



TECHNISCHE
UNIVERSITÄT
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Processing Intensive Sessions with VieVS


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VieVS User Workshop
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Vienna



Introduction


INT1 (2-3 days latency)

 Kokee-Wettzell

 Mo-Fr 18:30

INT2 (e-transfer)

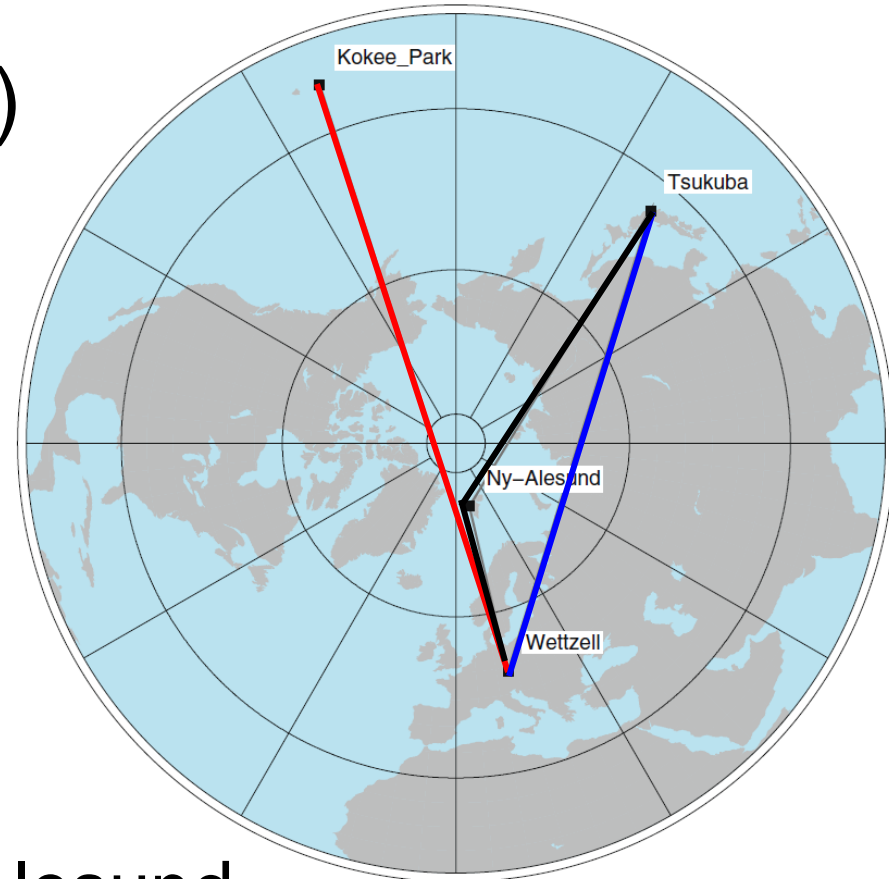
 Tsukuba-Wettzell

 Sa-So 7:30

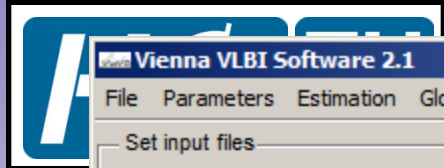
INT3 (e-transfer)

 Tsukuba-Wettzell-NyAlesund

 Mo 7:00



Luzum and Nothnagel (2010)



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File Parameters Estimation Global solution Scheduling Simulation Run Plotting Help

Set input files

Process list

2011/11APR02XK_N003

Browse for sessions

Browse for process_lists

Add previous

Clear selected

OPT file

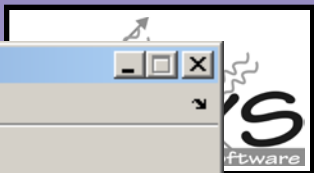
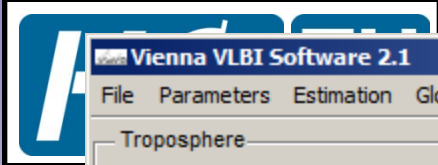
OPT directory: DEFAULT

Outlier file

Outlier directory: Eliminate outliers

Save runp Save + Run

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



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Troposphere

Pressure

- NGS (GPT2 backup)
- GPT
- GPT2

Temperature

- NGS (GPT2 backup)
- GPT
- GPT2

Mapping function

- VMF1
- GMF
- GPT2

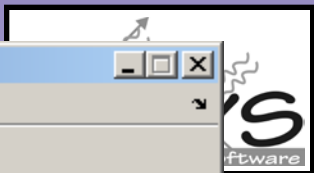
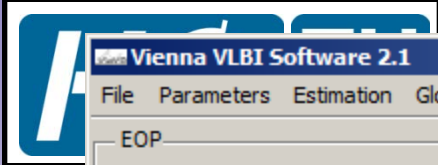
Gradients

- No gradients
- APG (Böhm)
- DAO (MacMillan)

Delay from external file LHG -> Create

Save runp Save + Run

This would have an influence ...



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EOP

A priori time series

- 05 C04
- 08 C04
- finals
- other

include a priori celestial pole offsets

Models

Include high frequency

- Ocean tides
- Libration (xp, yp) 10 terms
- Libration (UT1) 11 terms

Precession/Nutation model

- IAU 2000A
- IAU 2006/2000A

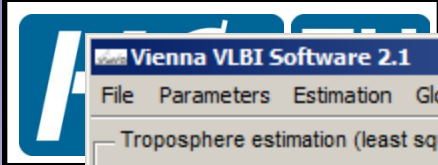
Interpolation

- linear
- lagrange

- Tidal UT variations (RG_ZONT2)
 - UT1R <35d
 - UT1S all constituents

Save runp Save + Run

Remember that



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Troposphere estimation (least squares)

Zenith wet delays

- Estimate zenith wet delays
- ZWD interval [min]
- introduce relative constraints between pwf zenith wet delay offsets
- ZWD constraints [cm] after 1440 minutes

Gradients

Estimate north gradients

- NGR interval [min]
- introduce relative constraints between pwf NGR offsets
- NGR constraints [cm] after 360 minutes
- introduce absolute constraints between pwf NGR offsets
- NGR abs. constr. [cm]

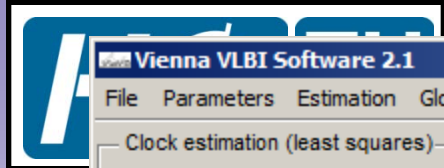
Estimate east gradients

- EGR interval [min]
- introduce relative constraints between pwf EGR offsets
- EGR constraints [cm] after 360 minutes
- introduce absolute constraints between pwf EGR offsets
- EGR abs. constr. [cm]

Save runp Save + Run

We usually estimate one constant zwd per station per session

We usually don't estimate gradients



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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]

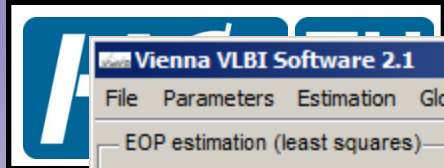
introduce relative constraints between pwl clock offsets

Clock constraints [cm] 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



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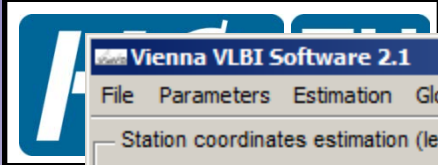
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EOP estimation (least squares)

| | estimation interval [min] | relative | |
|--|---------------------------|---|---------------------------|
| <input type="checkbox"/> Estimate Xpol (inter. pole coord. in TRF) | 1440 | <input checked="" type="checkbox"/> constraints [mas] | 1.0e-4 after 1440 minutes |
| <input type="checkbox"/> Estimate Ypol (inter. pole coord. in TRF) | 1440 | <input checked="" type="checkbox"/> constraints [mas] | 1.0e-4 after 1440 minutes |
| <input checked="" type="checkbox"/> Estimate dUT1 (rotation angle) | 1440 | <input checked="" type="checkbox"/> constraints [mas] | 1.0e-4 after 1440 minutes |
| <input type="checkbox"/> Estimate nutdx (CIP coord. in celes. long.) | 1440 | <input checked="" type="checkbox"/> constraints [mas] | 1.0e-4 after 1440 minutes |
| <input type="checkbox"/> Estimate nutdy (CIP coord. in obliquity) | 1440 | <input checked="" type="checkbox"/> constraints [mas] | 1.0e-4 after 1440 minutes |

Save runp Save + Run

We estimate one constant dut1 value per session



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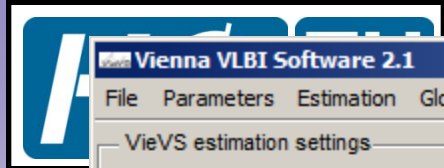
Station coordinates estimation (least squares)

- 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.

Save runp Save + Run

Station coordinates need to be fixed.



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ViewS 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

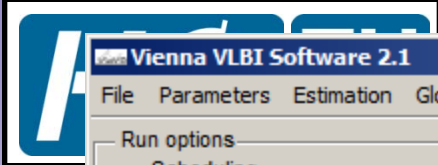
Main solution

- Run main solution (parameter estimation)
 - Simple outlier test ($c * m0$)
 - Normal outlier test ($c * m0 * \text{sqrt}(qv\text{v})$)
- Estimate parameters (otherwise: only N matrix created)

Write all parameters to ASCII file

- 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.



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Run options

Scheduling

Run vie_sched

Simulation

Run vie_sim

VieVS

one subdirectory (recommended)

different subdirectories

vie_init -> vie_mod -> vie_lsm ->

vie_glob ->

Run vie_init

Run vie_mod

Run vie_lsm scanwise update Run vie_lsm

Run parallel Number of cores

Info: Faster for >1 sessions, but
Command Window output is disarranged!

Global solution

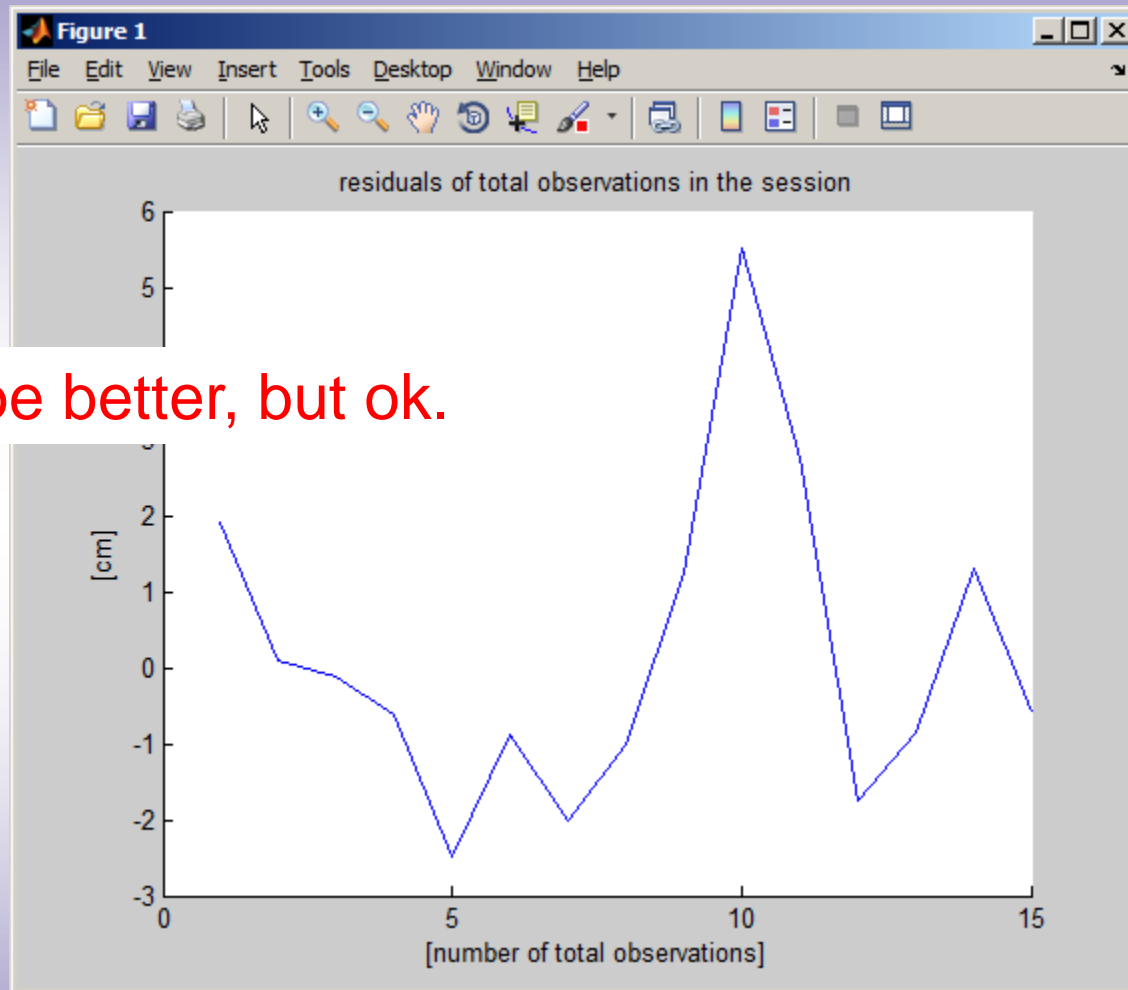
Path to LEVEL2 data

LEVEL2 subdirectory

Output directory for vie_glob Run vie_glob

Let's run the session





Could be better, but ok.

```
session 1 of 1
Current file: ../DATA/LEVEL0/INT/11APR02XK_N003
```

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

```
Stations to be excluded: 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: 5.4932
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: 2.6762

chi-squared of antenna KOKEE : 1.7841
chi-squared of antenna WETTZELL : 1.7841

chi-squared of baseline KOKEE - WETTZELL: 1.7841

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 1.454163 seconds.
```

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

```
>> load('..\DATA\LEVEL3\INT\x_11APR02XK_N003.mat')
>> x_.dut1
ans =
    col: [7 8]
    mjd: [55653 55654]
    val: [-0.0098 -0.0098]
    mx: [0.0154 0.0154]
```

The result is $-9.8 \mu\text{s}$, which is reasonable; also the formal error is ok.