



TECHNISCHE  
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# Processing Intensive Sessions with VieVS


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# Introduction


## **INT1** (2-3 days latency)

 Kokee-Wettzell

 Mo-Fr 18:30

## **INT2** (e-transfer)

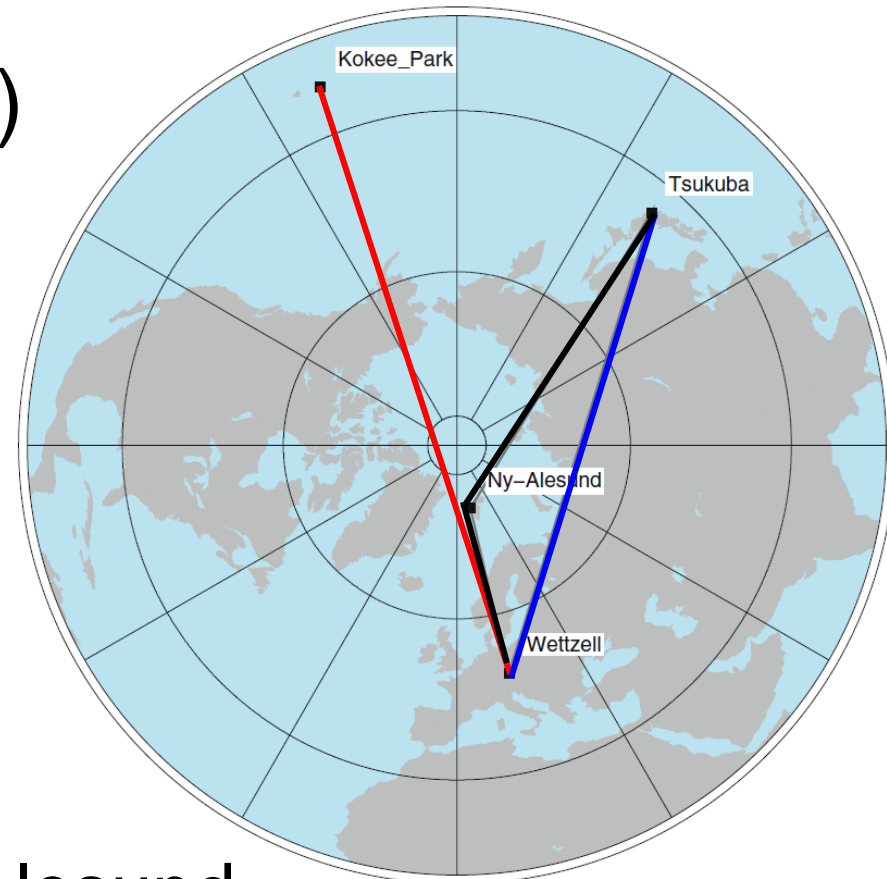
 Tsukuba-Wettzell

 Sa-So 7:30

## **INT3** (e-transfer)

 Tsukuba-Wettzell-NyAlesund

 Mo 7:00



Luzum and Nothnagel (2010)

Mode

Observed Data     Simulated data

click to choose

- ..
- 2008
- 2009
- 2010
- 2011

- 11APR01XU\_N004
- 11APR02XK\_N003
- 11APR03XK\_N003
- 11APR04XA\_N004
- 11APR04XA\_N005
- 11APR04XU\_N004
- 11APR05XA\_N004
- 11APR05XU\_N004
- 11APR06XU\_N004

- 2011/11APR02XK\_N003

Predefined lists

- 

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

Parameter files

- DEFAULT
- CURRENT

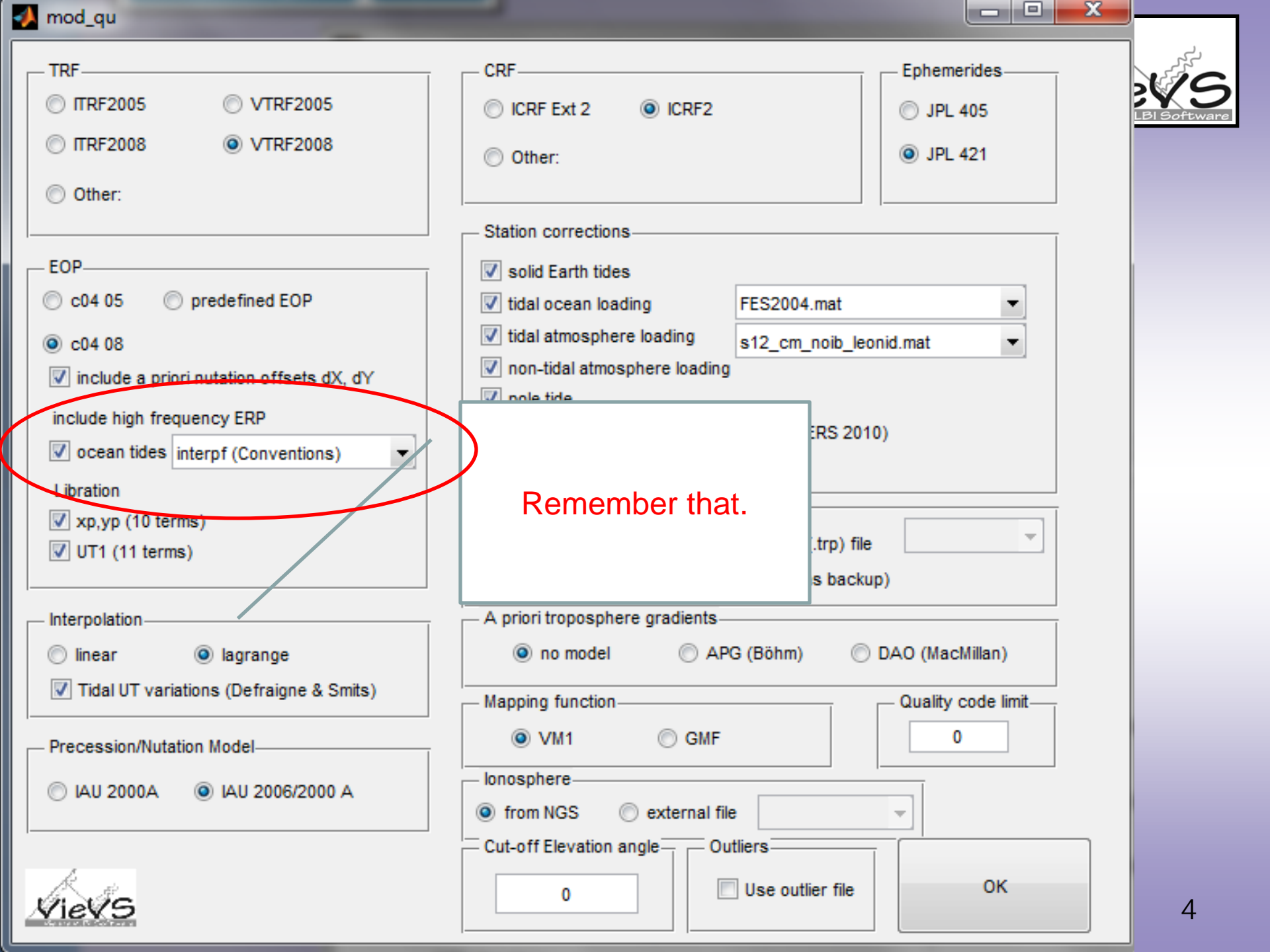
- Run VIE\_INIT
- Run VIE\_MOD
- Run VIE\_LSM     Run VIE\_SIM

Name of subdirectories

OPT directory

Outlier directory

OK



TRF

- ITRF2005
- ITRF2008
- Other:
- VTRF2005
- VTRF2008

CRF

- ICRF Ext 2
- Other:
- ICRF2

Ephemerides

- JPL 405
- JPL 421

EOP

- c04 05
- c04 08
- predefined EOP
- include a priori nutation offsets dX, dY

include high frequency ERP

- ocean tides

Libration

- xp,yp (10 terms)
- UT1 (11 terms)

Interpolation

- linear
- lagrange
- Tidal UT variations (Defraigne & Smits)

Precession/Nutation Model

- IAU 2000A
- IAU 2006/2000 A

Station corrections

- solid Earth tides
- tidal ocean loading
- tidal atmosphere loading
- non-tidal atmosphere loading
- pole tide

Remember that.

A priori troposphere gradients

- no model
- APG (Böhm)
- DAO (MacMillan)

Mapping function

- VM1
- GMF

Quality code limit

0

Ionosphere

- from NGS
- external file

Cut-off Elevation angle

0

Outliers

- Use outlier file

OK



## vie\_ism [ multiple sessions 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)
- Manually find clock breaks

### main solution

- apply main solution
- simple outlier test [ coefficient \* mo ] coefficient
- basic outlier test [ coefficient \* mo \*sqrt(qw) ]

Next

At least not more than a linear function between the two clocks.

vie\_ism\_multi\_gui\_clock

### vie\_ism [ multiple sessions 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

clock constraints	clock interval
0.5000	1440

- Reference clocks specified in OPT files.
- unit of clock estimation intervals is minute.
- unit of clock constraints is  $\text{picosec}^2/\text{sec}$ .
- 0.1  $\text{picosec}^2/\text{sec}$  is loose constraint for clock estimation.

Back Next

Choose this option.

This is important. The time interval should cover the whole session.

### vie\_lsm [ multi sessions troposphere ]

— apply relative constraints between tropospheric offset estimates —

- introduce REALTIVE CONSTRAINTS between pwl ZENITH WET DELAY offsets
- introduce RELATIVE 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

- all units of estimation intervals are minutes
- units of ZWD constraints are picosec<sup>2</sup>/sec (0.7 is loose)
- units of NGR & EGR relative constraints are millimeters/day e.g. 2 mm/day (relative) is loose
- units of NGR & EGR absolute constraints are millimeters e.g. 1 mm (absolute) is loose

ZWD constr.	NGR rel. constr.	EGR rel. constr.	NGR abs. constr.	EGR abs. constr.	ZWD int.	NGR int.	EGR int.	est. ZWD	est. NGR	est. EGR
1.0000e-04	2	2	1	1	120	360	360	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Back Next

Make one constant zenith wet delay per station and do not estimate gradients.

vie\_lsm\_multi\_gui\_statcoor

### vie\_lsm [ station coordinates ]

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)
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Do not estimate station coordinates.**

Back

Next



vie\_lsm\_multi\_gui\_eop

### vie\_lsm [ multiple sessions EOP ]

Earth Orientation Parameter (EOP) pwl offsets estimation options

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

- unit of estimation intervals is minute
- units of constraints are mas/day & ms/day for EOP
- 30 mas/day and 2 ms/day constraints are loose for all EOP
- 0.001 mas/day and 0.00007 ms/day constraints are tight for all EOP

Back

Next

Only estimate one constant dUT1 per session. (1e-4)

vie\_lsm\_multi\_gui\_sourcoor

### vie\_lsm [ multiple sessions source coordinates ]

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

	est. source coor.	constraints	coordinate interval
1	<input type="checkbox"/>	1.0000e-...	1440

- units of constraints is mas/day  
- units of pwl offset source coordinates estimation interval  
- Please, fix at least one source which has more than 1 observation if you select estimate sources

Back Next

**Do not estimate source coordinates.**

## vie\_ism [ multiple sessions output ]

Estimate parameters according to the options in previous GUIs

Prepare  $N_{\text{global}}$  and  $b_{\text{global}}$  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  
 $N_{\text{sinex}}$

clock parameters

zenith wet delay

troposphere gradients

parameters

include into  
SINEX file

reduce from  
 $N_{\text{sinex}}$

source coordinates

station coordinates

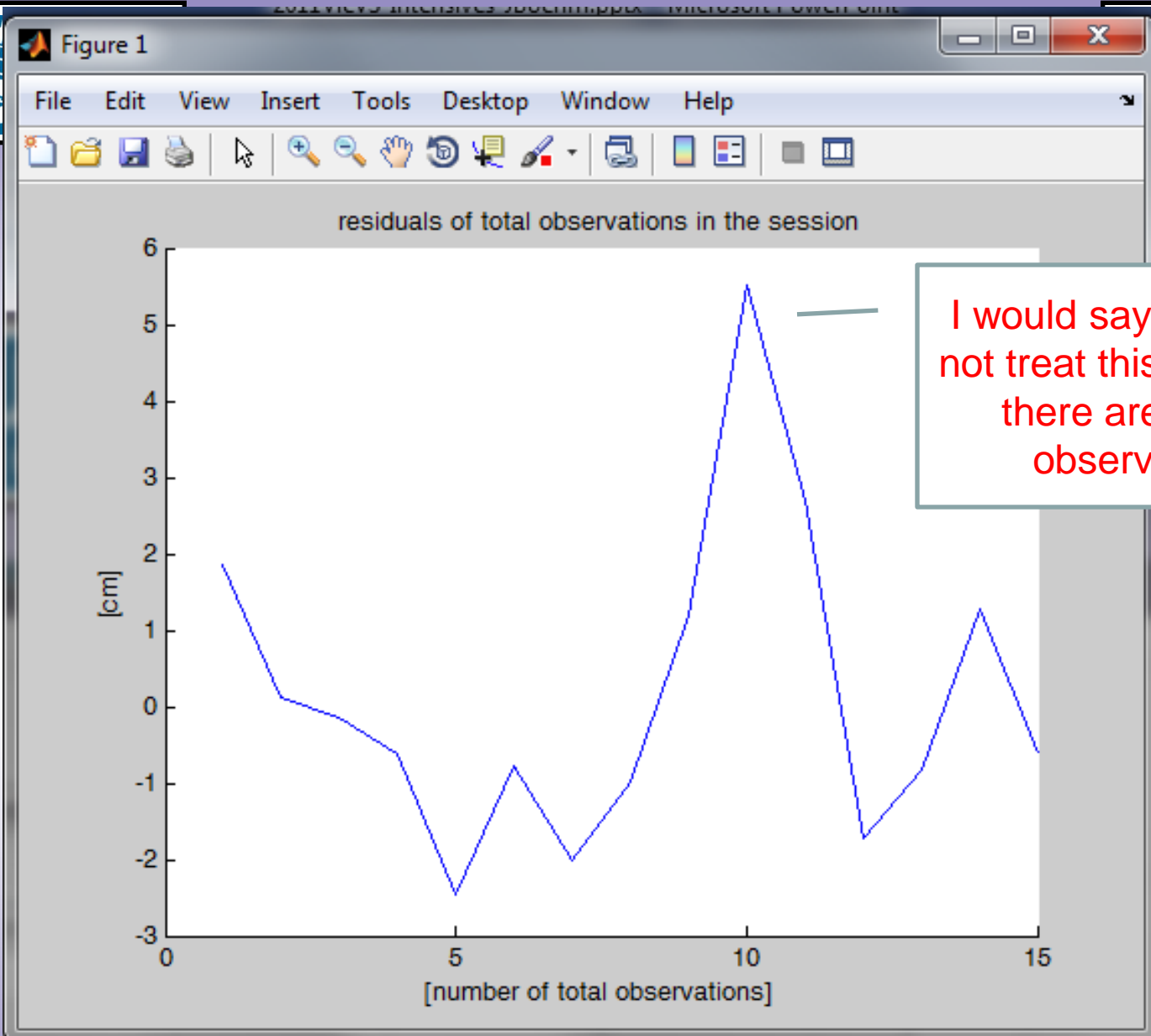
EOP

Add extra parameters to the  $N$  matrix

ALLOW FOR STATIONWISE AND SOURCEWISE PARAMETERIZATION FOR EACH SESSION

Back

Finish



I would say ok. I would not treat this as outlier if there are only 15 observations.

Thanks for your choice!

```
session      1  of    1
fil =
../DATA/LEVEL0//11APR02XK_N003
```

```
-----
|                               Welcome to VIE_INIT!!!!                               |
-----
```

```
Start reading 2011/11APR02XK_N003
[antenna,sources,scan]=read_ngs(ngsfile,trffile,infofile,crffile,ini_opt)
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
Lagrange interpolation of EOP
interp (Conventions)
reading_jpl_421 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!
```



This is not too much.

-----  
Welcome to VIE\_LSM!!!!

Warning: The fourth output, VERSN, of FILEPARTS will be removed in a future release.

> In [fileparts at 35](#)

In [vie\\_lsm at 132](#)

In [vie\\_batchld at 109](#)

In [views at 67](#)

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 "Pobser  
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: 2.3201

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

condition number of normal equation matrix: 6.1497e+008

clock KOKEE is selected as the ref. clock for the main solution

chi-squared of main solution: 1.6135

Could be better but ok.

```
-----  
outlier detection test was not applied!
```

```
-----  
total number of estimated parameters: 10  
total clock offsets: 2  
total rate and quad. terms of clock funct.: 0  
total zenith wet delay offsets: 6  
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 (nututation dx) offsets: 0  
total celestial pole (nututation 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//x_11APR02XK_N003.mat  
estimation options are saved as ../VieVS/DATA/LEVEL3//opt_11APR02XK_N003.mat  
normal equation matrix is saved as ../VieVS/DATA/LEVEL3//atpa_11APR02XK_N003.mat  
right hand side vector is saved as ../VieVS/DATA/LEVEL3//atpl_11APR02XK_N003.mat  
8. vie_lsm IS COMPLETED!  
Elapsed time is 0.707389 seconds.  
Thank you for using vievs!
```

Actually, we only have 5 parameters:  
2 for a linear clock between the  
stations, 2 for constant zenith wet  
delays at the stations, 1 dUT1.

```
>> cd ../DATA/LEVEL3/
>> ls

.          atpa_11APR02XK_N003.mat  atpl_11APR02XK_N003.mat  opt_11APR02XK_N003.ma
..         atpa_11APR04XA_N004.mat  atpl_11APR04XA_N004.mat  opt_11APR04XA_N004.ma

>> load x_11APR02XK_N003.mat
>> x_
x_ =
    pwclk: [1x2 struct]
    rqclk: [1x2 struct]
     zwd: [1x2 struct]
antenna: [1x2 struct]
     ngr: [1x2 struct]
     egr: [1x2 struct]
    xpol: [1x1 struct]
    ypol: [1x1 struct]
    dut1: [1x1 struct]
    nutdx: [1x1 struct]
    nutdy: [1x1 struct]
    coorx: [1x2 struct]
    coory: [1x2 struct]
    coorz: [1x2 struct]

>> x_.dut1
ans =
    col: [9 10]
    mjd: [55653 55654]
    val: [-0.0036 -0.0036]
     mx: [0.0152 0.0152]
```

Here it is dUT1 in msec. It has been estimated in addition to the apriori values.