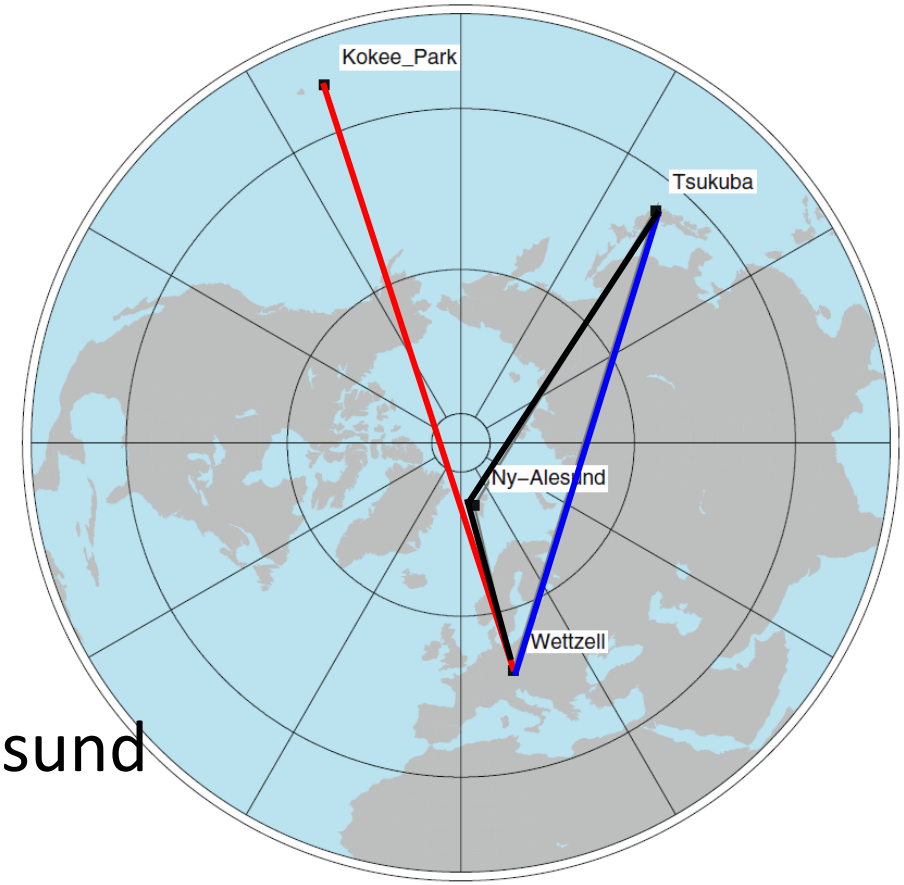
TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

Processing Intensive Sessions with VieVS

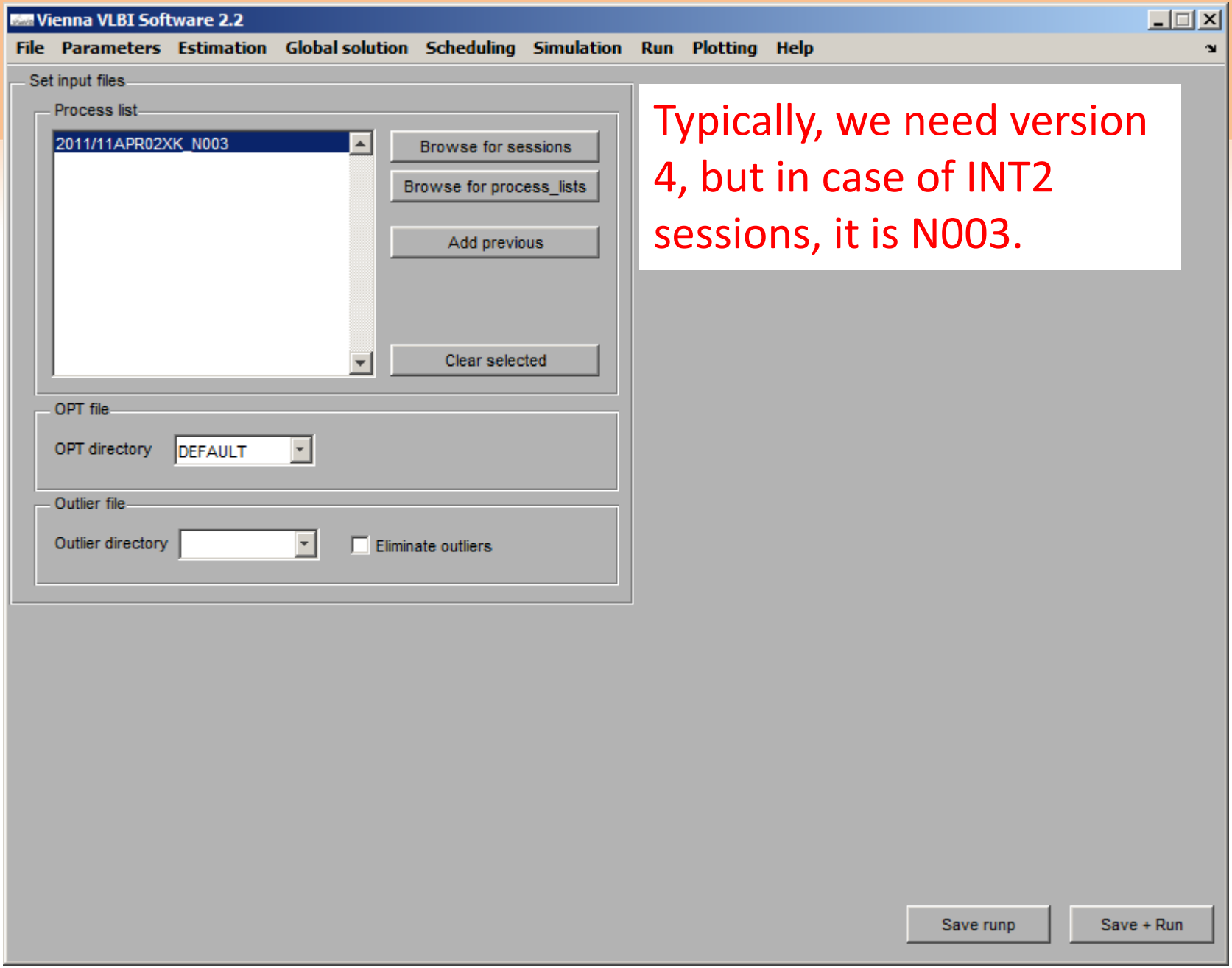
Armin Hofmeister, Johannes Böhm

Introduction

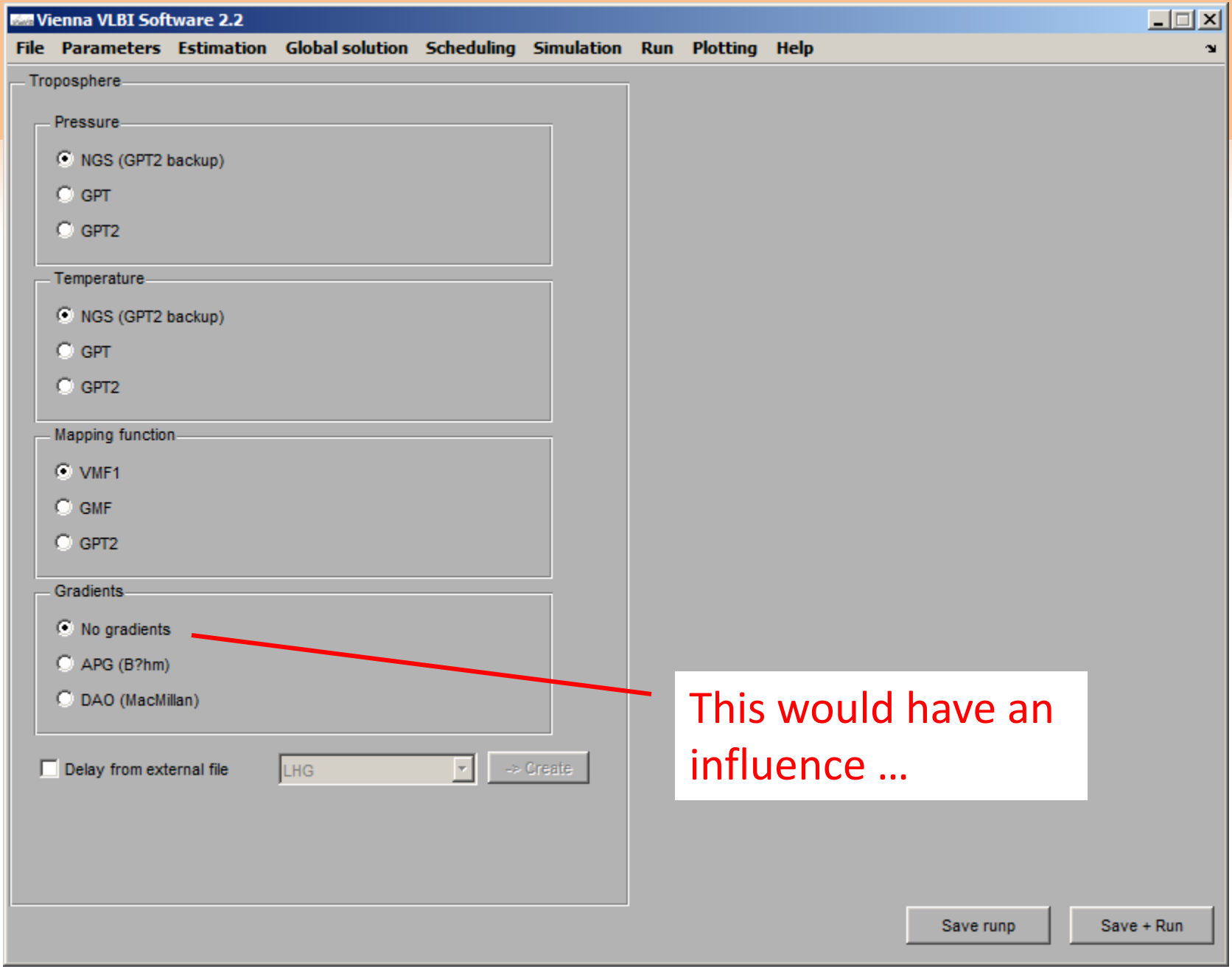
- INT1 (2-3 days latency)
  - Kokee-Wettzell
  - Mo-Fr 18:30
- INT2 (e-transfer)
  - Tsukuba-Wettzell
  - Sa-So 7:30
- INT3 (e-transfer)
  - Tsukuba-Wettzell-NyAlesund
  - Mo 7:00

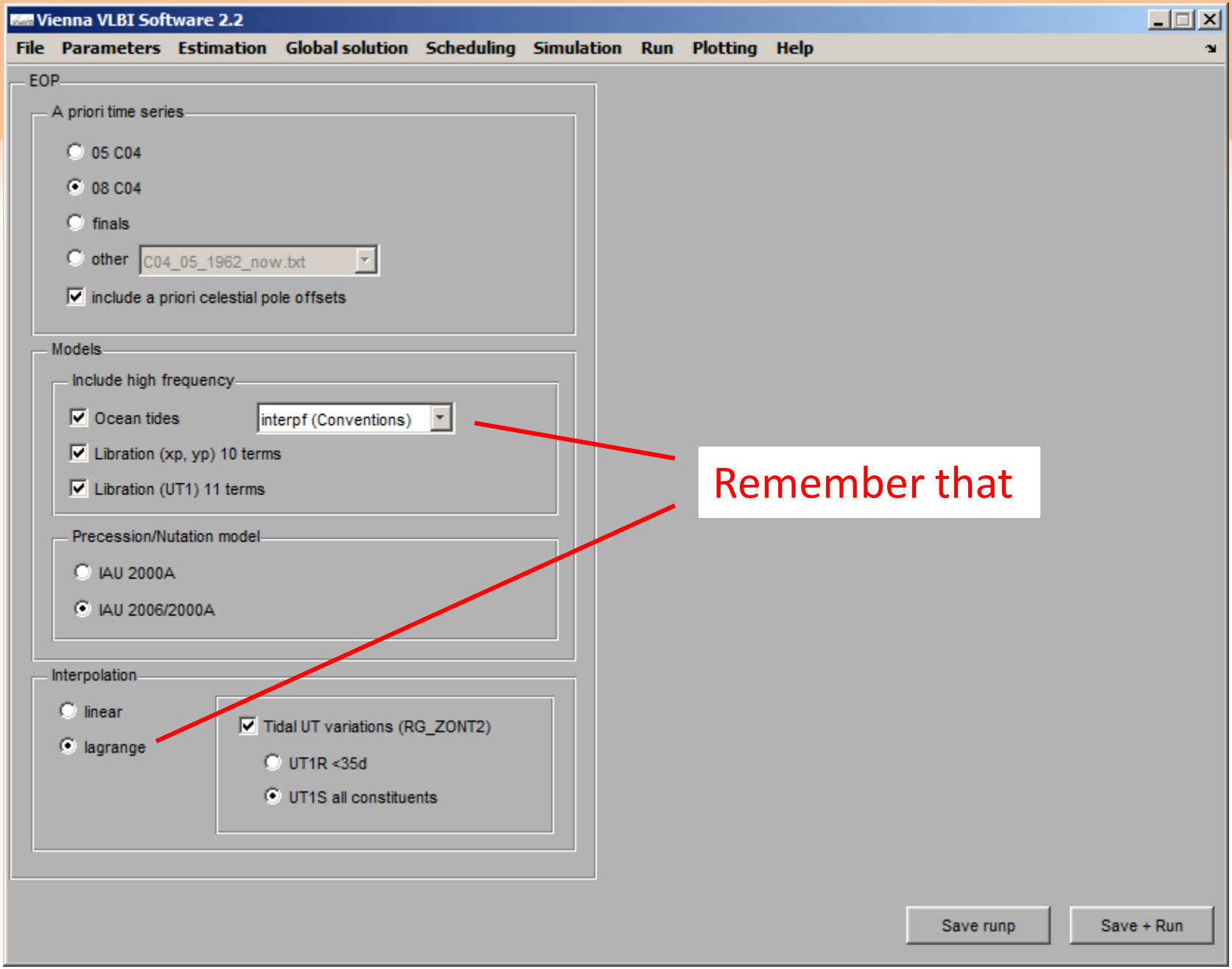


Luzum and Nothnagel (2010)



Typically, we need version 4, but in case of INT2 sessions, it is N003.


Vienna VLBI Software 2.2
File
Parameters
Estimation
Global solution
Scheduling
Simulation
Run
Plotting
Help
Troposphere
Pressure
NGS (GPT2 backup)
GPT
GPT2
Temperature
NGS (GPT2 backup)
GPT
GPT2
Mapping function
VMF1
GMF
GPT2
Gradients
No gradients
APG (B?hm)
DAO (MacMillan)
Delay from external file
LHG
-> Create
This would have an influence …
Save runp
Save + Run


Vienna VLBI Software 2.2
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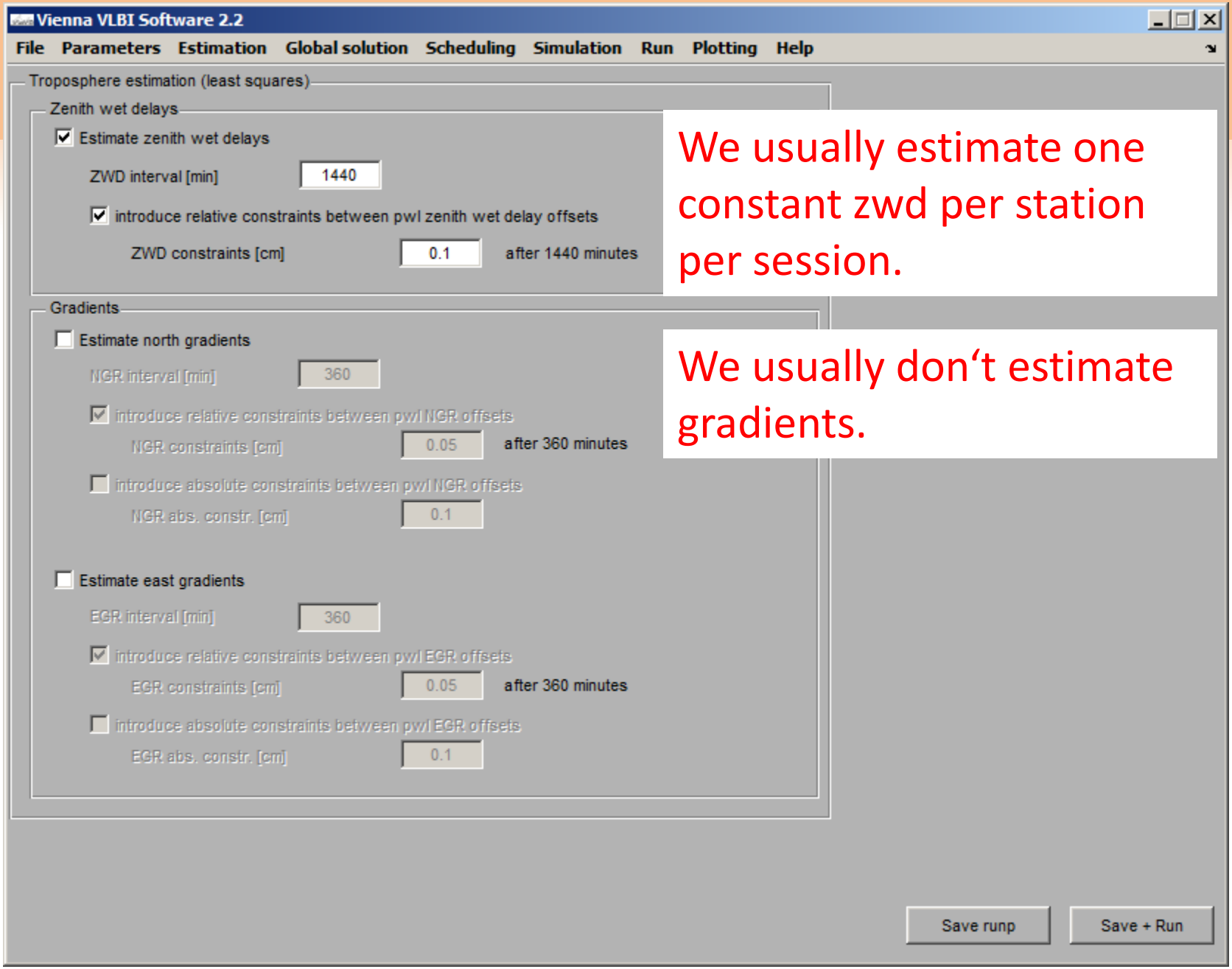
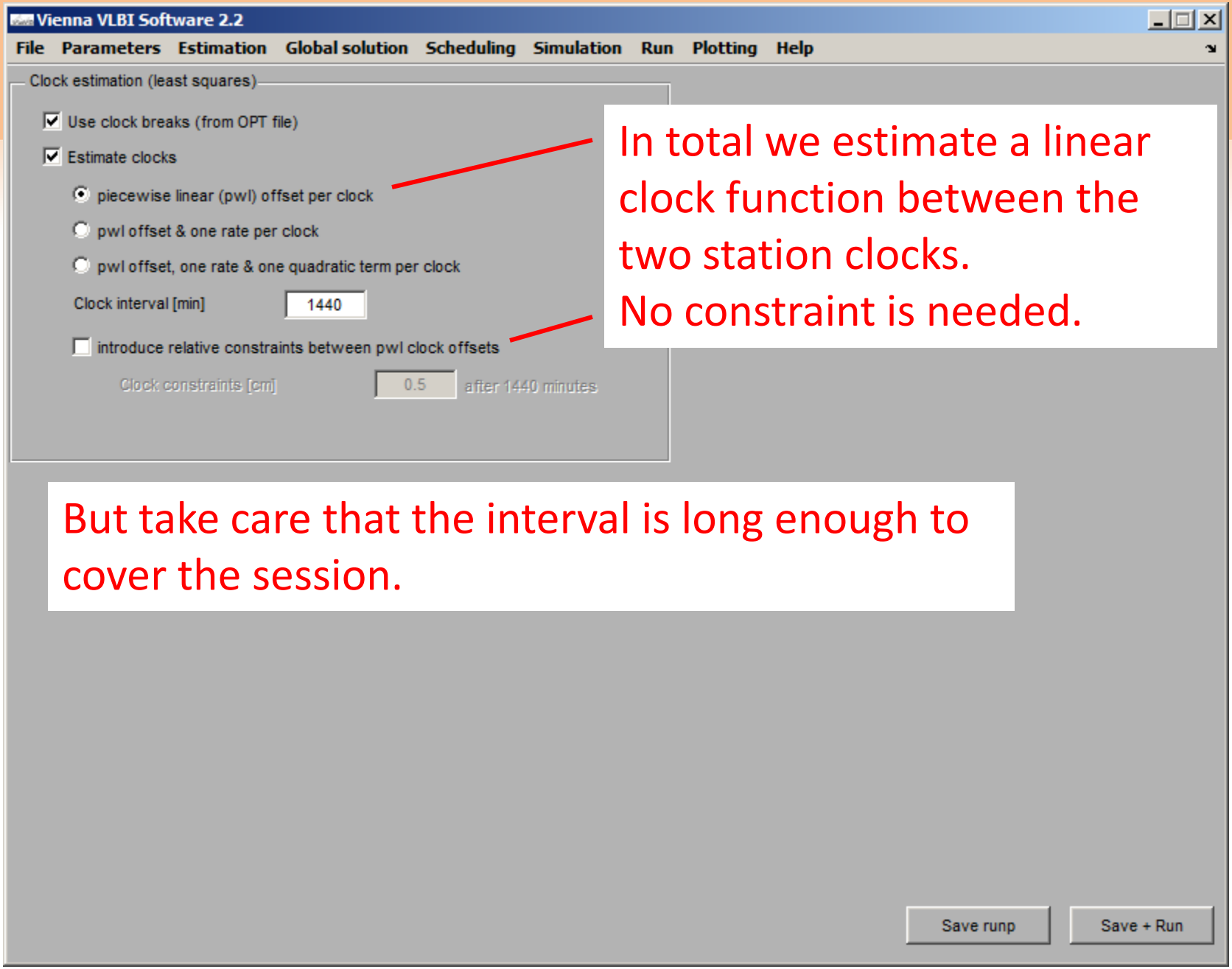
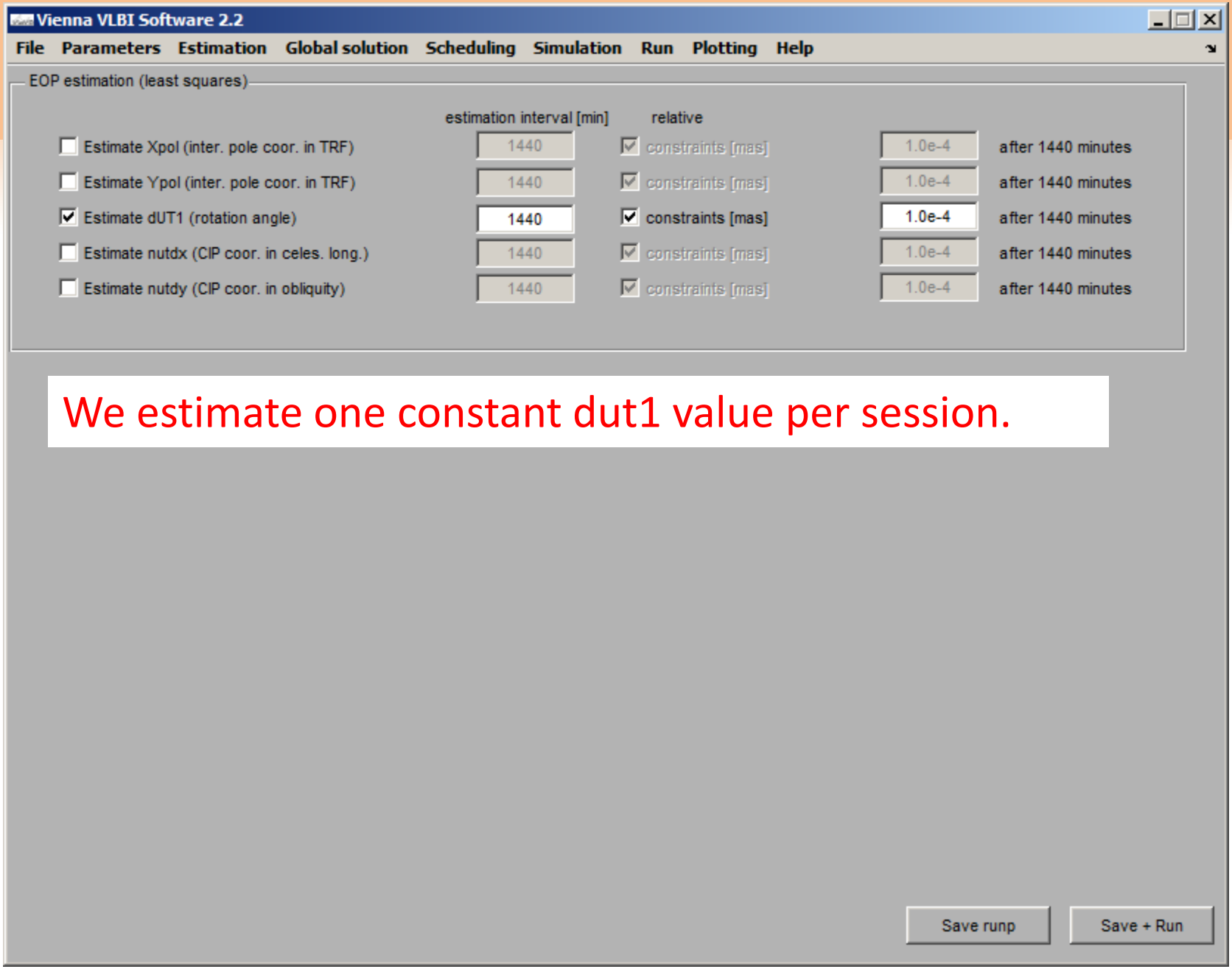
Help
EOP
A priori time series
05 C04
08 C04
finals
other
C04_05_1962_now.txt
include a priori celestial pole offsets
Models
Include high frequency
Ocean tides
interpf (Conventions)
Libration (xp, yp) 10 terms
Libration (UT1) 11 terms
Precession/Nutation model
IAU 2000A
IAU 2006/2000A
Interpolation
linear
lagrange
Tidal UT variations (RG_ZONT2)
UT1R <35d
UT1S all constituents
Remember that
Save runp
Save + Run

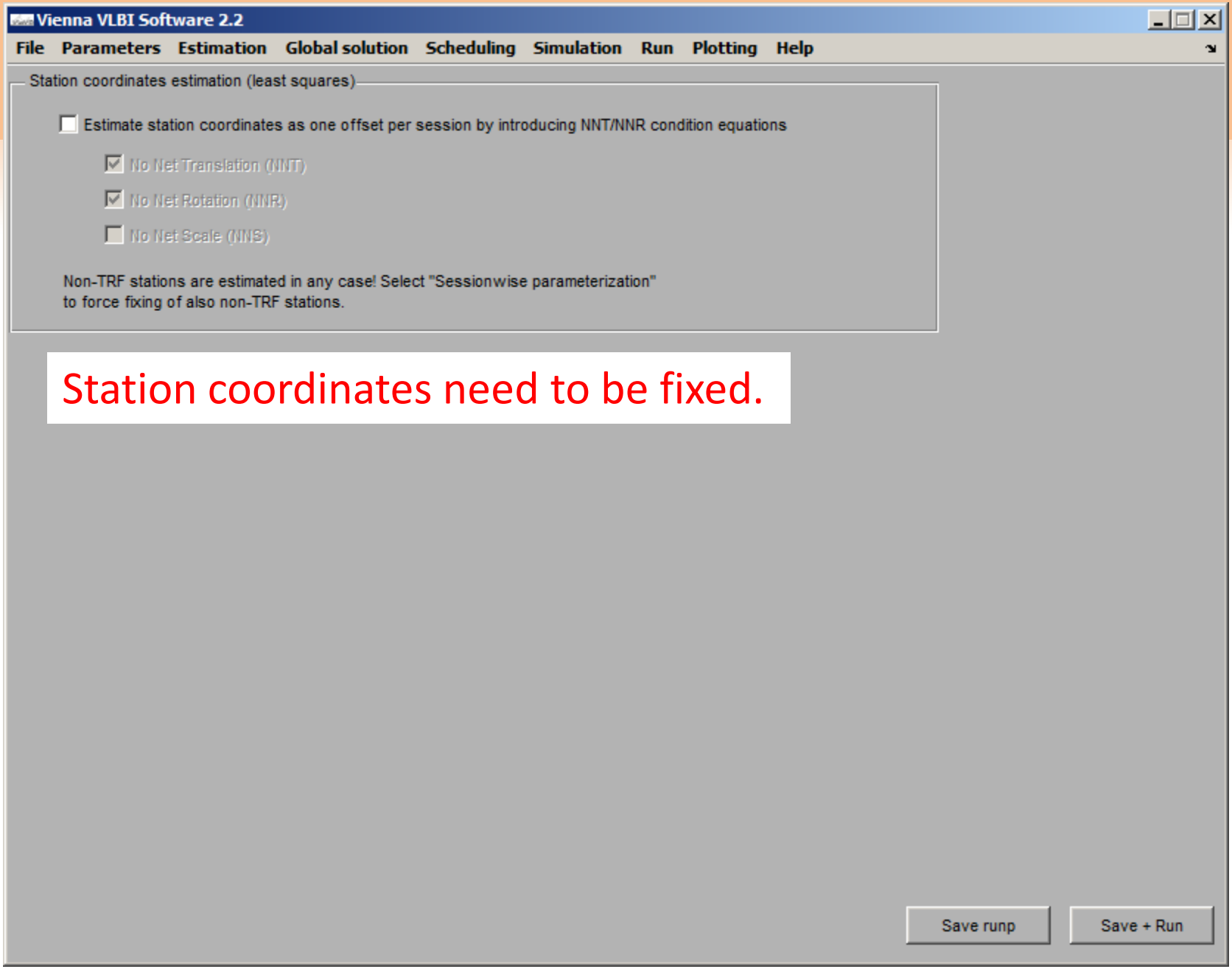


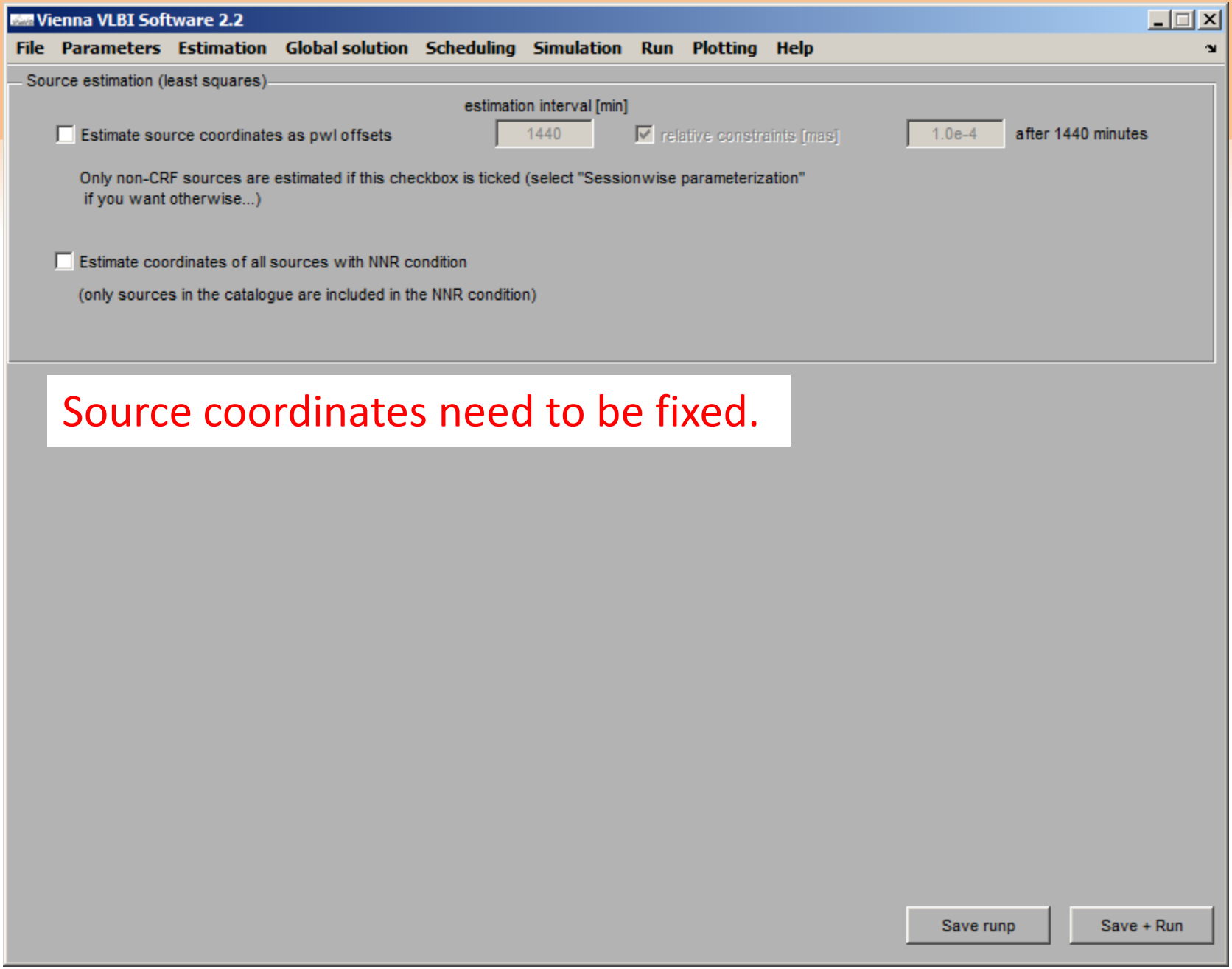
We usually estimate one constant zwd per station per session.

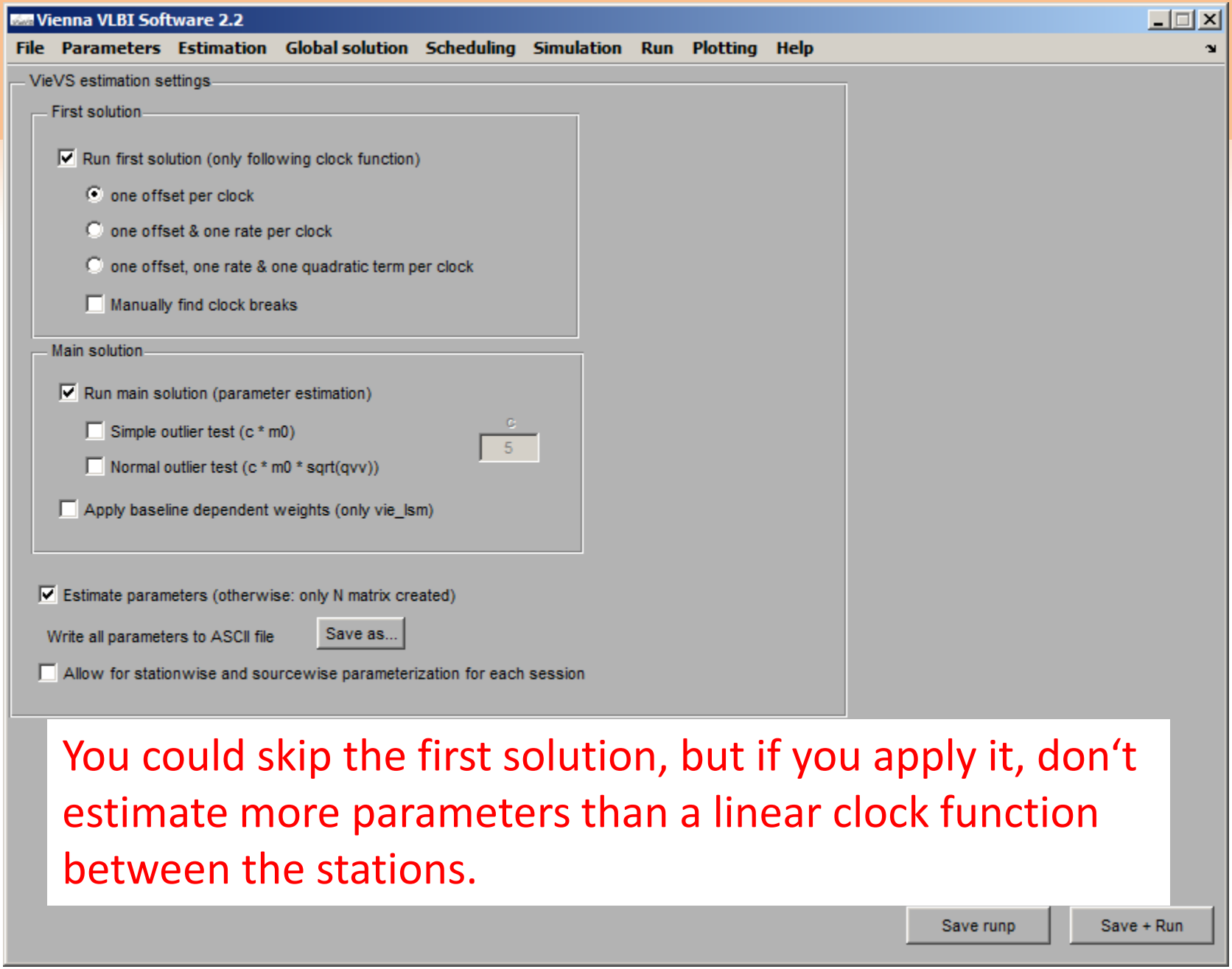
We usually don‘t estimate gradients.

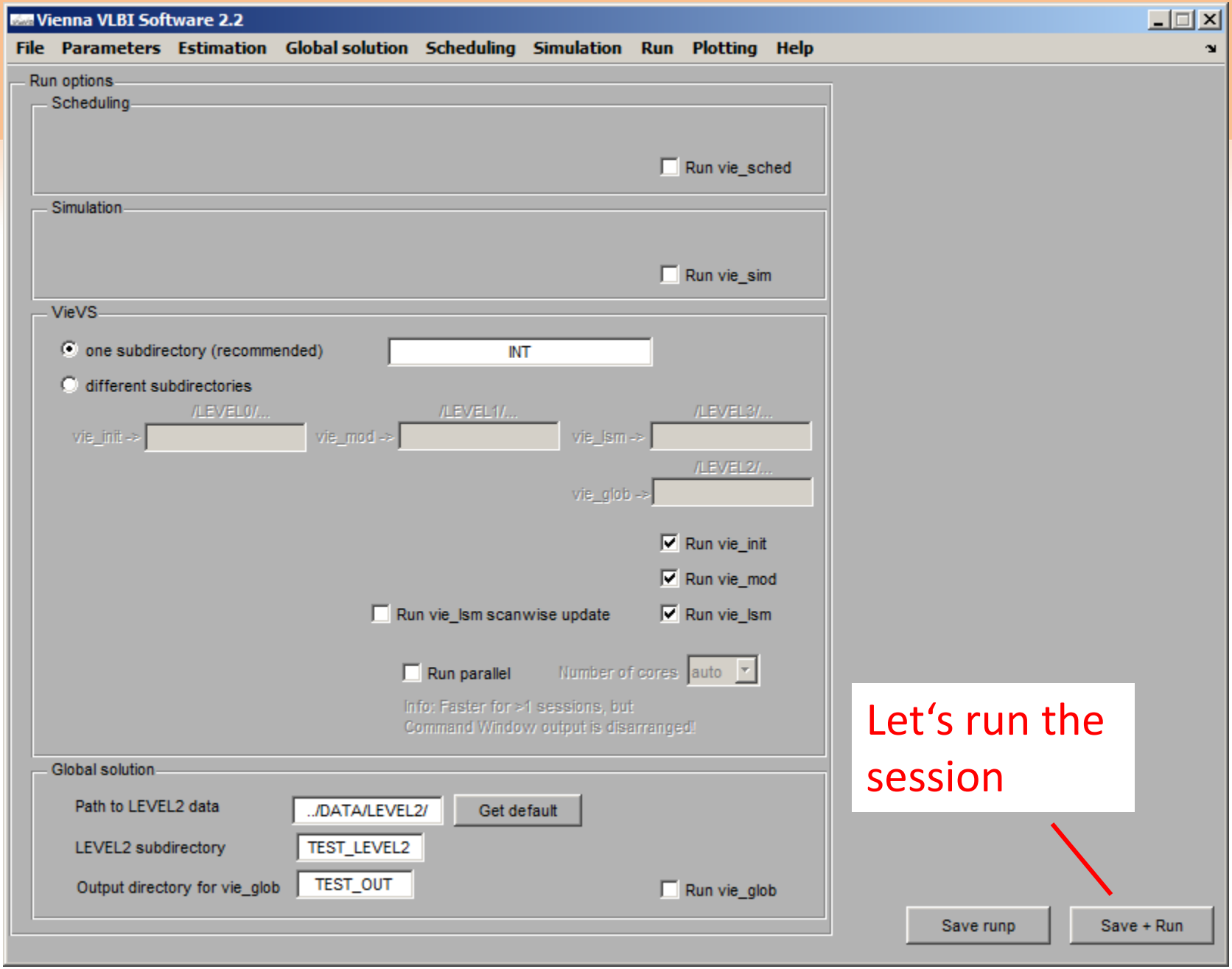

Vienna VLBI Software 2.2
File Parameters Estimation Global solution Scheduling Simulation Run Plotting Help
Clock estimation (least squares)
Use clock breaks (from OPT file)
Estimate clocks
piecewise linear (pwl) offset per clock
pwl offset & one rate per clock
pwl offset, one rate & one quadratic term per clock
Clock interval [min]
1440
introduce relative constraints between pwl clock offsets
Clock constraints [cm]
0.5
after 1440 minutes
In total we estimate a linear clock function between the two station clocks.
No constraint is needed.
But take care that the interval is long enough to cover the session.
Save runp
Save + Run


Vienna VLBI Software 2.2
File
Parameters
Estimation
Global solution
Scheduling
Simulation
Run
Plotting
Help
EOP estimation (least squares)
estimation interval [min]
relative
Estimate Xpol (inter. pole coor. in TRF)
1440
constraints [mas]
1.0e-4
after 1440 minutes
Estimate Ypol (inter. pole coor. in TRF)
1440
constraints [mas]
1.0e-4
after 1440 minutes
Estimate dUT1 (rotation angle)
1440
constraints [mas]
1.0e-4
after 1440 minutes
Estimate nutdx (CIP coor. in celes. long.)
1440
constraints [mas]
1.0e-4
after 1440 minutes
Estimate nutdy (CIP coor. in obliquity)
1440
constraints [mas]
1.0e-4
after 1440 minutes
We estimate one constant dut1 value per session.
Save runp
Save + Run


Vienna VLBI Software 2.2
File
Parameters
Estimation
Global solution
Scheduling
Simulation
Run
Plotting
Help
Station coordinates estimation (least squares)
Estimate station coordinates as one offset per session by introducing NNT/NNR condition equations
No Net Translation (NNT)
No Net Rotation (NNR)
No Net Scale (NNS)
Non-TRF stations are estimated in any case! Select "Sessionwise parameterization"
to force fixing of also non-TRF stations.
Station coordinates need to be fixed.
Save runp
Save + Run


Vienna VLBI Software 2.2
File
Parameters
Estimation
Global solution
Scheduling
Simulation
Run
Plotting
Help
Source estimation (least squares)
estimation interval [min]
Estimate source coordinates as pwl offsets
1440
relative constraints [mas]
1.0e-4
after 1440 minutes
Only non-CRF sources are estimated if this checkbox is ticked (select "Sessionwise parameterization" if you want otherwise...)
Estimate coordinates of all sources with NNR condition
(only sources in the catalogue are included in the NNR condition)
Source coordinates need to be fixed.
Save runp
Save + Run


Vienna VLBI Software 2.2
File
Parameters
Estimation
Global solution
Scheduling
Simulation
Run
Plotting
Help
VieVS estimation settings
First solution
Run first solution (only following clock function)
one offset per clock
one offset & one rate per clock
one offset, one rate & one quadratic term per clock
Manually find clock breaks
Main solution
Run main solution (parameter estimation)
Simple outlier test (c * m0)
Normal outlier test (c * m0 * sqrt(qvv))
c
5
Apply baseline dependent weights (only vie_lsm)
Estimate parameters (otherwise: only N matrix created)
Write all parameters to ASCII file
Save as...
Allow for stationwise and sourcewise parameterization for each session
You could skip the first solution, but if you apply it, don‘t estimate more parameters than a linear clock function between the stations.
Save runp
Save + Run


Vienna VLBI Software 2.2
File
Parameters
Estimation
Global solution
Scheduling
Simulation
Run
Plotting
Help
Run options
Scheduling
Run vie_sched
Simulation
Run vie_sim
VieVS
one subdirectory (recommended)
INT
different subdirectories
/LEVEL0/...
vie_init ->
/LEVEL1/...
vie_mod ->
/LEVEL3/...
vie_lsm ->
/LEVEL2/...
vie_glob ->
Run vie_init
Run vie_mod
Run vie_lsm scanwise update
Run vie_lsm
Run parallel
Number of cores
auto
Info: Faster for >1 sessions, but
Command Window output is disarranged!
Global solution
Path to LEVEL2 data
../DATA/LEVEL2/
Get default
LEVEL2 subdirectory
TEST_LEVEL2
Output directory for vie_glob
TEST_OUT
Run vie_glob
Let‘s run the session
Save runp
Save + Run

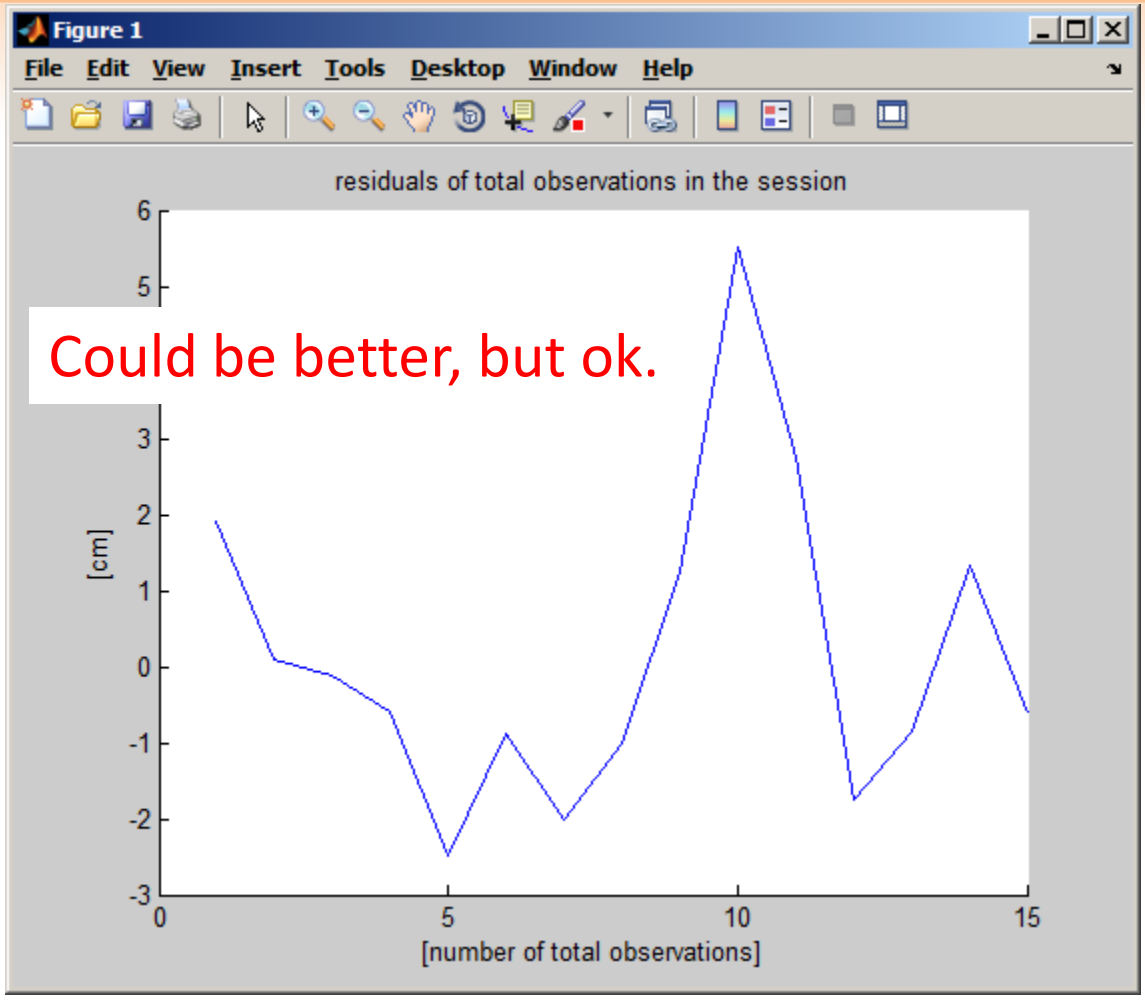


Figure 1
File Edit View Insert Tools Desktop Window Help
residuals of total observations in the session
Could be better, but ok.
6
5
3
2
1
0
-1
-2
-3
[cm]
0
5
10
15
[number of total observations]

```
session     1  of     1
Current file: ../DATA/LEVEL0/INT/11APR02XK_N003
-----------------------------------------------------------------
|                Welcome to VIE_INIT!!!!!                       |
-----------------------------------------------------------------

No OPT file was found
Stations to be excluded: 0
Stations to be down-weighted: 0
Sources to be excluded: 0
Baselines to be excluded: 0

Start reading 2011/11APR02XK_N003
[antenna,sources,scan]=read_ngs(ngsfile,trffile,crffile,ini_opt,pt, tp, trf, crf)
Done reading the file!
A total of 2 stations, 14 sources and 15 scans were found
The following stations were found:
KOKEE
WETTZELL
VIE_INIT finished!!! You can now continue with VIE_MOD
-----------------------------------------------------------------
|                  Welcome to VIE_MOD                           |
-----------------------------------------------------------------
C04_08
remove tidal UT
UT1S
Lagrange interpolation of EOP
re-add tidal UT
UT1S
interpf (Conventions)
load existing ephemerides ...
IAU_2006A
station corrections
Cubic model after 2010.0 is not available, a linear model for extrapolation is used. (IERS Conv. 2010)

vie_mod successfully finished!
```

15 scans are not so many …

```
------------------------------------------------------------
|                Welcome to VIE_LSM!!!!!                   |
------------------------------------------------------------

number of scans :   15
number of antennas :  2
number of sources :  14
number of obs. :    15
2. CREATING DEFAULT OPTIONS
3. FORMING THE WEIGHT MATRIX OF THE OBSERVATIONS "Pobserv"
apriori std. dev. of unit weight. : 1.4741
obs. of the antenna KOKEE    :   15
obs. of the antenna WETTZELL :   15
4. FORMING THE REDUCED OBSERVATION VECTOR "oc_observ"
clock KOKEE    is selected as the ref. clock for the first solution
chi-squared of first solution: 5.4959
5. FORMING THE DESIGN MATRICES "A(i).sm" ...
6. FORMING THE CONSTRAIN MATRIX and WEIGHT MATRIX OF CONSTRAINTS
7. ESTIMATING THE PARAMETERS WITH LEAST SQUARES
clock KOKEE    is selected as the ref. clock for the main solution

chi-squared of main solution vTPv/degOfFreedom: 2.6821
WRMS of post-fit residuals sqrt(v_realTPv_real/sumOfWeights):  1.7768cm(  59.2688ps)

----------
```

```
outlier detection test was not applied!
----------
total number of estimated parameters:    8
total clock offsets:    2
total rate and quad. terms of clock funct.:    0
total zenith wet delay offsets:    4
total tropo. north gradients:    0
total tropo. east gradients:    0
total pole coor. (x-pol) offsets:    0
total pole coor. (y-pol) offsets:    0
total dUT1 offsets:    2
total celestial pole (nutation dx) offsets:    0
total celestial pole (nutation dy) offsets:    0
total right ascension offsets of sources :    0
total declination offsets of sources :    0
antenna coor. dx offsets:    0
antenna coor. dy offsets:    0
antenna coor. dz offsets:    0
----------
estimated parameters are saved as ../VieVS/DATA/LEVEL3/INT/x_11APR02XK_N003.mat
estimation options are saved as ../VieVS/DATA/LEVEL3/INT/opt_11APR02XK_N003.mat
normal equation matrix is saved as ../VieVS/DATA/LEVEL3/INT/atpa_11APR02XK_N003.mat
right hand side vector is saved as ../VieVS/DATA/LEVEL3/INT/atpl_11APR02XK_N003.mat
residuals are saved as ../VieVS/DATA/LEVEL3/INT/res_11APR02XK_N003.mat
8. vie_lsm IS COMPLETED!
Elapsed time is 0.110194 seconds.
```

Actually, we only have 5 parameters (one linear clock, two zwd offsets, one dut1 offset).

```
>> load('..\DATA\LEVEL3\INT\x_11APR02XK_N003.mat')
>> x_.dut1
ans =
    col: [7 8]
    mjd: [55653 55654]
    val: [-0.0094 -0.0094]
     mx: [0.0155 0.0155]
```

The result is -9.4 µs, which is reasonable.

Also the formal error is ok.

Thanks!