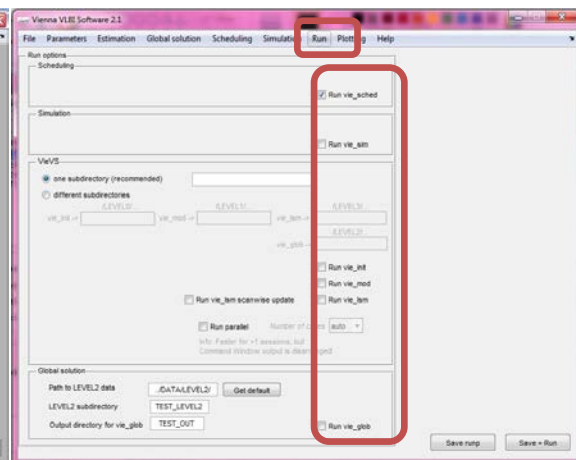


Figure 3.

Repeat the scheduling for the second session taking place on October 17, 2002. You have to change only the datum in the menu bar "Scheduling" (Fig. 2).

The created schedules and the scheduling protocol can be found in VIEVS/DATA/SCHED/2002/.

Simulation of the VLBI observations

You have now created two schedules - instructions for the radio telescopes which source will be observed at which time. Because there do not exist any real observations which would follow your instructions, we will simulate artificial time delays.

In VieVS the simulated VLBI observables are generated taking into account the three most important stochastic error sources in VLBI, i.e. tropospheric wet delay, station clock, and measurement error.

1. With the simulation tool we want to simulate all observations which were scheduled. Therefore do not choose any directory with outliers (GUI menu bar "File") and as the directory with specific session options choose an empty directory. If you do not have it in your computer, create an empty directory in VIEVS/DATA/OPT/ and name it e.g. EMPTY (Fig. 4).
2. In the menu bar "File" select sessions (i.e. the prepared schedules in NGS format) which you want to simulate. You find them in VIEVS/DATA/SCHED/2002/ (Fig. 4).
3. In the menu bar "Simulation" you can choose the error sources which will be taken into account. They can be defined for all stations identically in the GUI by the click on "specify now". You do not need to change the default values (Fig. 5).
4. The simulation software can be started in the menu bar "Run". For the creation of the simulated time delays the modules `vie_init`, `vie_mod` and `vie_sim` have to be run. You can specify a name of the subdirectory where the interim results and data will be stored in VIEVS/DATA/LEVEL0/ and LEVEL1 directories. For the run press the button "Save +Run" (Fig. 6).

The simulated NGS files will be stored in VIEVS/DATA/SIM/2002/.

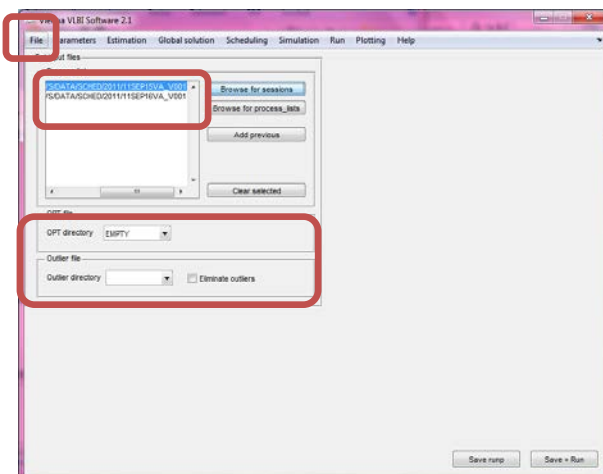


Figure 4.

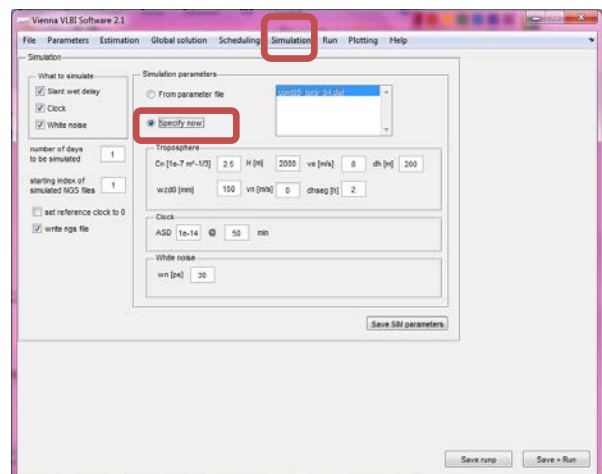


Figure 5.

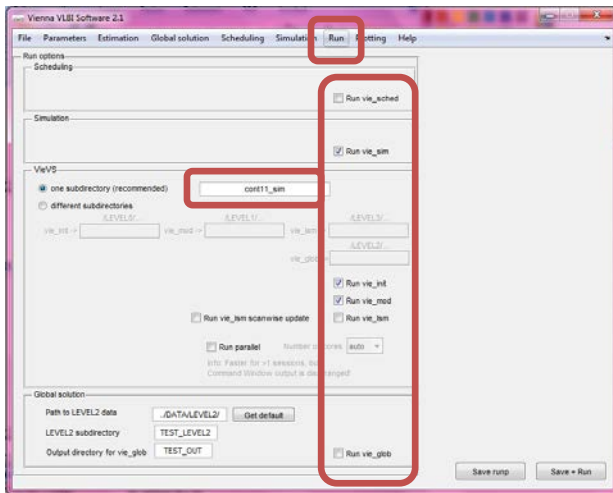


Figure 6.

Analysis of the artificial VLBI observations

The analysis of the artificial observations will be done in the same way as it would be done for the real time delays. It is only recommended not to use any outliers and option directories.

In the analysis of a 24 hour session we usually estimate: clock parameters, zenith wet delays, troposphere gradients, EOP and station coordinates. You can also estimate the source coordinates. For the parameterization of these parameters use the default settings of the GUI.

1. In the menu bar "File" select the NGS files with observations which you want to analyse. The simulated files can be found in VIEVS/DATA/SIM/2002/ (Fig. 7).
2. Do not select any outlier and OPT-directories (Fig. 7).
3. For a further processing of the data with Vie_GLOB click on the button for preparation of the normal equation matrices which will be used as input for Vie_GLOB. This has to be done in the menu bar "Estimation / Global parameters". You can also add partial derivatives of source coordinates into the NEQ system (Fig. 8).
4. In the menu bar "Run" select the modules "vie_init", "vie_mod" and "vie_ism". Choose a name for the subdirectory where the results will be saved (VIEVS/DATA/LEVEL3/subfolder). The analysis can be started with the "Save +Run" button (Fig. 9).

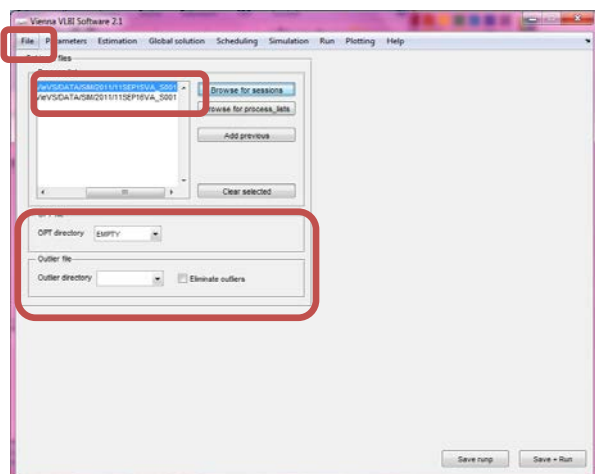


Figure 7.

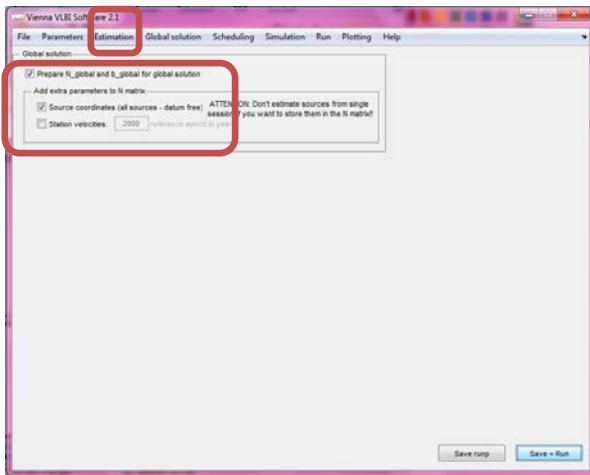


Figure 8.

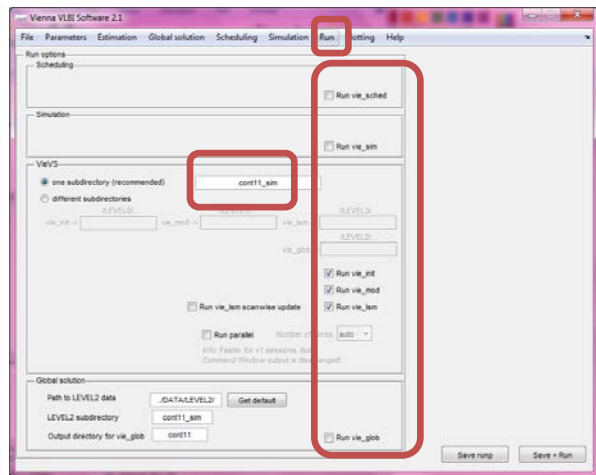


Figure 9.

Use the GUI plotting tool and plot the baseline length repeatabilities computed from these two sessions.

In the menu bar "Plotting / Session analysis" load your subfolder with the results and click on "basel. len. rep." (Figure 10).

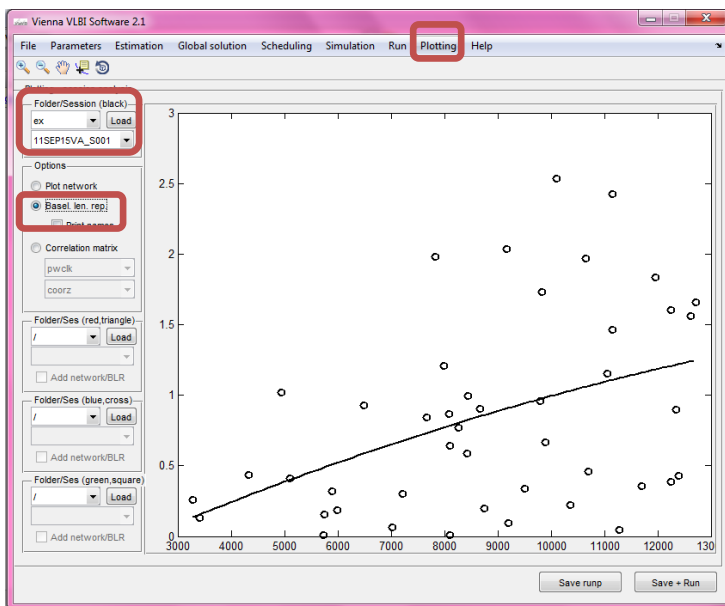


Figure 10.

Global solution

With the module Vie_GLOB estimate station coordinates from both sessions in a common adjustment.

Before selecting the options in GUI, an external .txt file with names of the stations which will be used for datum definition (NNT+NNR) has to be created.

You can use e.g. KOKEE, NYALES20, ONSALA60, WESTFORD and WETTZELL.

Save this file in VIEVS/DATA/GLOB/TRF/DATUM/.

(In case you want also estimate the source coordinates, another datum file for the sources has to be created. For this exercise a .txt file called datum_test.txt is prepared in VIEVS/DATA/GLOB/CRF/DATUM/).

1. Parameters which will be estimated in the global solution can be selected in the menu bar "Global solution / Select parameters". In this exercise we will estimate the station and source coordinates (Figure 11).
2. In "Global solution / TRF/CRF parameterization" select for the NNT/NNR condition the file with the names of the stations which you have already created; and for the NNR condition the file with the datum sources (Figure 12).
3. In the menu bar "Run" select only the module "vie_glob". In the window "LEVEL2 subdirectory" for the global solution the name of your subfolder where you stored the NEQ has to be written. In the window "Output directory for vie_glob" you can write an arbitrary name of a folder, where the results from Vie_GLOB will be saved.
4. Start the global solution with the "Save + Run" button (Figure 13).

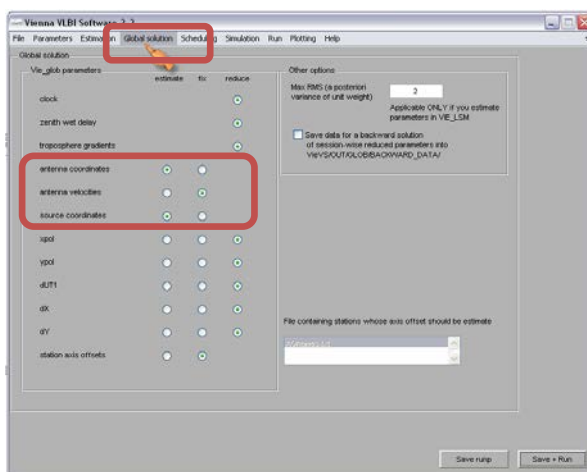


Figure 11.

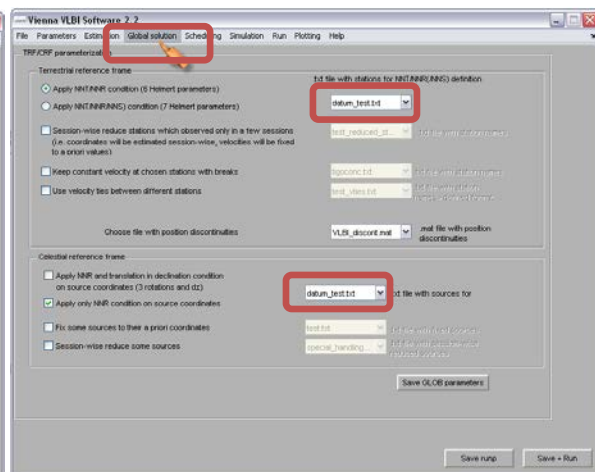


Figure 12.

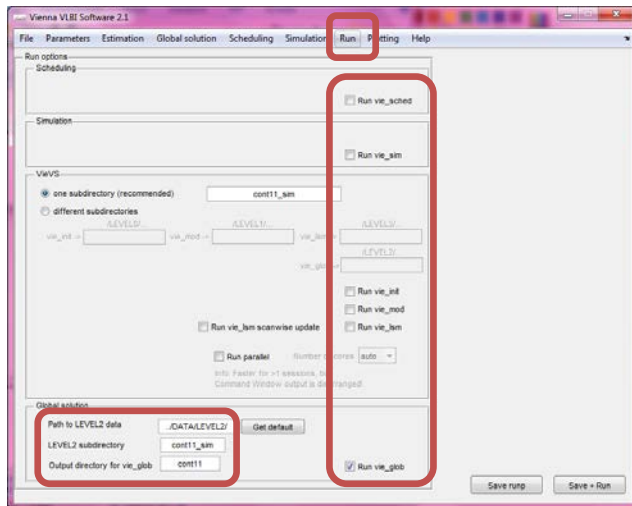


Figure 13.

The results are stored in a .txt file in VIEVS/OUT/GLOB/_ESTIMATES/subfolder and the plots in VIEVS/OUT/GLOB/_PLOTS/subfolder.