Introduction to VieVS 2.2

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What is VieVS?

- VieVS = Vienna VLBI Software
- A new, state of the art, geodetic VLBI data analysis software package
- Written in Matlab
- Since 2008 it is developed at the Department of Geodesy and Geoinformation (Research Group Advanced Geodesy), Vienna University of Technology
- Close cooperation with former colleagues (University of Tasmania, Hacettepe University in Turkey, Shanghai Astronomical Observatory)

- Current reference:
Why did we develop VieVS?

• Important that there exist several different types of VLBI analysis software

• Different software packages can validate each other. Helps identifying bugs etc.

• Analysts have a choice of what to use

• VLBI2010 / VGOS put new demands and challenges on the VLBI analysis software

• We want to have a VLBI software which is easy to use:
  – BSc, MSc, and PhD students can easily learn it and use it
  – Should be easy to add new models etc. for special investigations
  – Graphical User Interface (GUI)
  – Should have a clear structure
Who did develop VieVS?

Former & current members of the VieVS group at the Vienna University of Technology:

+ contributions from external partners from international universities worldwide
VieVS development

- Development started in 2008
- First version released in the end of 2009 (In the first version many parts were based on OCCAM. Now almost every subroutine is written from scratch)
- New Version 2.2 was released in August 2014
- Freely available to registered users: [http://vievs.geo.tuwien.ac.at](http://vievs.geo.tuwien.ac.at)
- Currently registered users from about 37 institutions worldwide
Why Matlab

• Advantages:
  – Easy to use
  – Easy to change source code
  – Good tools for plotting etc.
  – Matlab available on all major operating systems (Windows, Linux/UNIX, Mac OS)

• Disadvantages:
  – Matlab is an expensive commercial software
    (VieVS is in principle working on GNU Octave, but without GUI and it is much slower; Qt Interface (V. Choliy))
  – Slower than C++ or Fortran. Not a major problem.
System Requirements

- MATLAB 7.6 (R2008a) or later.

- About 7 GB of disk space, including all data files
  (NGS files 1979-now: 6.7 GB, source code: <10 MB)

- Should work with any operating system able to run the chosen MATLAB version (tested on Windows and Linux)

- Possible to run on older MATLAB versions or the free counterpart GNU-Octave if the Graphical User Interface is not used
Policy

• VieVS is freely available to registered users:
  – Easier to get feedback
  – Easy to spread information about bugs, new updates, etc.
  – Nice to know how many and who are using the software

• For information, see VieVS homepage http://vievs.geo.tuwien.ac.at and the new VieVS-Wiki webpage http://vievswiki.geo.tuwien.ac.at

• We are open for cooperation:
  – Modules etc. can be written at other institutions
• VieVS can be downloaded using ssh/sftp from the server: vievs.hg.tuwien.ac.at

• or from the VieVS website:
  http://vievs.geo.tuwien.ac.at/

  --> Get VieVS

• Log in as user users and download the VieVS directory.
**Downloading VieVS using rsync**

- On Unix/Linux systems, VieVS can easily be downloaded using the rsync command:
  
  ```
  rsync -aL users@vievs.hg.tuwien.ac.at:VieVS
  ```

- The same command can also be used to update your VieVS installation.

- To skip the NGS files (e.g. slow connections):
  
  ```
  rsync -aL --exclude 'DATA/NGS/*' users@vievs.hg.tuwien.ac.at:VieVS
  ```
Downloading VieVS using an sftp/scp client

- Log in to vievs.hg.tuwien.ac.at with your favourite sftp client (e.g. Filezilla).
- Download the VieVS directory
Updating VieVS

• Regularly updates (to be able to analyse the latest sessions):
  – VieVS/DATA/NGS/
  – VieVS/ATM/, VieVS/VM1/
  – VieVS/EOP/
  – (VieVS/HYDLO/ - not updated automatically on the server)

• For a session with a new station or source
  – check for updated superstation.mat file in VieVS/TRF and/or updated supersource.mat file in VieVS/CRF

• When a new version is released:
  – VieVS/COMPILE/
  – VieVS/OUT/
  – VieVS/WORK/
  – Possible other directories...
time-series of atmospheric non-tidal loading corrections for station coordinates APL_VIENNA/GSFC/
VieVS directories

input information for the scheduling module Vie_SCHED
VieVS directories

source code of VieVS

VieVS

ATM
CATALOGS
COMPILE
CRF
DATA
DOC
EOP
...

VieVS

EPHEM
HYDLO
ION
OUT
TRF
TRP
VM1
WORK
contains the file **supersource.mat** (position of sources in several catalogues) and functions to create this file
OPT files include specific options for analysis of a session

NGS files contain the measured time delay

files with outliers for each session created with VieVS

results as SINEX files

master files contain a list of observed sessions
VieVS directories

- ATM
- CATALOGS
- COMPILE
- CRF
- DATA
- DOC
- EOP
- ...

- GLOB
- LEVEL2
- LEVEL0
- LEVEL1
- LEVEL3
- LEVEL4
- SIM
- MASTER
- NGS
- OPT
- OUTLIER
- SCHED
- LEVEL5
- TURB
- SNX

files created with Vie_INIT
files created with Vie_MOD
results stored with Vie_LSM or Vie_LSM_scan
documentation and useful publications, user manual can be also downloaded at the VieVS homepage: [http://vievs.geo.tuwien.ac.at](http://vievs.geo.tuwien.ac.at)
Earth Orientation Parameters:
C04 05
C04 08
eop_finals2000A
planetary and lunar ephemeris:
JPL 405
JPL 421
time-series of hydrology loading corrections for station coordinates GSFC/ (Eriksson & MacMillan)
files and functions for using external ionospheric information, e.g. from GPS TEC maps
Matlab functions for further treatment of estimated parameters; in OUT/GLOB directory results from Vie_GLOB module are stored.
contains - the file `superstation.mat` (position of stations in several catalogues and time-independent parameters) - functions to create this file
files and functions for using external tropospheric information, e.g. from ray-tracing
VieVS directories

main VieVS working directory - VieVS starts from here
Modules of VieVS

Vie_SETUP

Vie_SCHED
Vie_INIT
Vie_MOD
Vie_LSM
Vie_LSM_scan

Vie_SIM
Vie_GLOB
Modules of VieVS

Vie_SETUP

Graphical User Interface for all modules;
allows to choose the options and parameterization

Vie_SCHED
Vie_MOD
Vie_LSM
Vie_LSM_scan
Vie_SIM
Vie_GLOB

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The 3 core modules for an analysis of a session
Vie_INIT - reads in data
Vie_MOD - calculates the theoretical time delay and builds up the partial derivatives
Vie_LSM – estimates the unknown parameters with Least Square Method
Vie_LSM_scan – similar to Vie_LSM but uses a scan-wise update of the A matrix (useful for large sessions)
Modules of VieVS

Vie_SETUP

Vie_SCHED
  Scheduling module

Vie_INIT

Vie_MOD

Vie_LSM

Vie_LSM_scan

Vie_SIM
  Simulation tool creating artificial observations

Vie_GLOB
  Global solution

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Files used and created by different parts of VieVS

- VIE_SETUP (= GUI)
- Reads: superstation.mat and supersource.mat

- Creates:
  - **WORK/process_list.mat**: list of sessions to be processed
  - **WORK/runp.mat**: general information about the processing, e.g. which parts of VieVS will be run
  - Parameter files in the **DATA/LEVEL0/ directory**
    Contains the chosen options for the analysis. One for each session in the process list. Name: **SESSIONNAME_parameter.mat**, e.g. **08AUG12XA_N004_parameter.mat**
Files used and created by different parts of VieVS

• VIE_INIT
  – Reads:
    – Parameter file from DATA/LEVEL0/ directory (e.g. 08AUG12XA_N004Parameter.mat)
    – Outlier file
    – OPT file
  – Creates structure arrays and saves them in DATA/LEVEL0/:
    – antenna: list of stations in the session (saved as e.g. 08AUG12XA_N004Antenna.mat)
    – sources: list of sources observed in the session (saved as e.g. 08AUG12XA_N004Sources.mat)
    – scan: list of scan (saved as e.g. 08AUG12XA_N004Scan.mat)
Files used and created by different parts of VieVS

- **VIE_MOD**
  - Reads:
    - structure arrays (parameter, antenna, sources, and scan) from `DATA/LEVEL0/`

  - Saves the structure arrays with added information in `DATA/LEVEL1/`:
    - the names are identical as in LEVEL0
Files used and created by different parts of VieVS

- **VIE_LSM**
  - Reads:
    - The structure arrays from `DATA/LEVEL1/` directory
    - OPT file
  - Creates:
    - `DATA/LEVEL3/`:
      - `x_` (e.g. `x_08AUG12XA_N004.mat`) contains the estimated parameters
      - `opt_` (e.g. `opt_08AUG12XA_N004.mat`) contains the lsm options
      - `apta_, atpl_`: normal equation matrices
      - `res_` (e.g. `res_08AUG12XA_N004.mat`) post-fit residuals
    - `DATA/LEVEL2/`: Data for global solution (datum free NEQs)
    - `DATA/OUTLIER/`: Detected outliers
How to start VieVS

• Start MATLAB
• Change directory to VieVS/WORK/
• Start VieVS with the command: vievs
• The VieVS GUI will now appear
Running VieVS in batch mode

• Run: `viefs('batch')`

• The processing starts directly, GUI is not displayed

• Requires that all option files (process list, parameter files, runp) have already been created (e.g. from a previous run)
Run an older version of VieVS

- To run an older VieVS version, e.g. 1d: `vievs('1d')` or 2.1: `vievs('21')`

- To run version 2.2 in batch mode: `vievs('22','batch')`

- Requires that the specific version of VieVS is installed.

- Never mix different versions!
Thank you for your attention!