VieVS 2.3 – status of the Vienna VLBI Software and plans for the future

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Introduction

The Vienna VLBI Software VieVS has been developed by the VLBI group at the Vienna University of Technology since 2008. VieVS is designed for the analysis of geodetic VLBI observation data as well as for scheduling and simulation of different VLBI sessions. The software incorporates the latest IERS Conventions and uses the concept of continuous piecewise linear offsets at integer hours for the parameter setup, consistent with the terms of reference of the GGOS. We present the status of the software focusing on the capabilities of the newest release 2.3.

VieVS structure
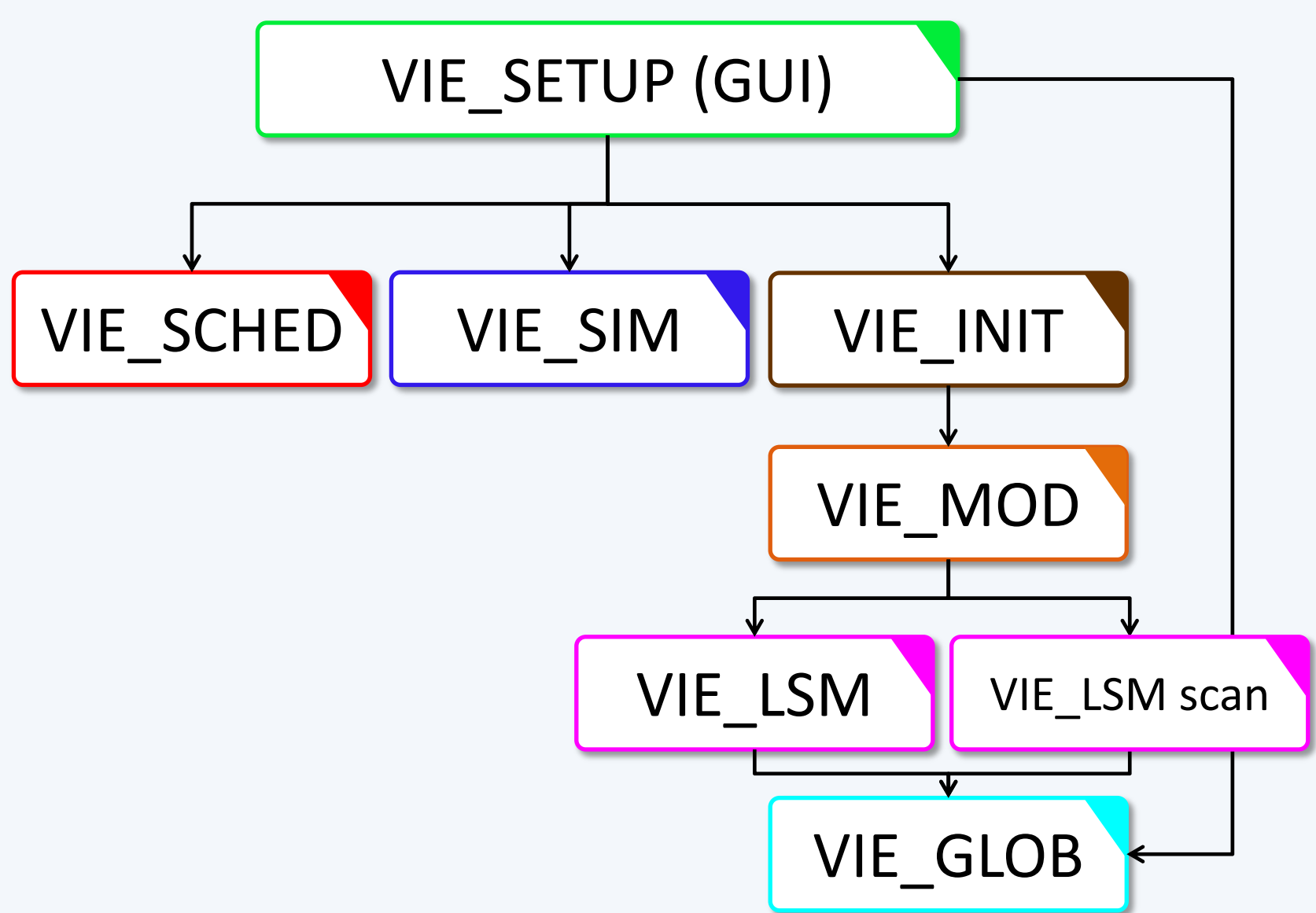
VIE_SETUP
- The processing setup is realized in one common graphical user interface (GUI).
- Start single session solution as well as single modules (scheduling, simulation, global solution).

VIE_SCHED
- Scheduling of observations → ngs-files for simulation, skd-files for antenna steering.

VIE_SIM
- Simulation of observations from real sessions or sessions scheduled with VIE_SCHED.

VIE_INIT
- Reading of observations, station coordinates and velocities, source coordinates.
- Removing of outliers and bad observations, exclusion of stations, sources or baselines.

VIE_MOD
- Calculation of theoretical delay and partial derivatives.
- Accounting for station corrections.

VIE_LSM & VIE_LSM scan
- Computation of least squares adjustment (inversion of whole design matrix or scan-wise update of normal equation matrix).
- Setup and storing of normal equations for global solution.

VIE_GLOB
- Stacking of single session normal equations to obtain global parameters.
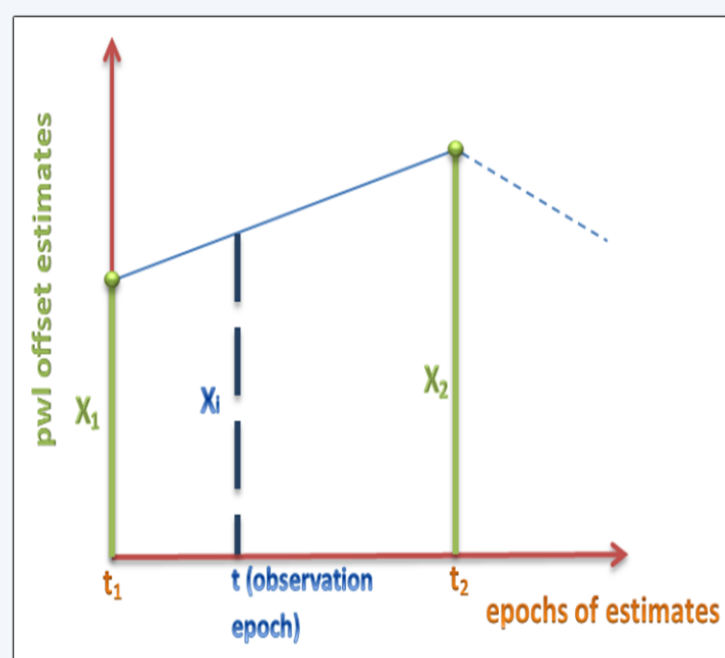
VieVS features

Session analysis

Single session analysis

Select session and parameters via a simple GUI.
Estimate Parameters as continuous piecewise linear offsets:
- EOP
- Station and source coordinates
- Zenith wet delays
- Clock offsets

Multi session analysis

Analysis of a predefined process list with the same parameterisation

New: Correct for source structure
(in cooperation with the University of Tasmania)

New: vgosDB-ready
New data format (netCDF) incorporated

New: Ray-tracing
Ray-traced delays for all VLBI observations

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

Scheduling and simulation

Scheduling
- **New: Refined scheduling for satellite observations**
- Prepare schedules for VLBI observing sessions automatically
- Include twin telescopes
- Station- or source based strategy
- AUST sessions are scheduled with VIE_SCHED

Simulation
- Monte-carlo-simulations
- Simulated parameters:
  - Clocks
  - White noise
  - Troposphere
  - Source structure
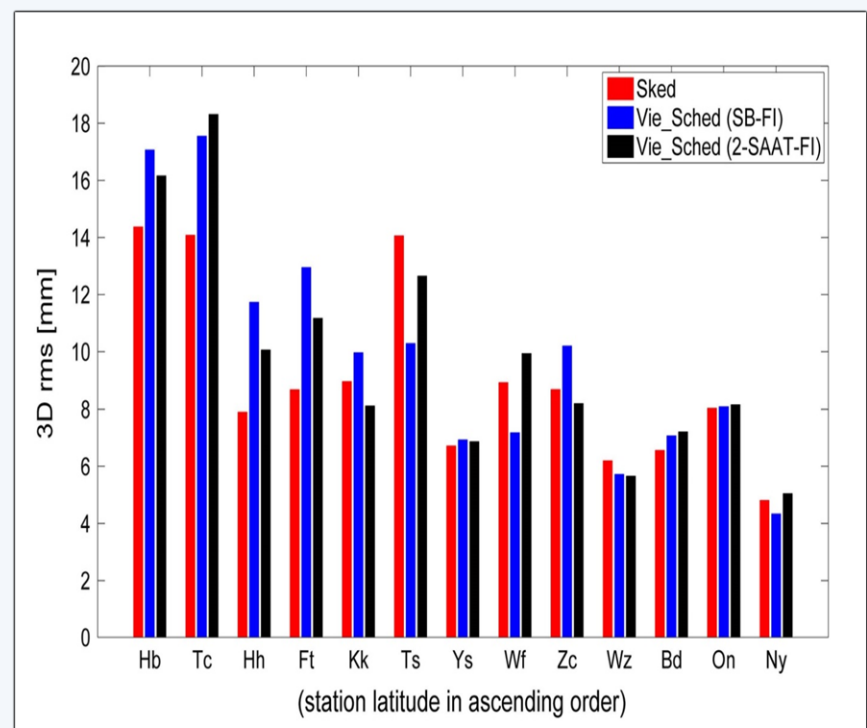
Comparison of schedules (Sun et al. 2014)
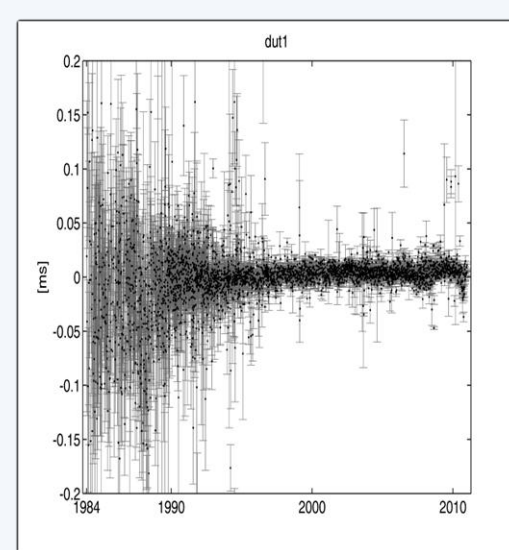
Global Solution

Estimate parameters which are common to all VLBI sessions
- **New: Tidal ERP terms**
- Station coordinates and velocities (TRF)
- Source coordinates (CRF)
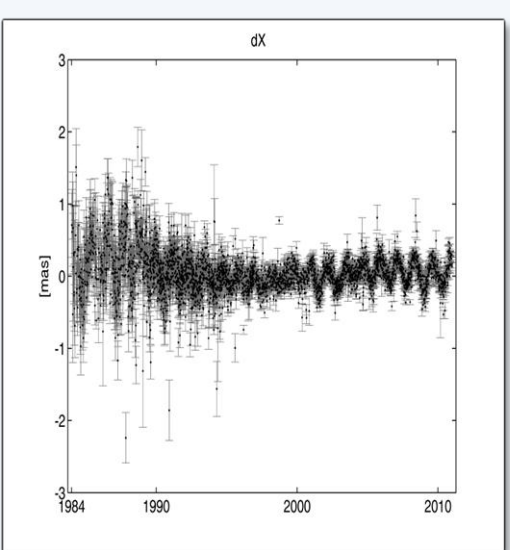- Earth orientation parameters (EOP)

Backwards solution for reduced parameters:
- Tropospheric delays, gradients
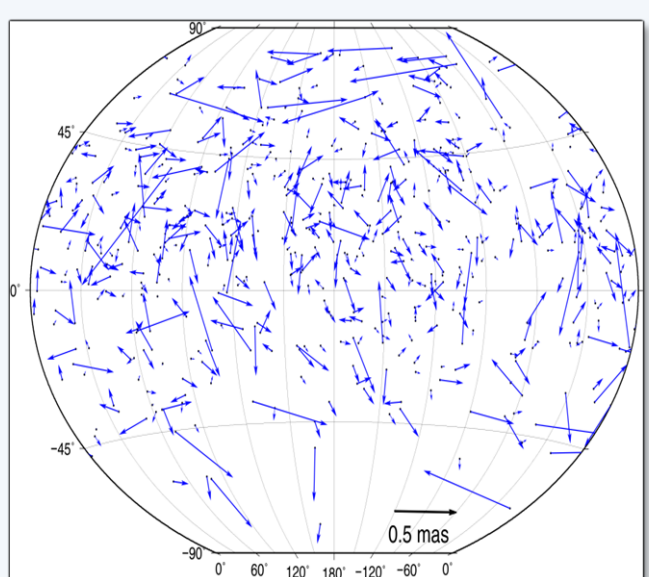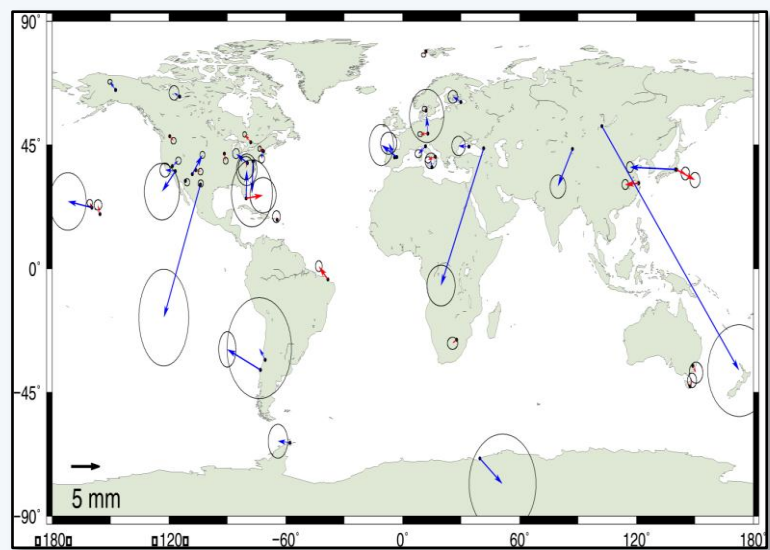- Station and source coordinates
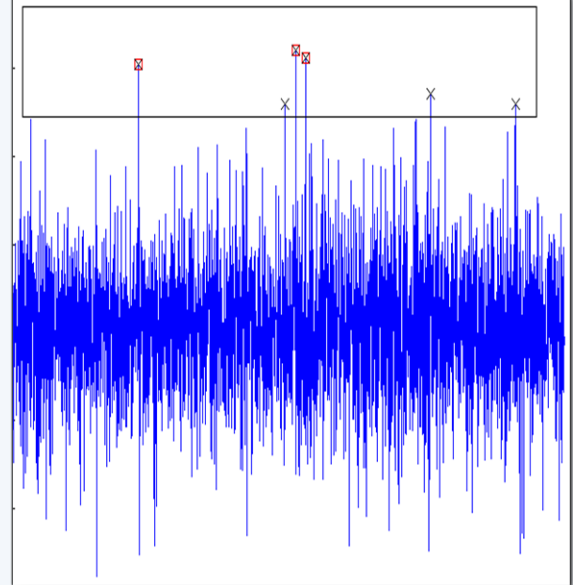- EOP, e.g.:

Horizontal position differences

Source positions in VieCRF10a w.r.t. ICRF2
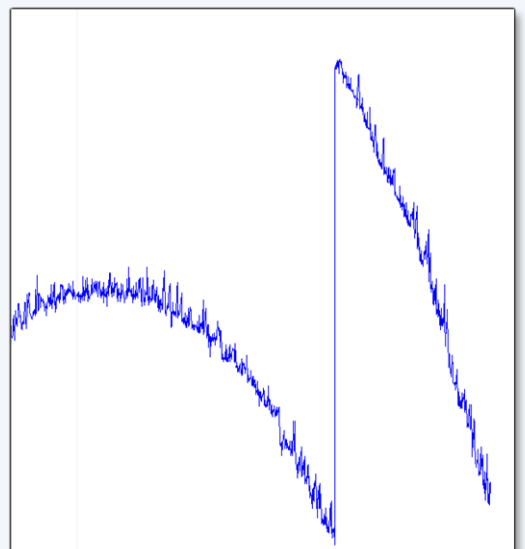

Nutation dX

dUT1 (UT1-UTC)

Plotting tool
- Plot residuals and parameters per station, baseline etc.
- Interactive selection of outliers and clock breaks
- Analyse sessions
- Plot network
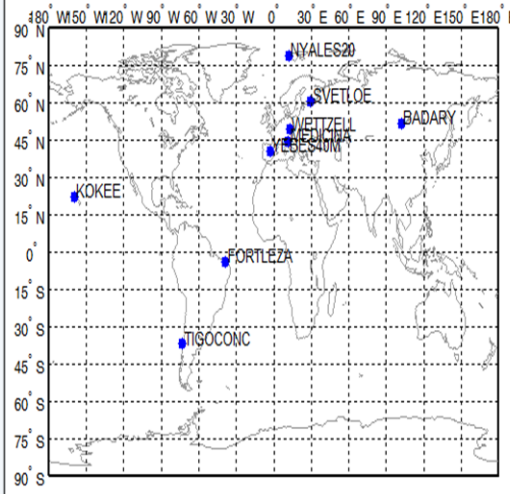- Plot correlation matrices
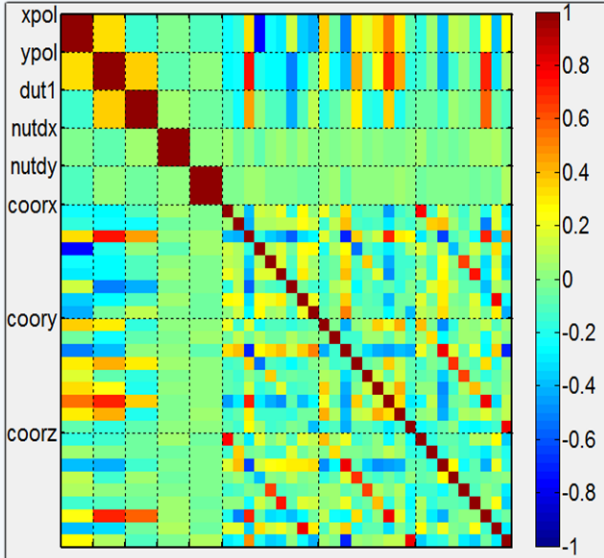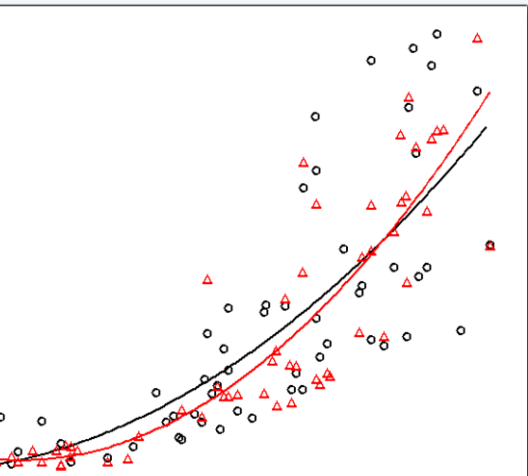- Plot baseline length repeatability

Residuals

Clock break

Network

Correlation matrix

Baseline length rep.

How can I become a user?

- VieVS is available free of charge for registered users.
- Registration: If you want to have access to VieVS, take a look at the requirements for external users and send a letter to Johannes Böhm (signed by the head of your institution) where you describe for which purposes you would like to have access to VieVS.
- The requirements for external users and a template for the application can be downloaded from the VieVS webpage (http://vievs.geo.tuwien.ac.at/)
- Reference: J. Böhm, S. Böhm, T. Nilsson, A. Pany, L. Plank, H. Spicakova, K. Teke, H. Schuh. The new Vienna VLBI Software VieVS, in Proceedings of IAG Scientific Assembly 2009, International Association of Geodesy Symposia Series Vol. 136, edited by S. Kenyon, M. C. Pacino, and U. Marti, pp. 1007-1011, 2012.

Future plans

More sophisticated scheduling module
- Schedules for VGOS
- Mixing legacy and new antennas

Improve scheduling of satellite observations
- Interactive scheduling approach
- Orbit calculation based on Two Line Element (TLE)
- Generation of scheduling files (VEX) capable of performing satellite observations with VLBI antennas

System requirements

- MATLAB 7.6 (R2008a) or later.
- About 7.5 GB of disk space, including all data files
- Should work with any operating system able to run this MATLAB version (tested on Windows and Linux).

User workshop

The next VieVS user workshop will be held September 2016 in Vienna!

Participants 2015