

Exercise: Multi session analysis

In brief

Do-it-yourself session analysis – work with process lists – detect and consider outliers – use parallel processing – compare baseline length repeatabilities from different processing settings.

Baseline length repeatability

The baseline length repeatability is a commonly used tool to investigate the quality of VLBI results. It represents the precision of the baseline length measured with VLBI. On the x-axis, we have the baseline length and on the y-axis, we plot some sort of repeatability measure (standard deviation, RMS, WRMS). We use baseline length repeatability to identify how consistent our solutions are. It is also a great tool to investigate the impact of models on the station coordinates. Generally speaking, we can assume that a model that reduces the baseline length repeatability also increases the consistency of the VLBI result.

Sessions

We will use 10 R1 and R4 sessions from 2019 (19JUL29XA – 19AUG29XE).

Processing steps

1. Create OPT files for the sessions where a special handling is necessary. We will go through some sessions together to identify problems and find solutions. Inspected sessions: 19JUL29XA, 19AUG01XE, 19AUG05XA and 19AUG12XA. The default parameterization will be used, except that we will uncheck the estimation of source coordinates in “Estimation > Least squares > Source coordinates”.
2. Create a process list with all 10 sessions. In the panel “Set input files” click on the button *Browse for VGOS-DB* and select the XE and XA sessions from JUL29 to AUG29. To save the process list go to “File > Parameter files > Save process list as ...” and store your session list.
3. Outlier detection: we will now use ready-made OPT-files from the directory VIENNA, to enable the outlier detection go to “Run > VieVS estimation settings” and tick *Simple outlier test* in the panel *Main solution*. Outliers will be written to VLBI/DATA/OUTLIER/2019/ in session-wise files with the extension OUT. In “Run > Run options” define a sub-directory for the results, for example “standard” and check *Use parallel processing* in the panel *Advanced options*. Click the button “Save + Run”.
4. Create a “standard” solution and apply outliers. To eliminate outliers we have to go again to “File > Set input files > Outlier file” and tick the option *Eliminate outliers*. In “Run > VieVS estimation settings” you have to deselect *Simple outlier test*, otherwise more outliers are detected and appended to the existing *.OUT file. Since the

outliers are applied in `vie_lsm` we do not have to run `vie_init` and `vie_mod` again: go to “Run > Run options” and deselect `Run vie_init` and `Run vie_mod`. Click the button “Save + Run”.

5. Create a solution with different modelling for comparison: select again `Run vie_init` and `Run vie_mod`, use a different sub-directory for the results, for example “no_otl”. Then we will change something in the modelling of the station coordinates – go to “Models > Station models” and deselect “Tidal ocean loading”. Click the button “Save + Run”.

Investigate results

Analyse the baseline length repeatabilities of the two solutions: Go to “Plotting > Session Analysis” and choose the “standard” folder in the first drop down window and press *Load*. In the *Options* panel choose *Basel. len. rep.*, in the second drop down window select the “no_otl” folder and tick *Add network/BLR*. Note that the software was slightly modified for the VieVS days because there is usually a minimum number of baseline observations of 10 hard-coded for the BLR calculation – here it was set to 6.

The result should look like this:

