

# Vie\_LSM V2.2 (part 2: station- and source-based parameterization)

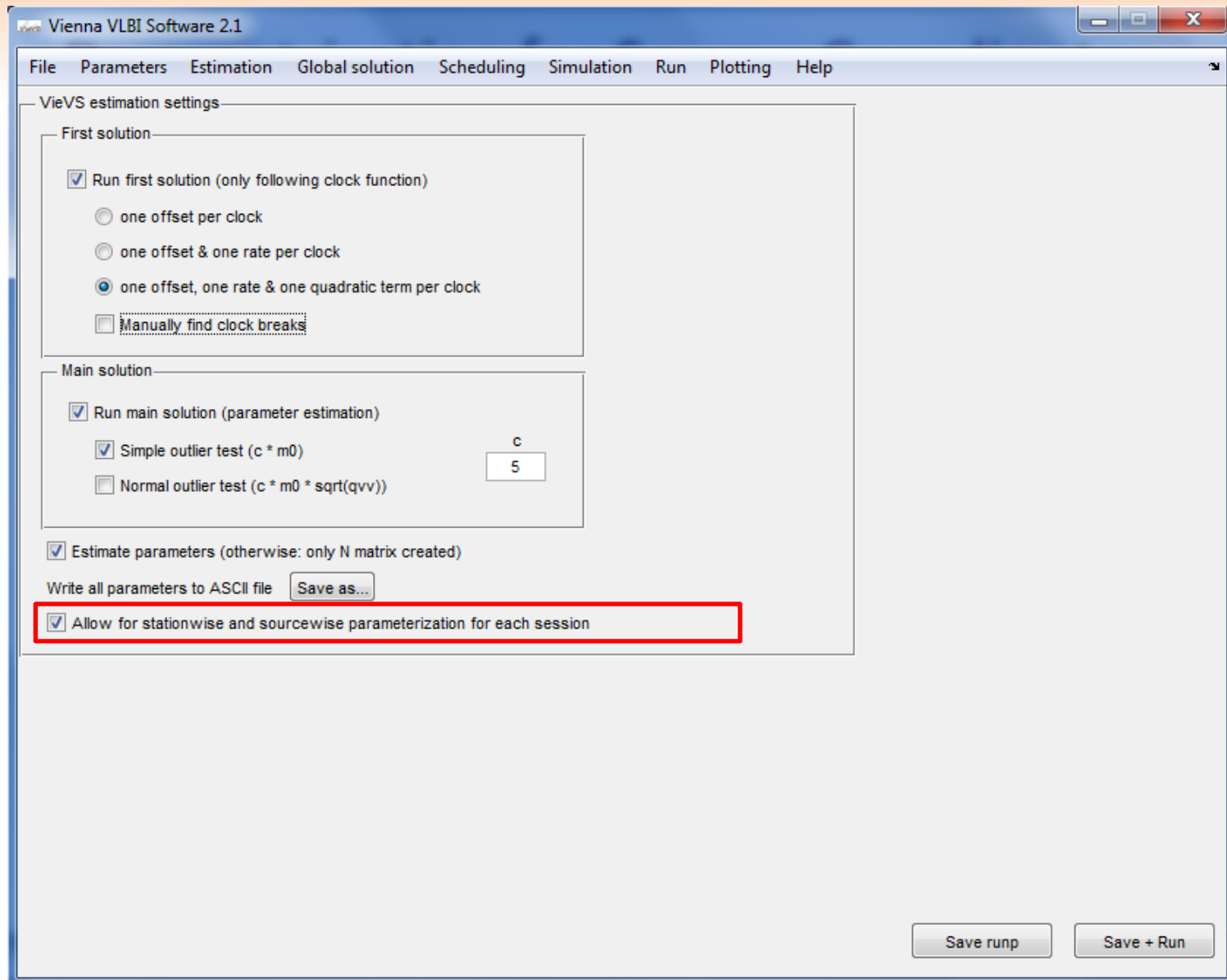
Kamil Teke and Johannes Böhm



# Introduction

- Station- and source-wise parameterization allows to change station- and source-specific parameters for each station and source separately.

# changing to station- and source-wise options



# selecting reference clock

## vie\_ism [ single session first solution ]

parameterization for removing large clock errors

apply first basic solution (only with clock function)

one offset per clock

one offset & one rate per clock

one offset, one rate, & one quadratic term per clock

use clock breaks (From OPT file)

main solution

apply main solution

coefficient

simple outlier test [ coefficient \* mo ]

5

basic outlier test [ coefficient \* mo \*sqrt(qw) ]

clock/s that have breaks in the session

ZELENCHK

Next

reference clock for the first solution

WETZELL

TSUKUB32

WETZELL

SVETLOE

ZELENCHK

ONSALA60

NYALES20

HARTRAO

KOKEE

WESTFORD

MEDICINA

TIGOCONC

# clock-wise parameterization

parameterization for clocks

- estimate clocks
  - piecewise linear (pwl) offsets per clock
  - pwl offsets & one rate per clock
  - pwl offsets, one rate, & one quadratic term per clock
- introduce relative constraints between pwl clock offsets

- Default reference clock has not any clock break.  
- Reference clock is the first clock in the NGS file  
OR if any OPT file of the session exists fixed clock is from OPT file  
- Unit of clock estimation intervals is minutes.  
- Unit of clock constraints is centimeters  
E.g. 1.3 cm after 1 hour is relatively loose.

	clock constraints	clock interval	reference clock
TSUKUB32	1.3000	60	<input type="checkbox"/>
WETTZELL	1.3000	60	<input checked="" type="checkbox"/>
SVETLOE	1.3000	60	<input type="checkbox"/>
ZELENCHK	1.3000	60	<input type="checkbox"/>
ONSALA60	1.3000	60	<input type="checkbox"/>
NYALES20	1.3000	60	<input type="checkbox"/>
HARTRAO	1.3000	60	<input type="checkbox"/>
KOKEE	1.3000	60	<input type="checkbox"/>
WESTFORD	1.3000	60	<input type="checkbox"/>
MEDICINA	1.3000	60	<input type="checkbox"/>
TIGOCONG	1.3000	60	<input type="checkbox"/>

Back Next

# station-wise troposphere delay parameterization

vie\_ism\_gui\_tropo

## vie\_ism [ single session troposphere ]

apply relative constraints between tropospheric offset estimates

introduce RELATIVE CONSTRAINTS between pwl ZENITH WET DELAY offsets

introduce REALTIVE CONSTRAINTS between pwl tropo. NORTH GRADIENT offsets

introduce RELATIVE CONSTRAINTS between pwl tropo. EAST GRADIENT offsets

introduce ABSOLUTE CONSTRAINTS between pwl tropo. NORTH GRADIENT offsets

introduce ABSOLUTE CONSTRAINTS between pwl tropo. EAST GRADIENT offsets

- unit of estimation intervals is minute.

- unit of ZWD relative constraints is cm e.g. 1.5 cm after 1 hour is relatively loose.

- unit of NGR & EGR relative constraints is cm, e.g. 0.05 cm after 6 hours is relatively loose.

- unit of NGR & EGR absolute constraints is cm, e.g. 0.1 cm absolutely loose.

	ZWD coef.	NGR rel. coef.	EGR rel. coef.	NGR abs. coef.	EGR abs. coef.	ZWD int.	NGR int.	EGR int.	est. ZWD	est. NGR	est. EGR
TSUKUB32	1.5000	0.0500	0.0500	0.1000	0.1000	60	360	360	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
WETZELL	1.5000	0.0500	0.0500	0.1000	0.1000	60	360	360	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SVETLOE	1.5000	0.0500	0.0500	0.1000	0.1000	60	360	360	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ZELENCHK	1.5000	0.0500	0.0500	0.1000	0.1000	60	360	360	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ONSALA60	1.5000	0.0500	0.0500	0.1000	0.1000	60	360	360	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
NYALES20	1.5000	0.0500	0.0500	0.1000	0.1000	60	360	360	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
HARTRAO	1.5000	0.0500	0.0500	0.1000	0.1000	60	360	360	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
KOKEE	1.5000	0.0500	0.0500	0.1000	0.1000	60	360	360	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
WESTFORD	1.5000	0.0500	0.0500	0.1000	0.1000	60	360	360	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
MEDICINA	1.5000	0.0500	0.0500	0.1000	0.1000	60	360	360	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

6th VieVS User Workshop

# selecting TRF datum stations to introduce NNT/NNR conditions

## Case 1: NNT/NNR (one coordinate offset per session)

The screenshot shows the 'vie\_lsm [ single session station coordinates ]' window. On the left, under 'general options for estimation of stations coordinates', the following options are visible:

- estimate station coordinates
- one offset per session
  - NNT/NNR
  - Fix some stations
- pwl offsets per session

On the right, a table lists station parameters:

	NNT	NNR	NNS	XYZ_est	constraints	coord. intervals
TSUKUB32	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
WETZELL	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
SVETLOE	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
ZELENCHK	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
ONSALA60	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
NYALES20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
HARTRAO	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
KOKEE	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
WESTFORD	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
MEDICINA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360

Unit of TRF relative constraints is cm, e.g. 10 cm after 6 hours is relatively loose.

Buttons: Back, Next

# selecting TRF datum stations to fix a priori coordinates

## Case 2: Fix some station coordinates (one coordinate offset per session)

The screenshot shows the 'vie\_lsm [ single session station coordinates ]' window. On the left, under 'general options for estimation of stations coordinates', the following options are visible:

- estimate station coordinates
- one offset per session
  - NNT/NNR
  - Fix some stations
- pwl offsets per session

On the right, a table lists station parameters:

	NNT	NNR	NNS	XYZ_est	constraints	coor. intervals
TSUKUB32	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
WETZELL	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10	360
SVETLOE	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
ZELENCHK	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
ONSALA60	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
NYALES20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10	360
HARTRAO	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
KOKEE	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10	360
WESTFORD	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10	360
MEDICINA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
TIGOCONG	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360

Unit of TRF relative constraints is cm, e.g. 10 cm after 6 hours is relatively loose.

Buttons: Back, Next



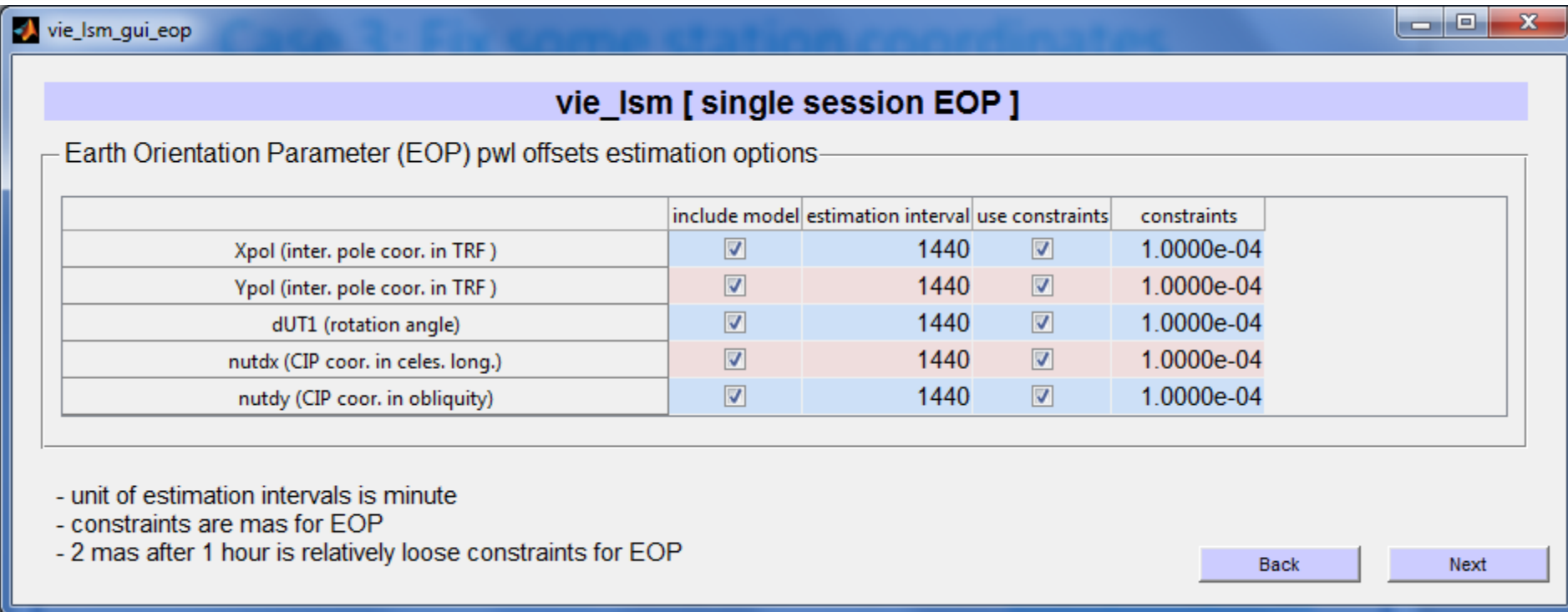
# estimating CPWLO station coordinates

## Case 3: Fix some station coordinates (CPWLO coordinates)

The screenshot shows the 'vie\_ism [ single session station coordinates ]' window. On the left, under 'general options for estimation of stations coordinates', there are several options: 'estimate station coordinates' (checked), 'one offset per session' (radio button), 'pwl offsets per session' (radio button), 'Fix some stations' (radio button), and 'introduce relative constraints between pwl coordinate offsets' (checked). Below these options is a note: 'Unit of TRF relative constraints is cm, e.g. 10 cm after 6 hours is relatively loose.' On the right, there is a table with columns: NNT, NNR, NNS, XYZ\_est, constraints, and coord. intervals. The table lists 12 stations with their respective settings.

	NNT	NNR	NNS	XYZ_est	constraints	coord. intervals
TSUKUB32	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
WETZELL	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10	360
SVETLOE	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
ZELENCHK	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
ONSALA60	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
NYALES20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10	360
HARTRAO	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
KOKEE	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10	360
WESTFORD	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10	360
MEDICINA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360
TIGOCANC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	360

# Earth Orientation Parameters



The screenshot shows a software window titled "vie\_lsm\_gui\_eop" with a sub-header "vie\_lsm [ single session EOP ]". Below the header is a section titled "Earth Orientation Parameter (EOP) pwl offsets estimation options" containing a table with five rows of parameters. Each row has columns for "include model", "estimation interval", "use constraints", and "constraints". All checkboxes are checked, and the estimation interval is 1440 minutes and the constraint is 1.0000e-04 mas for all parameters.

	include model	estimation interval	use constraints	constraints
Xpol (inter. pole coord. in TRF )	<input checked="" type="checkbox"/>	1440	<input checked="" type="checkbox"/>	1.0000e-04
Ypol (inter. pole coord. in TRF )	<input checked="" type="checkbox"/>	1440	<input checked="" type="checkbox"/>	1.0000e-04
dUT1 (rotation angle)	<input checked="" type="checkbox"/>	1440	<input checked="" type="checkbox"/>	1.0000e-04
nutdx (CIP coord. in celes. long.)	<input checked="" type="checkbox"/>	1440	<input checked="" type="checkbox"/>	1.0000e-04
nutdy (CIP coord. in obliquity)	<input checked="" type="checkbox"/>	1440	<input checked="" type="checkbox"/>	1.0000e-04

- unit of estimation intervals is minute  
- constraints are mas for EOP  
- 2 mas after 1 hour is relatively loose constraints for EOP

Back Next

# source coordinates

vie\_lsm\_gui\_sourcoor

**vie\_lsm [ single session source coordinates ]**

estimate coordinates of sources as pwl offsets [ all the unselected sources will be fixed to CRF ]

introduce relative constraints between pwlo source coordinates

- unit of constraints is mas.  
- unit of coordinate estimation intervals in minutes.  
- Please, fix at least one source which has more than 1 observation  
if you select estimate sources  
- Non-CRF sources will be estimated as default.

	source name	total observations	est. coord.	constraints	coord. interval
34	1044+719	80	<input type="checkbox"/>	1.0000e-04	1440
35	1308+326	4	<input type="checkbox"/>	1.0000e-04	1440
36	2201+315	35	<input type="checkbox"/>	1.0000e-04	1440
37	0656+082	7	<input type="checkbox"/>	1.0000e-04	1440
38	1034-293	41	<input type="checkbox"/>	1.0000e-04	1440
39	1124-186	110	<input checked="" type="checkbox"/>	1.0000e-04	1440
40	1219+044	6	<input type="checkbox"/>	1.0000e-04	1440
41	3C274	77	<input type="checkbox"/>	1.0000e-04	1440
42	1351-018	8	<input type="checkbox"/>	1.0000e-04	1440
43	0106+013	38	<input type="checkbox"/>	1.0000e-04	1440
44	0749+540	35	<input type="checkbox"/>	1.0000e-04	1440
45	0805+410	3	<input type="checkbox"/>	1.0000e-04	1440
46	0743+259	36	<input type="checkbox"/>	1.0000e-04	1440
47	2243-123	23	<input type="checkbox"/>	1.0000e-04	1440
48	3C371	90	<input type="checkbox"/>	1.0000e-04	1440
49	1739+522	13	<input checked="" type="checkbox"/>	1.0000e-04	1440
50	1954-388	14	<input type="checkbox"/>	1.0000e-04	1440
51	1156+295	26	<input type="checkbox"/>	1.0000e-04	1440
52	2121+053	49	<input type="checkbox"/>	1.0000e-04	1440

Back Next

# vie\_lsm output

vie\_lsm\_gui\_global

## vie\_lsm [ single session output ]

Estimate parameters according to the options in previous GUIs

Prepare N\_global and b\_global for global solution

No parameters are reduced. (Reduction can be done in VIE\_GLOB.) Constraints according to previous GUIs. Conditions on station coordinates are removed. N and b will be stored in DATA/LEVEL2/

write data into SINEX file (DATA/SNX/)

parameters	include into SINEX file	reduce from N_sinex	parameters	include into SINEX file	reduce from N_sinex
clock parameters		<input checked="" type="radio"/>	source coordinates	<input checked="" type="radio"/>	
zenith wet delay	<input checked="" type="radio"/>	<input type="radio"/>	station coordinates	<input checked="" type="radio"/>	
tropospheric gradients	<input checked="" type="radio"/>	<input type="radio"/>	EOP	<input checked="" type="radio"/>	<input type="radio"/>

**Add extra parameters to the N matrix**

source coordinates (all sources - datum free) **ATTENTION! Don't estimate sources from single session if you want to store them in the N matrix!!!**

station velocities:  reference epoch in years

station axis offsets

Back Finish

# Vie\_LSM V2.2

(part 2: station- and source-based parameterization)

Thanks for your attention!