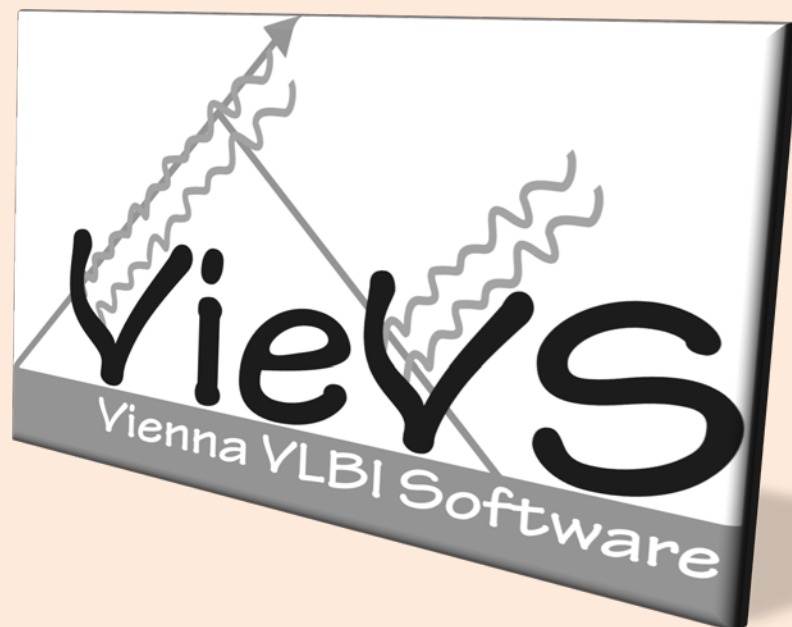


Vie_LSM V2.2 (part 2: station- and source-based parameterization)

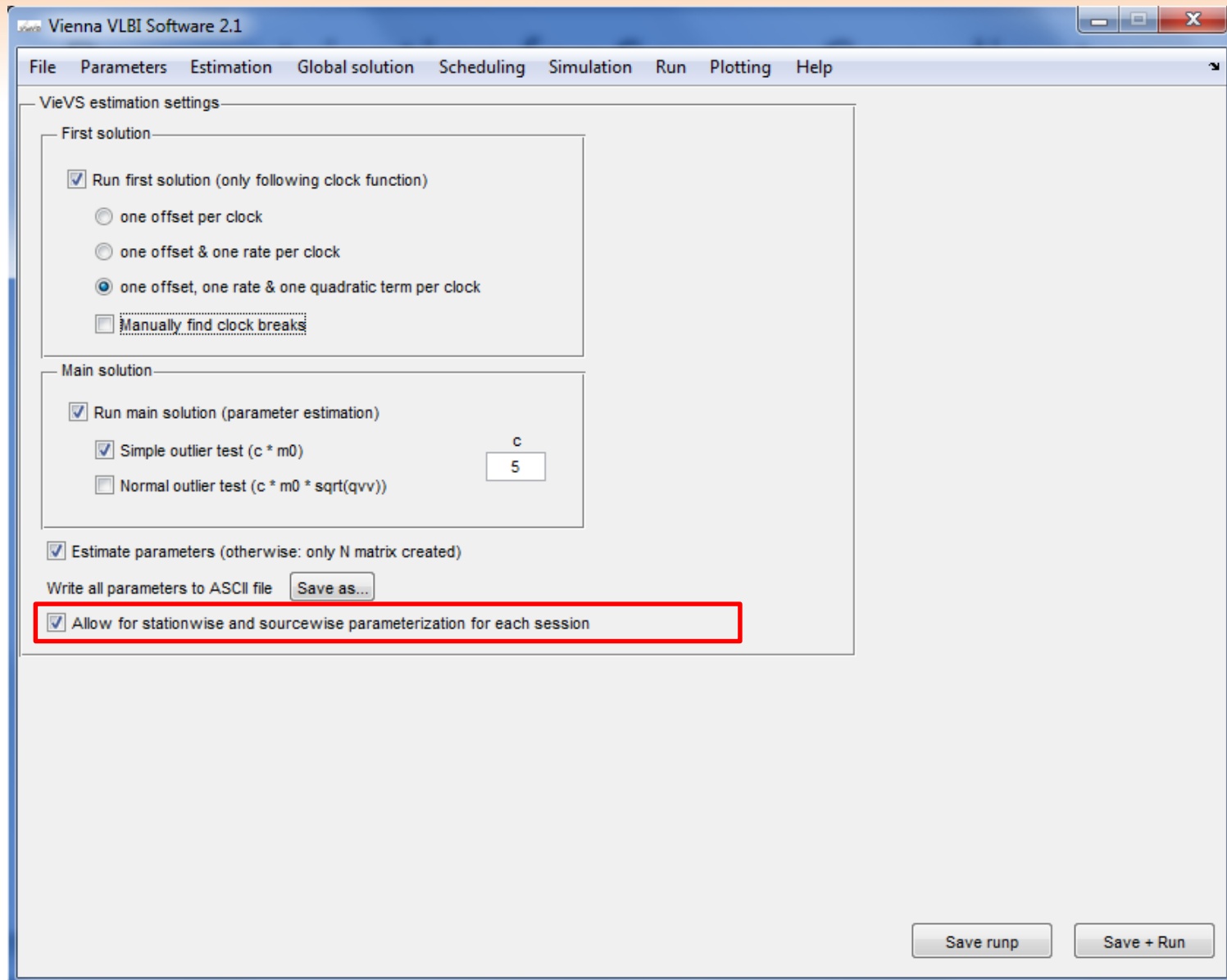
Kamil Teke and Johannes Böhm



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_lsm [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]

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☐ 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

vie_lsm_gui_clock

vie_lsm [single session clocks]

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"/> |
| TIGOCNC | 1.3000 | 60 | <input type="checkbox"/> |

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station-wise troposphere delay parameterization

vie_lsm [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"/> |
| WETTZELL | 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"/> |

selecting TRF datum stations to introduce NNT/NNR conditions

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

vie_lsm_gui_statcoor

vie_lsm [single session station coordinates]

general options for estimation of stations coordinates

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

| | 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 |
| WETTZELL | <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.

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selecting TRF datum stations to fix a priori coordinates

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

vie_lsm_gui_statcoor

vie_lsm [single session station coordinates]

general options for estimation of stations coordinates

☒ estimate station coordinates

☒ one offset per session

☐ NNT/NNR

☒ Fix some stations

☐ pwl offsets per session

| | 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 |
| WETTZELL | <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.

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estimating CPWLO station coordinates

Case 3: Fix some station coordinates (CPWLO coordinates)

vie_lsm_gui_statcoor

vie_lsm [single session station coordinates]

general options for estimation of stations coordinates

☒ estimate station coordinates

☐ one offset per session

☒ pwl offsets per session

☒ Fix some stations

☒ introduce relative constraints between pwl coordinate offsets

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

| | 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 |
| WETTZELL | <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 |
| TIGOCONE | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | 10 | 360 |

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Earth Orientation Parameters

vie_lsm_gui_eop

vie_lsm [single session EOP]

Earth Orientation Parameter (EOP) pwl offsets estimation options

| | 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

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source coordinates

vie_lsm_gui_sourcoord

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 |

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vie_lsm output



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

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Finish

Vie_LSM V2.2

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

Thanks for your attention!