Vienna VLBI Software

Current release and plans for the future

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Introduction

Vienna VLBI Software (VieVS)

- VLBI data analysis software
- Developed since 2008
- Version 2.1 (release in March 2013)
- Written in Matlab
  - Easy to understand/use/modify
  - Many built-in functions
  - Slow
  - Expensive (→ Octave)

Graphical User Interface

- Freely available to registered users
Overview

- Single session analysis
  Analyze single VLBI session and estimate parameters

- Scheduling
  Create VLBI observation schedule

- Simulation
  Simulate VLBI observations

- Global solution
  Estimate global parameters

In one common Graphical User Interface
Combines all modules in one graphical interface

- Matlab GUIDE
- Set input files
- Change processing settings
- Define output options
Plotting tool

Allows user to plot ...

- Residuals
- Parameters
- Session overview
- Zoom
- Pan
- Get values
Plotting tool - Residuals

Detect bad stations, sources or baselines
Plotting tool - Residuals

Find and remove clock breaks interactively
Plotting tool - Residuals

Select outliers interactively
Plotting tool - Parameters

- Visualize estimated parameters
- Check models
- Output figure to any matlab supported filetype
Plotting tool - Session analysis

Plot session network
Plotting tool - Session analysis

Baseline length repeatability
Plotting tool - Session analysis

Correlation matrix
Single session analysis

Analyze one VLBI session and estimate parameters

- Read in data
  - NGS, netCDF
  - Removes outliers
  - Exclude stations, sources, baselines

- Calculate
  - Partial derivatives and theoretical delay
  - Most recent IERS conventions

- Estimation
  - Least squares
  - Clocks, zenith wet delays, gradients, Earth Orientation parameters, station coordinates, source coordinates
  - Piece-wise linear offsets
Piece-wise linear offsets

- At integer hours
- Estimation options
  - Intervals (5 minutes to 2 days)
  - Constraints

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

Estimation settings for tropospheric parameters

- Estimate (yes | no)
- Interval
- Constraints (absolute, relative)
Towards VLBI 2010
Twins included
5 R&D sessions
Source-based strategy

2 sources simultaneously
Global geodetic parameters

Multi-session combination
  - TRF, CRF, EOP
  - Stacking normal equations
Reduced parameters
  - Wet zenith delays
  - Gradients
Geodynamical parameters
  - FCN period
  - Love, Shida numbers

Horizontal position differences (VieTRF10a, VTRF2008)
Simulation

- Create simulated observations
- Write NGS files
- Simulate
  - Tropospheric delays *(Nilsson and Haas, 2010)*
  - Clock errors
  - Measurement noise
Tropospheric and ionospheric delays

Textfiles containing delays of observations

- Own data possible
- Flexibility

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<th>Ionosphere</th>
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<td>From GNSS TEC maps</td>
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<td>Gradients</td>
<td>Ionospheric studies</td>
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<td>Ray-tracing (some stations)</td>
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Main station and source files

- Binary (.mat) files containing all static information
- All-purpose
- Station file
  - TRF
  - Loading data
  - Discontinuities
  - Eccentricities
  - Antenna information
  - ... 
- Source file
  - CRF
Spacecraft tracking

- Processing of SELENE D-VLBI observations
  - Delay model of sources at finite distances
  - Moving target
- VLBI observations to satellites
  - Scheduling
  - Simulations
  - (Processing)
- Goals
  - Develop observing strategies
  - Frame ties
Future plans

- Parallel computing
- Kalman filter (Tobias Nilsson / GFZ)
- Scheduling (continue)
- Satellite observations (continue)
- Geophysical parameter estimation (e.g. galactic rotation)
Summary

- VieVS is VLBI data analysis software with several capabilities
- Written in Matlab
- Release of Version 2.1 in March 2013
- Free to registered users
User workshops

- Yearly held at TU Vienna (since 2010)
- Next: Probably autumn 2013
- Everybody welcome!

Participants of the VieVS User Workshop 2012