



Data analysis with VieVS

(exercise)

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AVN Training School, 22 February – 08 March 2016,
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Definition of the task

- **Analyze the data acquired during the first 4 days of the CONT14 campaign with VieVS**
- Target parameters:
 - Station coordinates
 - EOPs: Polar motion (X_p , Y_p), Nutation parameter (dX , dY), $dUT1$
- **Processing steps:**
 1. Load data (→ Vie_INIT)
 2. Calculate theoretical delays + partial derivatives (→ Vie_MOD)
 3. Estimate Parameters in a least squares adjustment (→ Vie_LSM)
 4. Check data residuals and investigate results

Data - CONT14

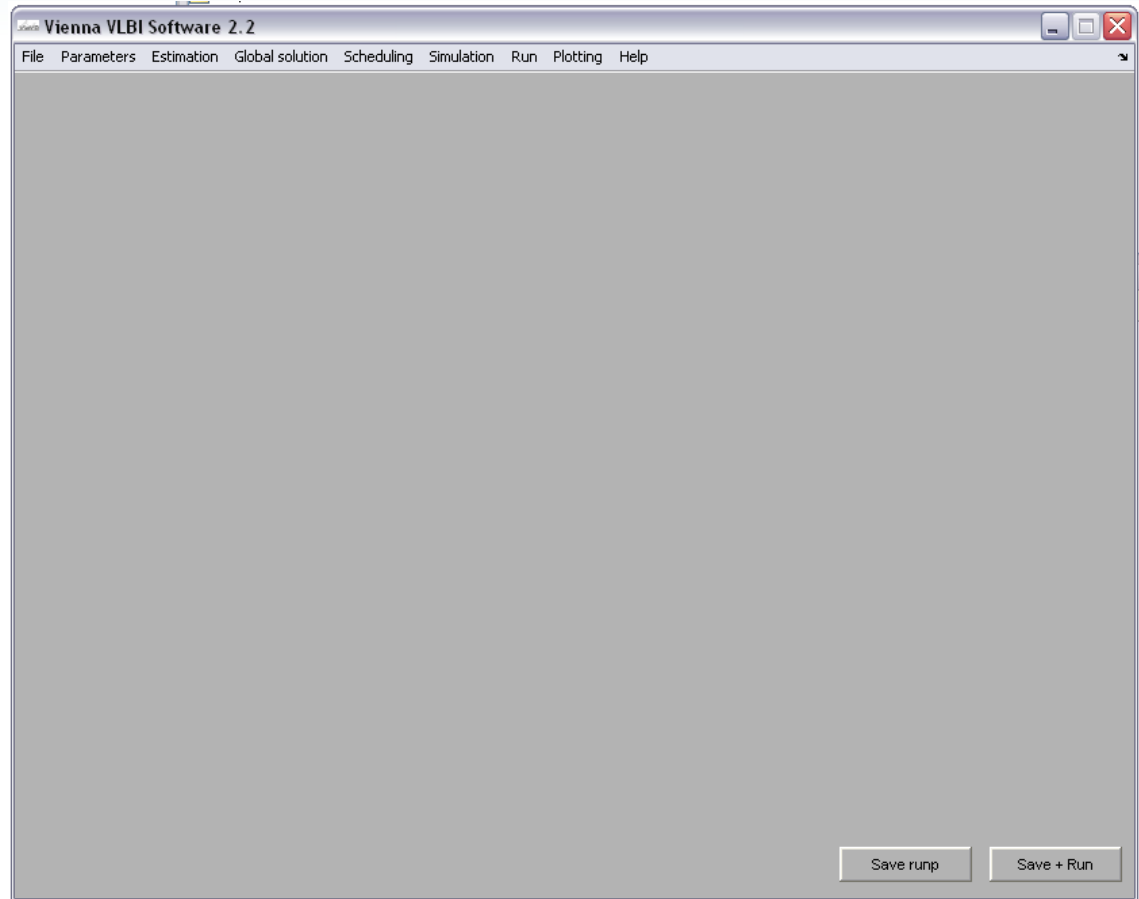
- Continuous VLBI Campaign 2014 (CONT14)
- 2 weeks of continuous VLBI observation with a global 17 station network
- 6-MAY-2014 00:00 UT to 20-MAY-2014 24:00 UT → 15 * 24 hour sessions
- **Goal:** *“... is to acquire state-of-the-art VLBI data over a time period of about two weeks to demonstrate the highest accuracy of which the current VLBI system is capable”*



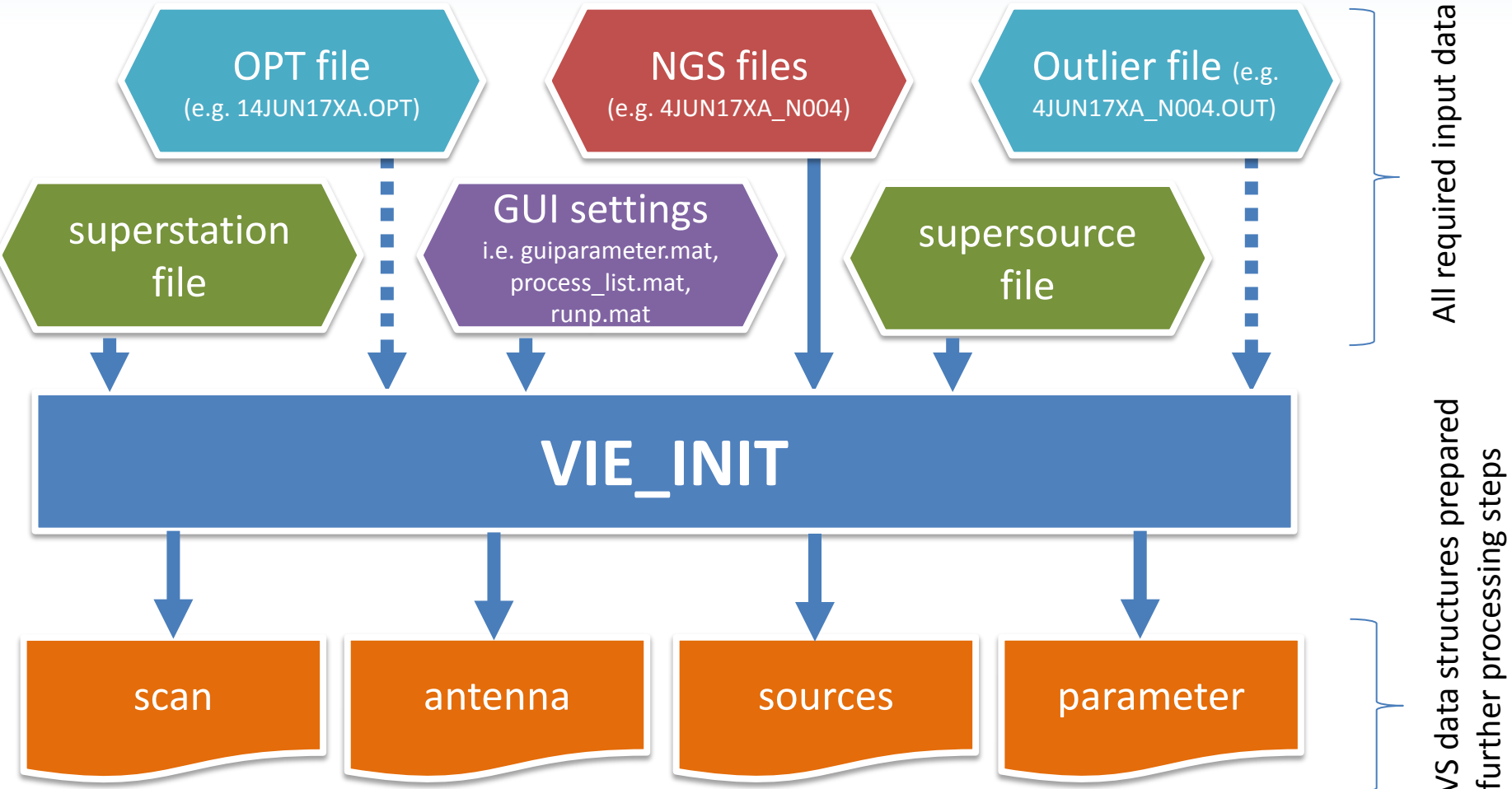
CONT14 station network
[\(http://ivs.nict.go.jp/mirror/program/cont14/\)](http://ivs.nict.go.jp/mirror/program/cont14/)

How to start VieVS

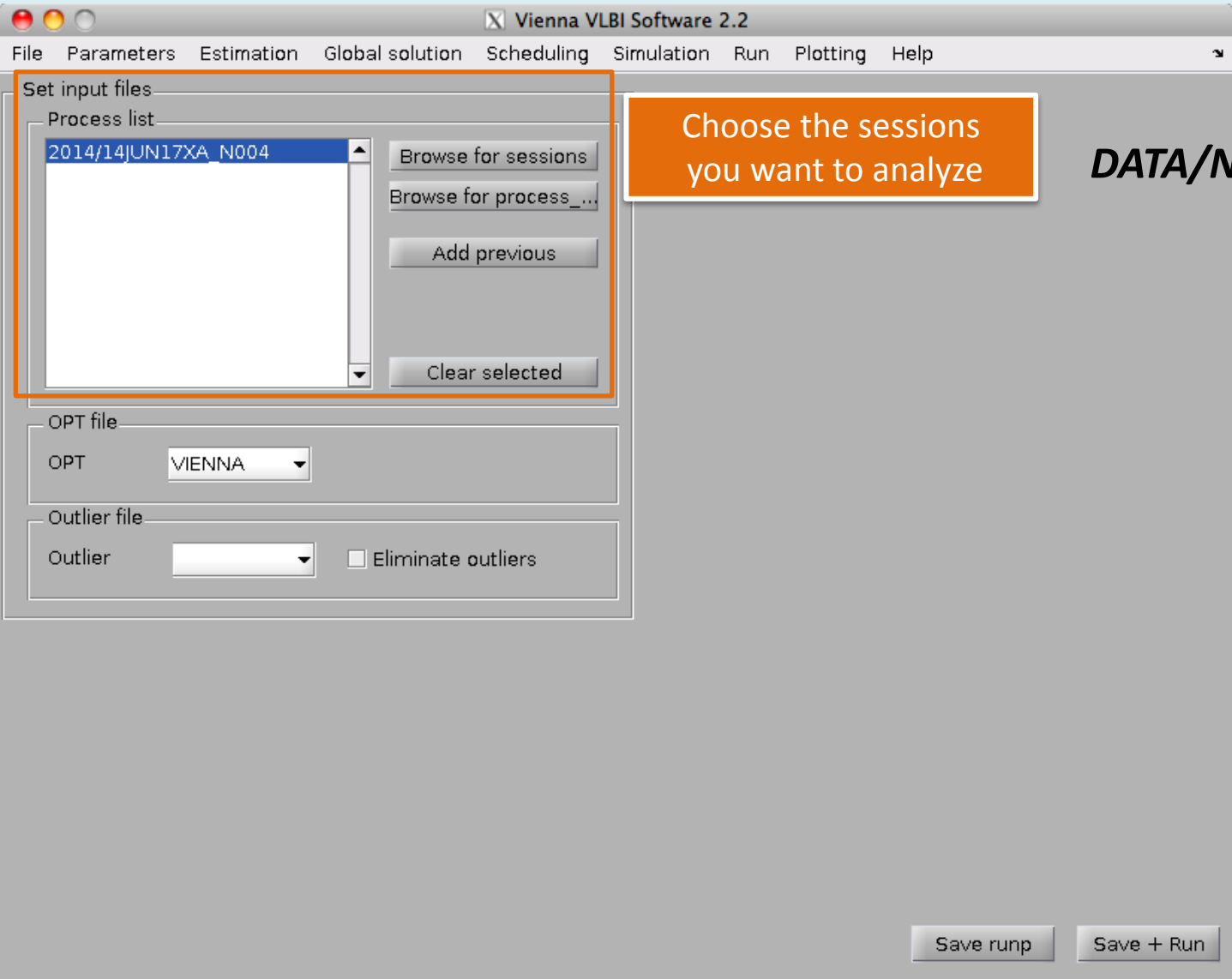
- Start MATLAB
- Change directory to **VieVS/WORK/**
- Start VieVS with the command:
views
- The VieVS GUI will now appear



1) Loading data (Vie_INIT)



VIE_INIT Options



File > Set input files

Choose the sessions
you want to analyze

DATA/NGS/

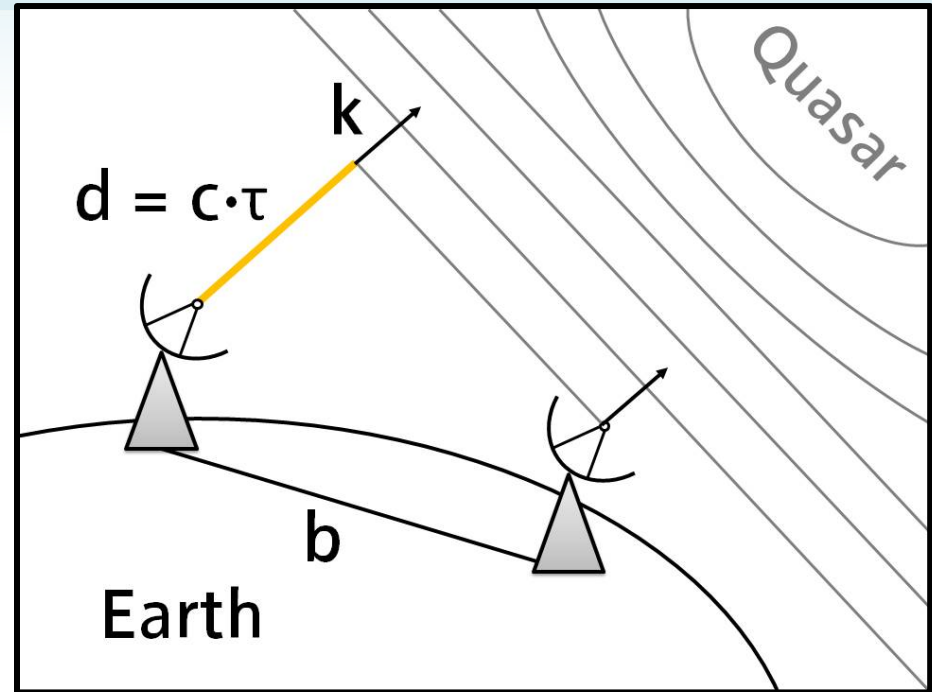
2.) Delay modelling (Vie_MOD)

- Vie_**MOD**elling of....
 - Computed delay times τ_{comp}
 - Partial derivatives $\frac{\partial \tau}{\partial VAR}$

Basics (1)

computed delay τ

$$\tau = -\frac{\vec{b} \cdot \vec{k}}{c}$$

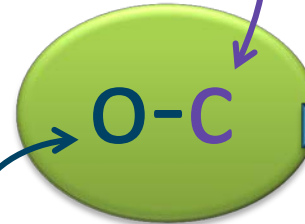


computed delay τ_{comp}

- Vie_MOD

observed delay τ_{obs}

- from NGS-card file, corrected for ionosphere



Adjustment
(LSM)

Basics (2)

Models in Vie_MOD

- + Tropospheric delay
- + Solid Earth tides
- + Ocean loading
- + Atmospheric loading
- + Hydrologic loading
- + Thermal antenna deformation
- + EOP

partial derivatives

$$\frac{\partial \tau}{dVAR}$$

computed delay τ_{comp}

- Vie_MOD

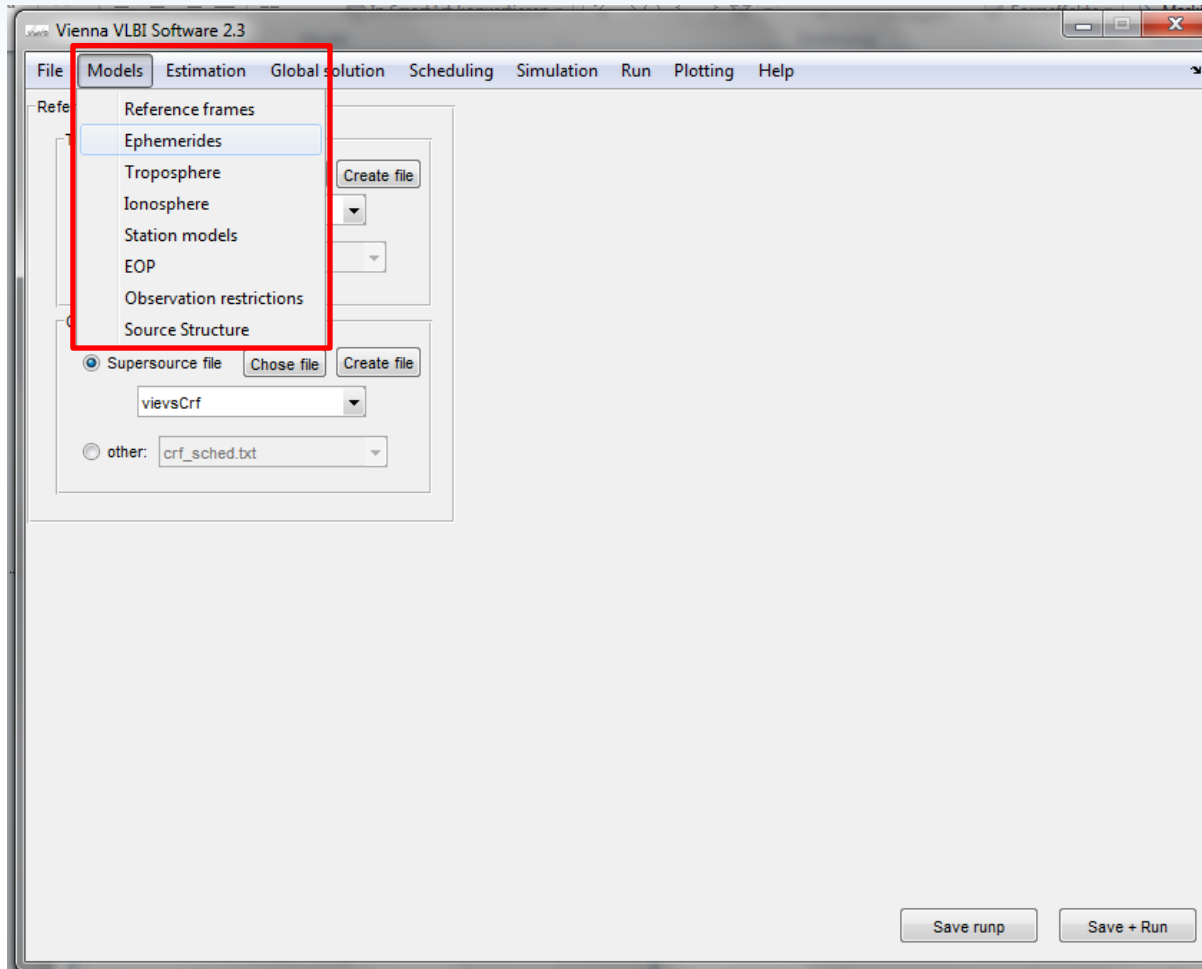
observed delay τ_{obs}

- from NGS-card file, corrected for ionosphere

O-C

Adjustment
(LSM)

Vie_MOD



- Computed delay times τ_{comp}

- Partial derivatives $\frac{\partial \tau}{\partial VAR}$

- Results are stored in:

.../DATA/LEVEL1/<sub_dir>/<sess_name>_antenna.mat
_parameter.mat
_scan.mat
_sources.mat

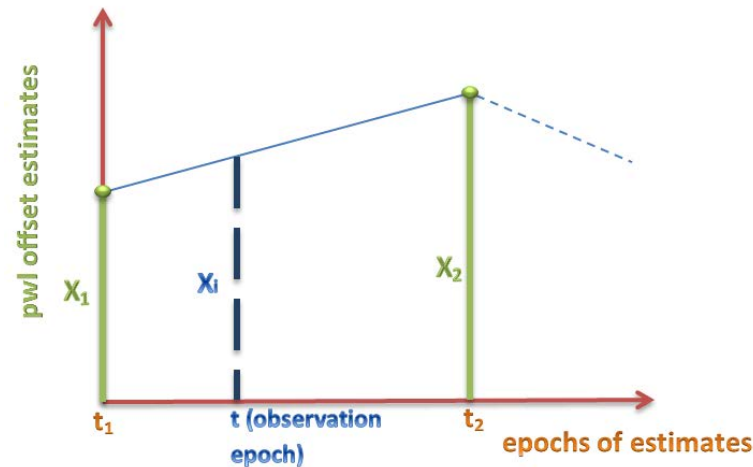
➔ Used as input for VIE_LSM

3.) Parameter estimation

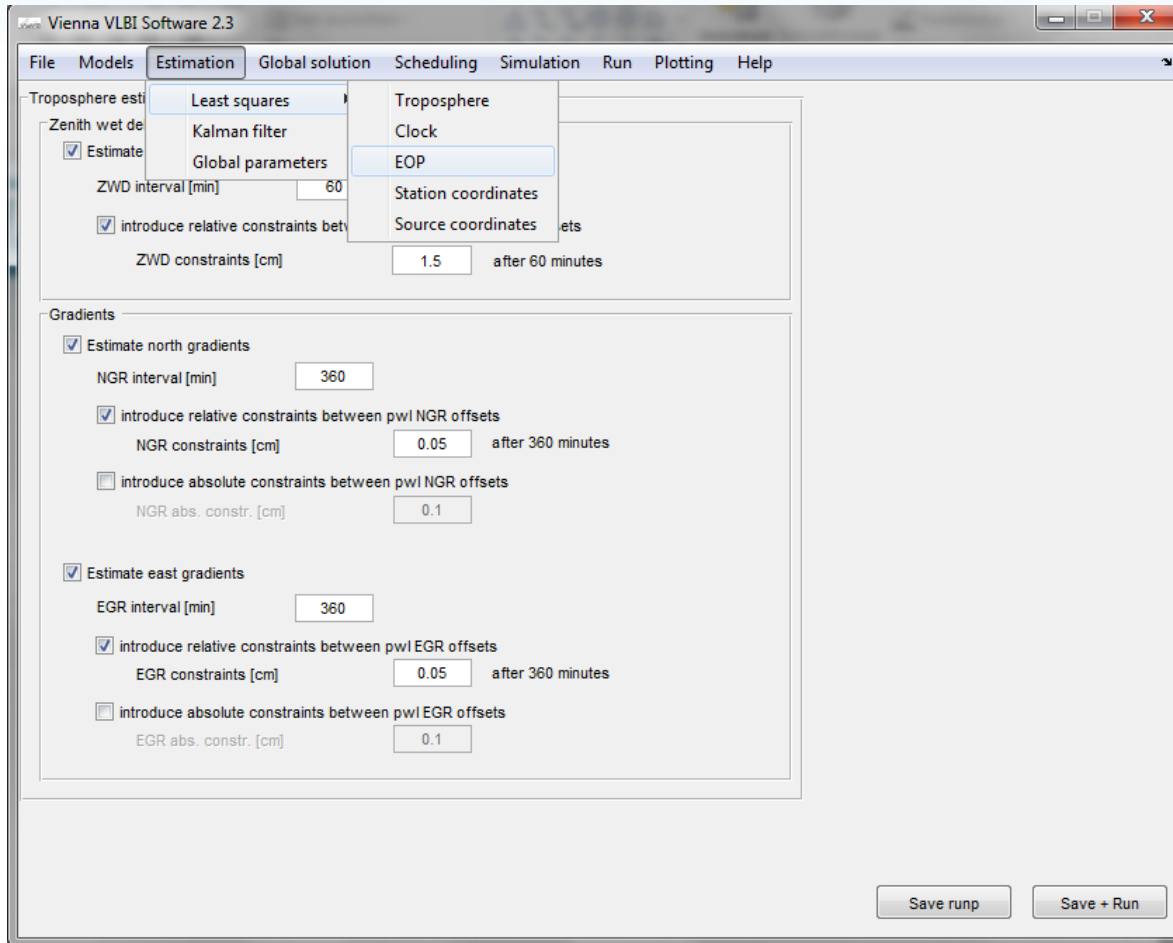
- **Vie_LSM module:** estimation of geodetic parameters with least squares adjustment from VLBI observations
- **Target parameters**
 - Station coordinates (one estimate per session)
 - EOPs (daily estimates)
- **Auxiliary parameters** (have to be estimates along the other parameters)
 - Troposphere
 - Zenith Wet Delay (hourly)
 - Gradients (every 6 hours)
 - Clock
 - PWLO (hourly) + one rate + one quadratic term per clock

Estimates

- In VieVS all parameters are estimated as **Piece-wise linear Offsets (PWLO)**
- Total values = estimates (PWLO) + a priori values (modelled)



$$x_i = x_1 + \frac{t - t_1}{t_2 - t_1} (x_2 - x_1)$$



Results of Vie_LSM

- The result of Vie_LSM are estimates and formal errors of the target and auxiliary parameters
- They are stored in:
 - .../DATA/LEVEL3/<sub-dir>/**atpa**<session_name>.mat
 - x**<session_name>.mat
 - res**<session_name>.mat

4.) Check the results

- Check the **estimation quality** and detect problems:
 - Characteristic values for one session: Chi2, WRMS
 - Post-fit residuals of the Least squares adjustment
- In case of **problems with a session**, e.g.:
 - lots of noise or flawed data due to problems at the observatory
 - Unstable clocks, clock jumps,...
 - etc.
- Detect and **eliminate Outliers** in the observations
- Apply certain rules defined in **OPT files**, e.g.
 - do not use observations of a specific baseline/station/source
 - Add “clock breaks” to account for jumps in the time stamps (clock jumps)
 - Downweight specific observations in the LSM parameter estimation

Investigate the estimates

- Tools in VieVS to inspect the results:
 - Parameter plotting tool
 - Session analysis tool

- Write output:
 - EOP/BAS out functions
 - EOP values
 - Baseline repeatabilities (measure for quality of estimated station coordinates)

Thank you for your attention!

Visit our webpage for more information on VieVS, e.g. how to get it for free:

<http://viev.s.geo.tuwien.ac.at>

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