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Vie_GLOB Version 2.2

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Global solution

What is a global solution?

A global solution combines VLBI sessions and estimates common parameters.

Why use it?

With this approach the whole history of VLBI data can be used to estimate parameters such as stations coordinates and velocities, source coordinates etc.

Theoretical background

- Sort parameters in the N-matrix and b-vector
- Reduction of parameters
  - always reduced: clock parameters, zwd and troposphere gradients
  - can be reduced: EOP, stations and sources not suitable for global solution

$$\begin{bmatrix} N_{11} & N_{12} \\ N_{21} & N_{22} \end{bmatrix} \cdot \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

globally estimated p.

reduced p.

$$N_{reduc} = N_{11} - N_{12} \cdot N_{22}^{-1} \cdot N_{21}$$

$$b_{reduc} = b_1 - N_{12} \cdot N_{22}^{-1} \cdot b_2$$

→ the reduced normal equation matrices are saved during a normal run in VieVS in the LEVEL2 directory.

- Stacking of the reduced normal equation systems

$$N = N_{reduc\_1} + N_{reduc\_2} + \ldots + N_{reduc\_nse}$$

$$b = b_{reduc\_1} + b_{reduc\_2} + \ldots + b_{reduc\_nse}$$

Constraints

Some constraints have to be chosen:

- zwd, troposphere gradients, EOP
  - constraints are chosen in VIE_LSM
- station coordinates and velocities
  - relative constraints for velocity
    - same velocity for all coordinate intervals at one station (e.g. antenna repair)
    - same velocity at stations in the same area (e.g. Hobart26 and Hobart12)
  - datum definition (NNT/NNR or NNT/NNR/NNS)
- source coordinates
  - datum definition (NNR or NNR + dz)

Final solution

- applying of the constraints

$$N^{C}_{REDUC} = \begin{bmatrix} N_{REDUC} & B^{\mathrm{T}} \\ B & 0 \end{bmatrix} \qquad b^{C}_{REDUC} = b_{REDUC} + w$$

- final solution for global parameters

$$dx_1 = \left(N^{C}_{REDUC}\right)^{-1} \cdot b_{REDUC}$$

- estimates are stored as a structure array in Matlab format and as a txt file
  - VieVS/OUT/GLOB/_ESTIMATES/*TEST_OUT*/
    - globsol_*TEST_LEVEL2*.mat
    - glob_results_*TEST_LEVEL2*.txt

Vie_GLOB_V22

Parameters which can be estimated:

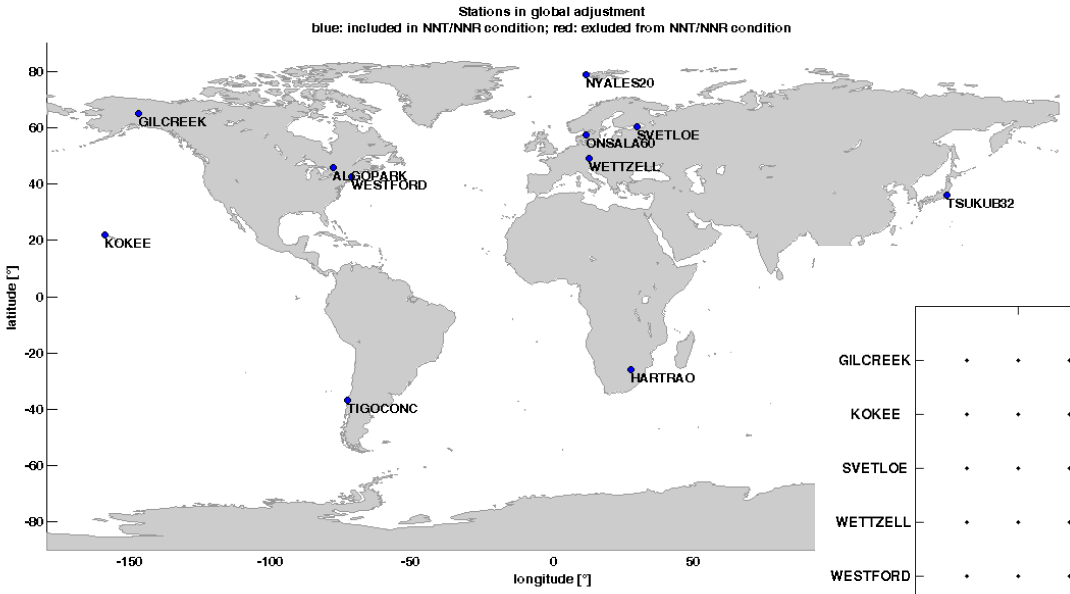
- from combination of more sessions
  - station coordinates and velocities: TRF
  - source coordinates: CRF
  - Earth orientation parameters
  - axis offset

- session-wise as reduced parameters
  - zenith wet delay
  - tropospheric gradients
  - Earth orientation parameters
  - station and source coordinates (not suitable for global estimation)

- input data
  - datum free N-matrices (A^TPA) and b-vectors (A^TPl)
  - VieVS/DATA/LEVEL2
  - created within a „normal“ run of VieVS

Plots

VieVS/OUT/GLOB/_PLOTS/*TEST_OUT*/



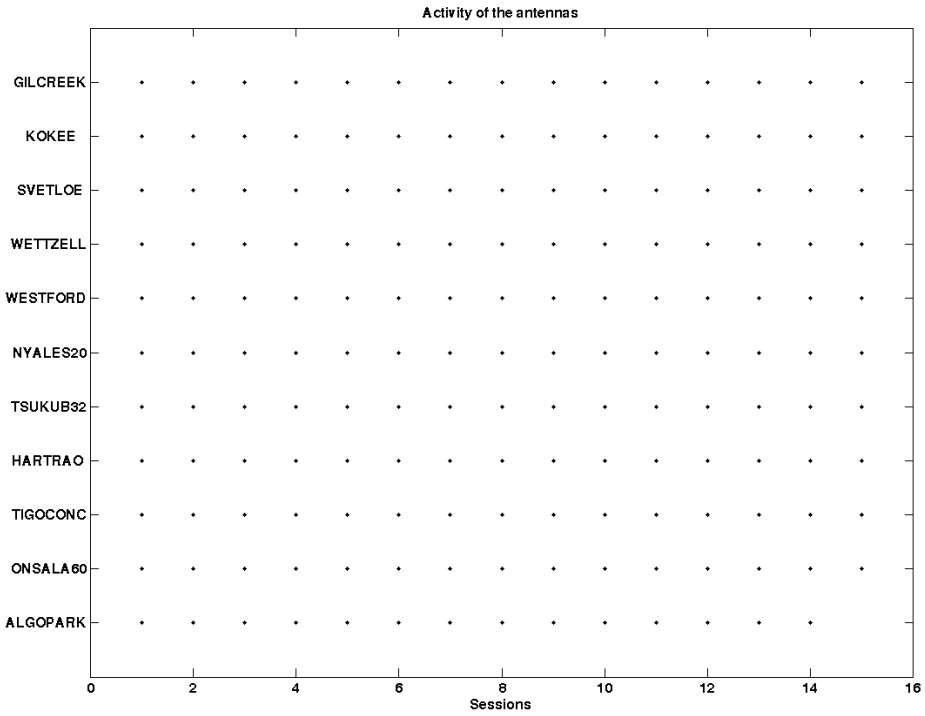
ant_map_*TEST_LEVEL2*.eps

map of stations,

blue circles: station included in NNT/NNR

red circles: station excluded from NNT/NNR

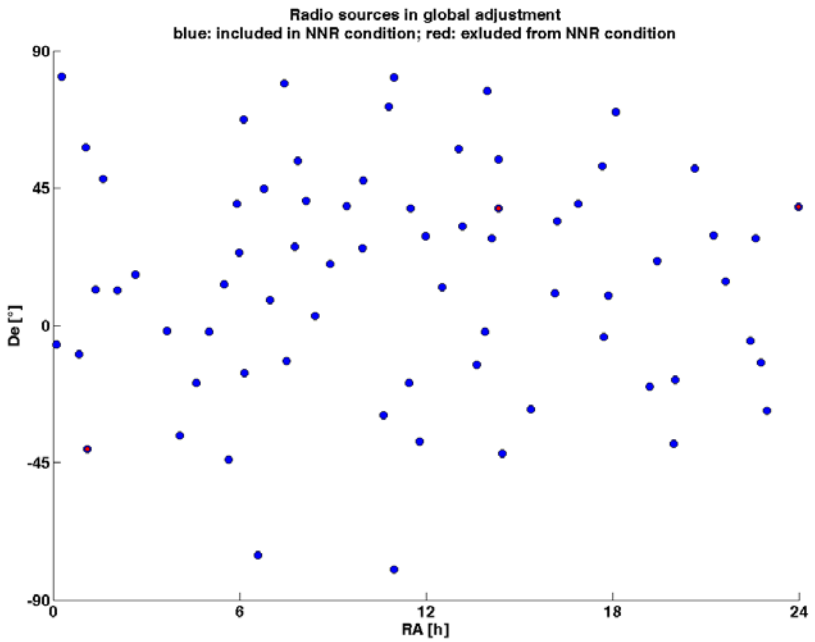
stations in sessions included in the global adjustment



ant_activity_*TEST_LEVEL2*.eps

Plots

VieVS/OUT/GLOB/_PLOTS/*TEST_OUT*/



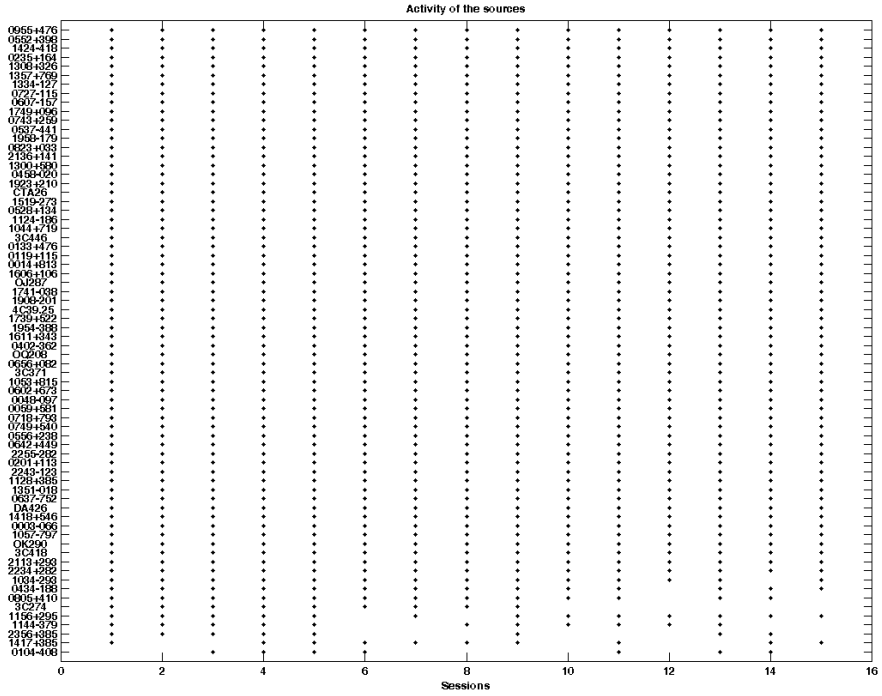
sou_map_*TEST_LEVEL2*.eps

map of sources,

blue circles: source included in NNR

red circles: source excluded from NNR

sources in sessions included in the global adjustment



sou_activity_*TEST_LEVEL2*.eps

Processing of a long time span of data (20 years or more)

- Problems
  - if e.g. EOP are considered as global parameters (stacking at the overlapping time steps), **the final N matrix is too huge** – not possible to handle it at a normal PC
  - **position of some sources is not stable enough** to handle it as a constant value
  - unequal observation time at the stations – at some stations the **observation interval is not sufficient to estimate reliable velocity**

Backward solution

- In these cases the concerned parameters have to be excluded from the global adjustment by a **session-wise reduction**.

$$\begin{bmatrix} N_{11} & N_{12} \\ N_{21} & N_{22} \end{bmatrix} \cdot \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

globally estimated p.

reduced p.

After running Vie_GLOB we know the vector x_1 (global parameters)

- The vector x_2 we get from a so-called back solution for each session:

$$x_2 = N_{22}^{-1} \cdot b_2 - N_{22}^{-1} \cdot N_{21} \cdot x_1$$

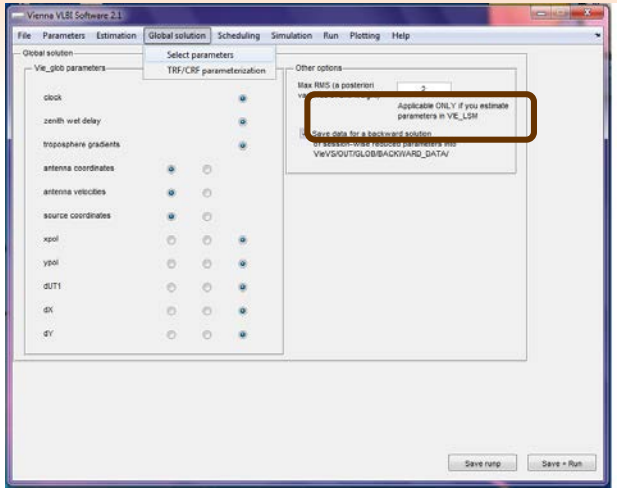
- Covariance matrix

$$Q_{22} = N_{22}^{-1} + N_{22}^{-1} \cdot N_{21} \cdot Q_{11} \cdot N_{12} \cdot N_{22}^{-1}$$

Backward solution

- If the button in the 1st GUI of Vie_GLOB is ticked, all needed parameters for a back solution will be stored in: VieVS/OUT/GLOB/BACKWARD_DATA/TEST_OUT/

  i.e., N_{21}, N_{22} and b_2 for each session + some other information, e.g. description of the columns



- After finishing of Vie_GLOB run VieVS/OUT/GLOB/backward_solution.m
  - in the source code you have to specify the name of the TEST_OUT and TEST_LEVEL2 directories and which reduced parameters you want to estimate
- The estimated values will be written into .txt files in VieVS/OUT/GLOB/BACKWARD_SOLUTION/TEST_OUT/ as
  - ant_TEST_LEVEL2.txt
  - eop_TEST_LEVEL2.txt
  - sou_TEST_LEVEL2.txt
  - tgr_TEST_LEVEL2.txt
  - zwd_TEST_LEVEL2.txt

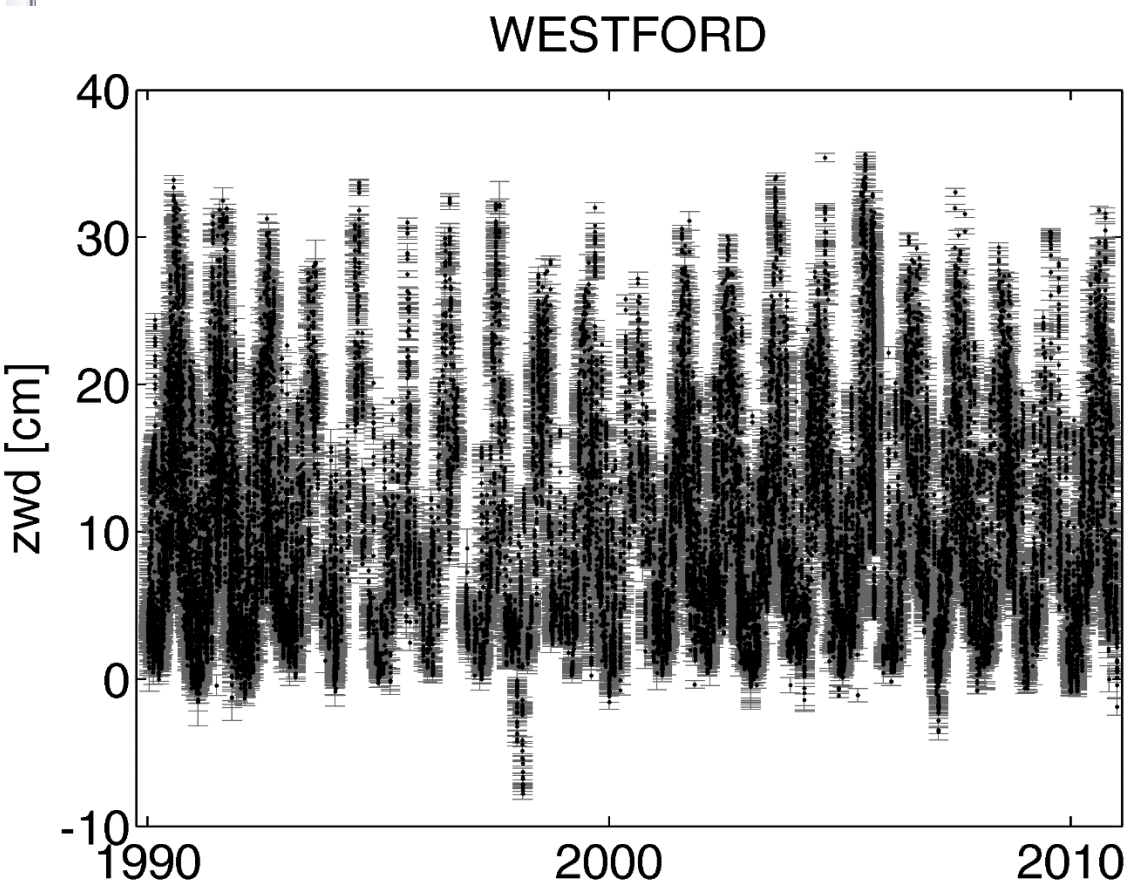
Backward solution: zwd

zwd_TEST_OUT - Notepad

File Edit Format View Help

```
 % parameter   station    mjd     value    standard deviation
 % Units are [cm]

zwd    GILCREEK       51449.75000       2.250       0.3411
zwd    GILCREEK       51449.79167       2.957       0.2928
zwd    GILCREEK       51449.83333       2.726       0.2689
zwd    GILCREEK       51449.87500       2.745       0.3364
zwd    GILCREEK       51449.91667       3.291       0.3463
zwd    GILCREEK       51449.95833       3.303       0.2791
zwd    GILCREEK       51450.00000       2.638       0.2144
zwd    GILCREEK       51450.04167       2.658       0.2112
zwd    GILCREEK       51450.08333       2.987       0.2220
zwd    GILCREEK       51450.12500       2.753       0.2275
zwd    GILCREEK       51450.16667       2.244       0.1961
zwd    GILCREEK       51450.20833       1.916       0.2253
zwd    GILCREEK       51450.25000       2.019       0.2453
zwd    GILCREEK       51450.29167       1.618       0.2274
zwd    GILCREEK       51450.33333       1.970       0.3577
zwd    GILCREEK       51450.37500       2.211       0.2475
zwd    GILCREEK       51450.41667       1.752       0.3311
zwd    GILCREEK       51450.45833       1.952       0.2305
zwd    GILCREEK       51450.50000       1.554       0.2281
zwd    GILCREEK       51450.54167       1.092       0.2829
zwd    GILCREEK       51450.58333       0.802       0.3375
zwd    GILCREEK       51450.62500       1.244       0.4321
zwd    GILCREEK       51450.66667       1.845       0.3693
zwd    GILCREEK       51450.70833       3.347       0.4254
zwd    GILCREEK       51450.75000       3.068       0.4533
zwd    KOKEE          51449.75000       8.335       0.3624
zwd    KOKEE          51449.79167       8.207       0.2668
zwd    KOKEE          51449.83333       8.971       0.4109
zwd    KOKEE          51449.87500       8.930       0.2243
zwd    KOKEE          51449.91667       8.608       0.2812
```



The estimates for each station can be plotted with:

VieVS/OUT/GLOB/
plot_backward_zwd.m

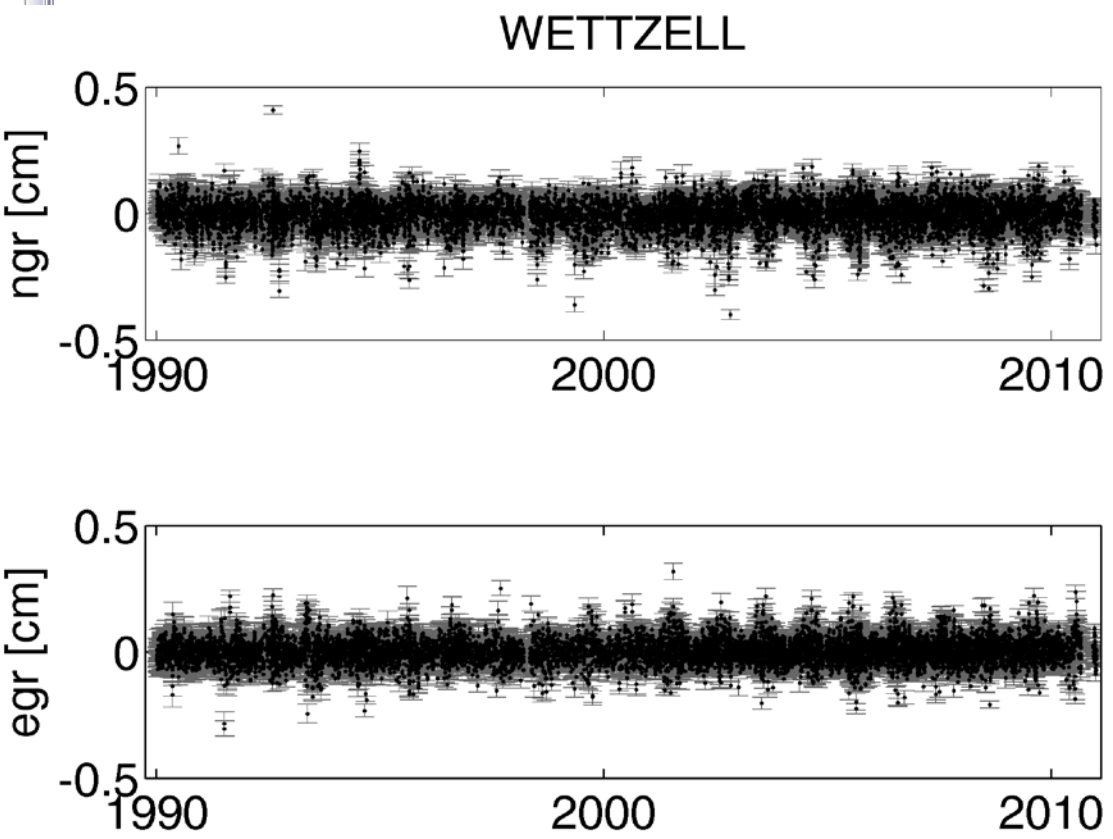
Backward solution: tgr

tgr_TEST_OUT - Notepad

File Edit Format View Help

```
 % parameter   station    mjd     value    standard deviation
 % Units are [cm]

ngr    GILCREEK       51449.75000       -0.064       0.0383
ngr    GILCREEK       51450.00000       -0.001       0.0264
ngr    GILCREEK       51450.25000       -0.021       0.0267
ngr    GILCREEK       51450.50000       -0.064       0.0294
ngr    GILCREEK       51450.75000        0.015       0.0433
ngr    KOKEE          51449.75000       -0.015       0.0418
ngr    KOKEE          51450.00000       -0.083       0.0306
ngr    KOKEE          51450.25000       -0.065       0.0307
ngr    KOKEE          51450.50000        0.019       0.0294
ngr    KOKEE          51450.75000       -0.021       0.0440
ngr    NRAO20         51449.75000       -0.048       0.0330
ngr    NRAO20         51450.00000        0.096       0.0198
ngr    NRAO20         51450.25000        0.021       0.0176
ngr    NRAO20         51450.50000       -0.025       0.0215
ngr    NRAO20         51450.75000       -0.044       0.0283
ngr    WETTZELL       51449.75000       -0.080       0.0345
ngr    WETTZELL       51450.00000       -0.054       0.0283
ngr    WETTZELL       51450.25000       -0.100       0.0262
ngr    WETTZELL       51450.50000       -0.179       0.0273
ngr    WETTZELL       51450.75000       -0.070       0.0342
egr    GILCREEK       51449.75000       -0.029       0.0360
egr    GILCREEK       51450.00000        0.006       0.0211
egr    GILCREEK       51450.25000       -0.014       0.0223
egr    GILCREEK       51450.50000       -0.025       0.0232
egr    GILCREEK       51450.75000        0.036       0.0410
egr    KOKEE          51449.75000       -0.102       0.0361
egr    KOKEE          51450.00000       -0.072       0.0268
egr    KOKEE          51450.25000        0.007       0.0243
egr    KOKEE          51450.50000       -0.002       0.0265
egr    KOKEE          51450.75000        0.020       0.0381
egr    NRAO20         51449.75000        0.065       0.0268
egr    NRAO20         51450.00000        0.022       0.0178
egr    NRAO20         51450.25000        0.034       0.0209
```



The estimates for each station can be plotted with:

VieVS/OUT/GLOB/
plot_backward_tgr.m

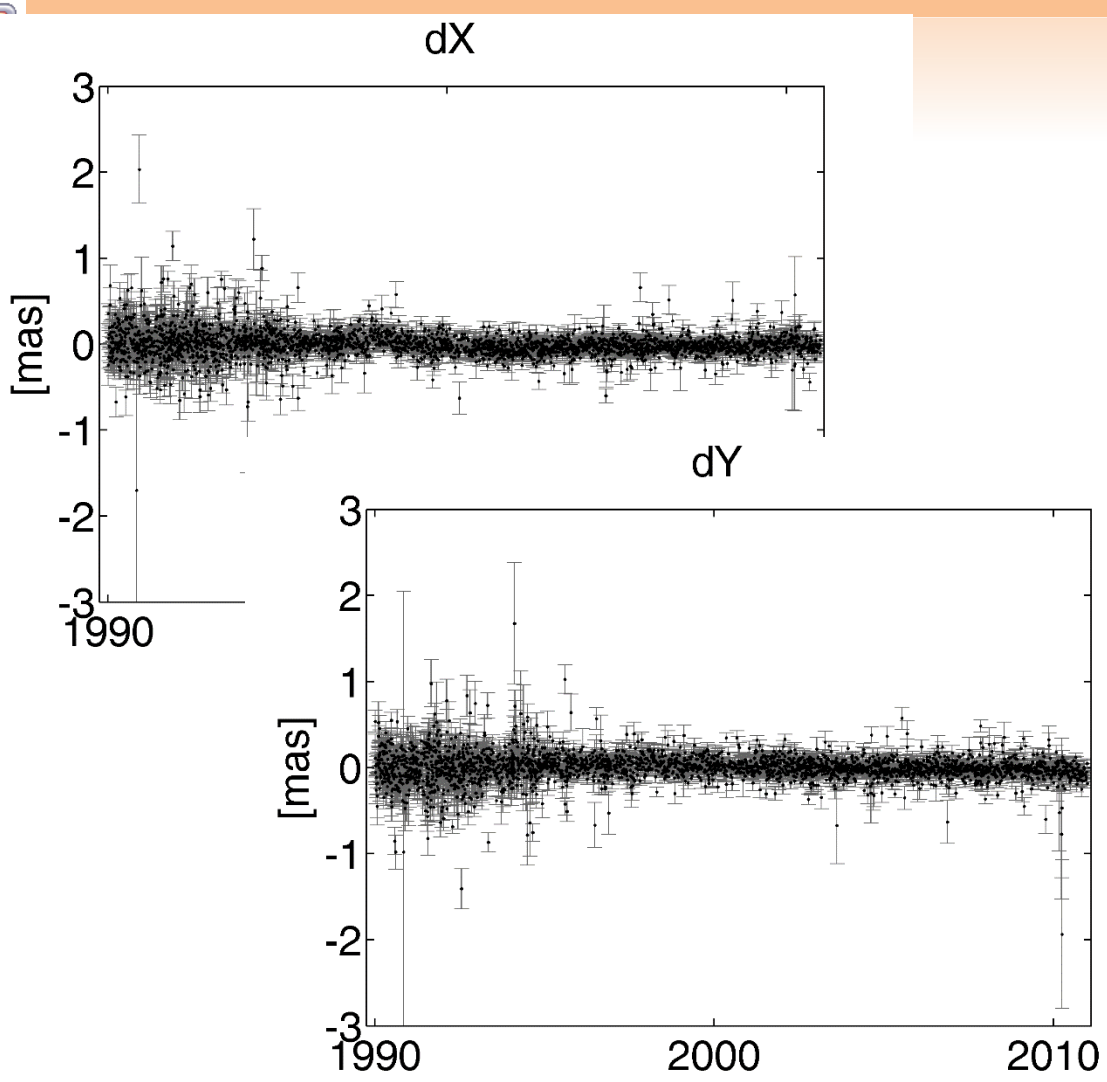
Backward solution: EOP

eop_TEST_OUT - Notepad

File Edit Format View Help

```
 % parameter    mjd     value     standard deviation
 % Units are [mas] for xpol, ypol, dX, dY;  [ms] for dut1

xpol     51449.00000       0.0978     0.08179
xpol     51450.00000       0.0978     0.08179
xpol     51451.00000       0.0978     0.08179
ypol     51449.00000      -0.0454     0.06463
ypol     51450.00000      -0.0454     0.06463
ypol     51451.00000      -0.0454     0.06463
dut1     51449.00000       0.0155     0.00400
dut1     51450.00000       0.0155     0.00400
dut1     51451.00000       0.0155     0.00400
dX       51449.00000       0.1723     0.05768
dX       51450.00000       0.1723     0.05768
dX       51451.00000       0.1723     0.05768
dY       51449.00000       0.0831     0.05616
dY       51450.00000       0.0831     0.05616
dY       51451.00000       0.0831     0.05616
xpol     51448.00000       0.0102     0.13117
xpol     51449.00000       0.0102     0.13117
xpol     51450.00000       0.0102     0.13117
ypol     51448.00000      -0.0351     0.11725
ypol     51449.00000      -0.0351     0.11725
ypol     51450.00000      -0.0351     0.11725
dut1     51448.00000      -0.0096     0.00459
dut1     51449.00000      -0.0096     0.00458
dut1     51450.00000      -0.0096     0.00458
dX       51448.00000      -0.1910     0.11299
dX       51449.00000      -0.1910     0.11299
dX       51450.00000      -0.1910     0.11299
dY       51448.00000      -0.2236     0.09069
dY       51449.00000      -0.2236     0.09069
dY       51450.00000      -0.2236     0.09069
```



The estimates for each EOP can be plotted with:

VieVS/OUT/GLOB/
plot_backward_eop.m

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VieVS
Vienna VLBI Software

Thank you for your attention!

Estimates - Example

VieVS/OUT/GLOB/_ESTIMATES/*TEST_OUT*/ glob_results_*TEST_LEVEL2*.txt

```
 % Sessions in the solution
11SEP15XA_N004
11SEP16XA_N004
11SEP17XA_N004
11SEP18XA_N004
11SEP19XA_N004
11SEP20XA_N004
11SEP21XA_N004
11SEP22XA_N004
11SEP23XA_N004
11SEP24XA_N004
11SEP25XA_N004
11SEP26XA_N004
11SEP27XA_N004
11SEP28XA_N004
11SEP29XA_N004

 % Number of sessions in the global adjustment
15

 % Maximal RMS of the sessions in the solution

 % applicable only if you run single-session solution in VIE_LSM
2.00

 % Sessions which were excluded from the solution (RMS > 2.00)


 % Corrections to station coordinates and formal errors in [cm]

 % station         dx         dy         dz         mx         my         mz      epoch    start      end
BADARY          -1.248      1.070      1.000      0.097      0.129      0.167      51544        0    99999
FORTLEZA         0.336      0.395     -0.436      0.068      0.077      0.047      51544        0    99999
HARTRAO         -0.178     -0.609     -0.305      0.060      0.068      0.063      51544        0    99999
HOBART12        -1.663      0.127     11.590      0.206      0.206      0.206      51544        0    99999
KOKEE           -0.031     -0.076     -1.807      0.114      0.177      0.174      51544        0    99999
NYALES20        -0.635      0.324     -0.240      0.066      0.060      0.107      51544        0    99999
ONSALA60        -0.201      0.029      0.389      0.077      0.044      0.089      51544        0    99999
TIGOCONC       -20.577     -3.771      1.207      0.159      0.204      0.155      51544    55604    99999
TSUKUB32         7.744     -3.352      5.580      0.098      0.150      0.166      51544    55631    99999
WARK12M          0.482     -1.891     -0.172      0.731      0.323      0.606      51544        0    99999
WESTFORD        -0.366     -0.107     -0.185      0.047      0.068      0.066      51544        0    99999
WETTZELL         0.208      0.322      0.926      0.036      0.035      0.053      51544        0    99999
YEBES40M       -25.957     28.635     14.070      0.075      0.035      0.062      51544        0    99999
ZELENCHK        -3.225     -1.546     -3.650      0.105      0.073      0.109      51544    54282    99999


 % Corrections to station velocities and formal errors in [cm/y]

 % station        dvx        dvy        dvz        mvx        mvy        mvz      epoch    start      end

 % datum definition: NNT/NNR
FORTLEZA
HARTRAO
WESTFORD
WETTZELL
```

names of sessions

number of sessions

sessions with RMS>maxRMS

corrections to station a priori coordinates and their formal errors [cm]

epoch of the coordinates [mjd]

start, end [mjd] of the interval (time between breaks)

stations which were used for NNT/NNR

corrections to station a priori velocities and their formal errors [cm/y]

Estimates - Example

```
% Corrections to source coordinates and formal errors: RA in [ms], De in [mas]

% source              RA          De          mRA         mDe
0002+200          0.0109      0.2532      0.0383      0.6023
0002-478         -0.0233      0.1463      0.0227      0.2375
0003+380         -0.0043      0.0784      0.0062      0.0846
0003-066          0.0006      0.0108      0.0008      0.0213
0007+106          0.0001      0.0311      0.0024      0.0289
0007+171         -0.0049     -0.1246      0.0089      0.1529
0008-264          0.0025     -0.0339      0.0067      0.1094
0008-311         -0.0109     -0.2421      0.0196      0.5982
0009+081         -0.0051      0.2973      0.0188      0.6458
0010+405          0.0020     -0.0050      0.0037      0.0596
0013-005          0.0025     -0.0911      0.0048      0.0862
0016+731          0.0003     -0.0086      0.0010      0.0045
0017+200          0.0026      0.0304      0.0064      0.0842
0019+058         -0.0044      0.0020      0.0019      0.0286
0021+243          0.0144     -0.0380      0.0248      0.5484
0025+197         -0.0027      0.0958      0.0037      0.0743
0026+346         -0.0045     -3.8526      0.9895     15.9758
0035+413         -0.0018      0.0064      0.0035      0.0484
0035-252         -0.0026     -0.0190      0.0035      0.0426
0037+139         -0.0272      0.2277      0.0282      0.5109
0039+230          0.0073     -0.1047      0.0070      0.1276
0046+316         -0.0016      0.1900      0.0067      0.1599
0046+511         -0.0261      1.4923      0.0172      0.3027
0047+023          0.0023     -0.4427      0.0111      0.4091
0047-579          0.0401     -0.2248      0.1672      0.7804
0048-097          0.0003      0.0128      0.0005      0.0104
0048-427         -0.0117      0.0088      0.0063      0.0681
0054+161         -0.0019     -0.0109      0.0033      0.0629
0055+300         -0.0391      0.0078
0055-059         -0.0021      0.0210
0055-340          0.0736      1.0075
0056-001         -0.1518     -1.0532
0059+581          0.0002     -0.0004
0104-408         -0.0005      0.0106
0106+315          0.1097     -2.4850
```

corrections to source a priori coordinates (RA, De) and their formal errors [ms] and [mas]

```
% EOPs were:  0 = fixed,  1 = estimated,  2 = reduced

% x pole: mjd of estimates, corrections in [mas], standard dev. in [mas]
1
53625.0000        0.9012      0.5757
53626.0000       -0.0795      0.0418
53627.0000       -0.0375      0.0401
53628.0000        0.0221      0.0300
53629.0000       -0.1489      0.0302
53630.0000        0.0905      0.0272
53631.0000        0.0045      0.0287
53632.0000       -0.0502      0.0270
53633.0000       -0.0164
53634.0000       -0.0465
53635.0000        0.0117
53636.0000       -0.1178
53637.0000        0.0402
53638.0000        0.0516
53639.0000        0.1507
53640.0000       -0.1269
53641.0000        0.0714

% y pole: mjd of estimates
1
53625.0000       -0.8131
53626.0000        0.1373
53627.0000       -0.1396
53628.0000        0.0518
53629.0000       -0.0079
53630.0000       -0.0434
53631.0000        0.0884      0.0291
53632.0000        0.0933      0.0280
53633.0000       -0.0562      0.0298
53634.0000        0.2049      0.0344
53635.0000       -0.0515      0.0285
53636.0000        0.0025      0.0289
53637.0000        0.1305      0.0306
53638.0000       -0.0480      0.0299
53639.0000        0.1123      0.0311
53640.0000        0.0293      0.0404
53641.0000        0.0967      0.1142

% ut1: mjd of estimates, corrections in [ms], standard dev. in [ms]
1
53625.0000        0.0163      0.0101
53626.0000        0.0044      0.0016
53627.0000       -0.0005      0.0014
53628.0000        0.0028      0.0014
53629.0000        0.0056      0.0014
53630.0000        0.0008      0.0014
```

estimates of EOP:

dx, dy pole [mas]

dut1 [ms]

dX, dY [mas]

and their formal errors

Results

trf_cont05 - Notepad

File Edit Format View Help

```
% A priori catalogue of station positions used for the analysis: ../../TRF/VTRF2008
% were the station coordinates estimated? (0/1) 1

% were the station velocities estimated?  (0/1) 0


% station          x [m]           y [m]          z [m]          vx [m/y]     vy [m/y]     vz [m/y]      epoch    start
GILCREEK      -2281547.3497   -1453645.0605   5756993.3212      -0.0406      -0.0331      -0.0736      51544    52581
GILCREEK      -2281547.3847   -1453645.1325   5756993.0892      -0.0293      -0.0099       0.0013      51544    52669
GILCREEK      -2281547.3977   -1453645.1045   5756993.0832      -0.0255      -0.0184       0.0031      51544    52758    52913
GILCREEK      -2281547.3797   -1453645.1305   5756993.1662      -0.0302      -0.0113      -0.0189      51544    52913    53094
GILCREEK      -2281547.4497   -1453645.1415   5756993.1272      -0.0136      -0.0088      -0.0097      51544    53094    53369
GILCREEK      -2281547.3737   -1453645.1385   5756993.0712      -0.0289      -0.0094       0.0015      51544    53369    54100
KOKEE         -5543837.6570   -2054567.6738   2387852.0366      -0.0091       0.0631       0.0323      51544        0    99999
SVETLOE        2730173.9127    1562442.6290   5529969.0453      -0.0183       0.0122       0.0083      51544        0    99999
WETTZELL       4075539.8347     931735.3140   4801629.3992      -0.0157       0.0170       0.0103      51544        0    99999
WESTFORD       1492206.5442   -4458130.5230   4296015.5525      -0.0153      -0.0014       0.
NYALES20       1202462.7137     252734.4200   6237766.0819      -0.0142       0.0073       0.
TSUKUB32      -3957408.7786    3310229.4073   3737494.7947      -0.0020       0.0058      -0.
HARTRAO        5085442.7749    2668263.5392  -2768696.9649      -0.0010       0.0200       0.
TIGOCONC       1492054.0641   -4887960.9900  -3803541.4049       0.0353      -0.0006       0.
ONSALA60       3370605.9839     711917.5300   5349830.7700      -0.0140       0.0144       0.
ALGOPARK        918034.6961   -4346132.2823   4561971.1783      -0.0158      -0.0037       0.
```

this new TRF catalogue can be used as input catalogue in VieVS

crf_cont05 - Notepad

File Edit Format View Help

```
% A priori catalogue of source positions used for the analysis: ../CRF/ICRF2
% Estimates dRA, dDe from LEVEL2 data: cont05


% source          RA [h min sec]              De [° min sec ]

0003-066          0   6  13.89288927          -6  23  35.3352572
0014+813          0  17   8.47494297          81  35   8.1364635
0048-097          0  50  41.31739400          -9  29   5.2103973
0059+581          1   2  45.76239115          58  24  11.1366673
0104-408          1   6  45.10794803         -40  34  19.9593254
0119+115          1  21  41.59503952          11  49  50.4132368
0133+476          1  36  58.59481370          47  51  29.1001267
0201+113          2   3  46.65704856          11  34  45.4096469
0235+164          2  38  38.93011131          16  36  59.2744620
0402-362          4   3  53.74989042         -36   5   1.9130580
0434-188          4  37   1.48273278         -18  44  48.6136034
0458-020          5   1  12.80987891          -1  59  14.2562099
0528+134          5  30  56.41675911          13  31  55.1495910
0537-441          5  38  50.36155139         -44   5   8.9389134
0552+398          5  55  30.80561794          39  48  49.1649440
0556+238          5  59  32.03313053          23  53  53.9267170
0602+673          6   7  52.67160325          67  20  55.4099681
0607-157          6   9  40.94952552         -15  42  40.6727594
0637-752          6  35  46.50787422         -75  16  16.8153203
0642+449          6  46  32.02600303          44  51  16.5900817
0656+082          6  59  17.99604570           8  13  30.9528845
0718+793          7  26  11.73520156          79  11  31.0161593
0727-115          7  30  19.11248164         -11  41  12.6005504
0743+259          7  46  25.87418250          25  49   2.1348435
0749+540          7  53   1.38456835          53  52  59.6370471
0805+410          8   8  56.65205143          40  52  44.8890602
0823+033          8  25  50.33835677           3   9  24.5201166
0955+476          9  58  19.67162716          47  25   7.8424262
1034-293         10  37  16.07973715         -29  34   2.8135858
1044+719         10  48  27.61990097          71  43  35.9385777
1053+815         10  58  11.53538437          81  14  32.6752794
1057-797         10  58  43.30971795         -80   3  54.1597271
1124-186         11  27   4.39245741         -18  57  17.4417308
1128+385         11  30  53.28261547          38  15  18.5469736
1144-379         11  47   1.37069238         -38  12  11.0233646
1156+295         11  59  31.83390347          29  14  43.8267841
1300+580         13   2  52.46527521          57  48  37.6093691
1308+326         13  10  28.66384908          32  20  43.7830493
1334-127         13  37  39.78278489         -12  57  24.6933243
```

„new catalogues“ (TRF and CRF) are created automatically in **VieVS/OUT/GLOB/**

TRF/*TEST_OUT*/trf_*TEST_LEVEL2*.txt

and

CRF/*TEST_OUT*/trf_*TEST_LEVEL2*.txt

Results

Created on 22.03.2014 at 04:24:21 local time
VieTRF13
Included data: January 1984 - December 2013
Created by Hana Krasna, Vienna University of Technology

STATION POSITIONS AT EPOCH 2000.0 AND VELOCITIES
VLBI STATIONS

DOMES NB.	SITE NAME	TECH.	ID.	X/Vx	Y/Vy	Z/Vz	Sigmas	DATA_START	DATA_END
						m/m/y			
40104S001	ALGOPARK	VLBI	7282	918034.6976	-4346132.2840	4561971.1805	0.0003 0.0006 0.0007	84:242:00000	06:216:00000
				-0.0156	-0.0041	0.0041	0.0000 0.0001 0.0001		
12338S003	BADARY	VLBI	7382	-838200.7001	3865751.5579	4987670.9290	0.0010 0.0019 0.0029	07:152:00000	13:361:00000
				-0.0278	0.0002	-0.0015	0.0001 0.0002 0.0003		
40473S001	BR-VLBA	VLBI	7614	-2112065.0172	-3705356.5186	4726813.7747	0.0003 0.0004 0.0005	93:215:00000	13:171:00000
				-0.0142	0.0001	-0.0071	0.0000 0.0001 0.0001		
12337S008	CRIMEA	VLBI	7332	3785231.0016	2551207.4568	4439796.4092	0.0012 0.0009 0.0014	94:176:00000	13:186:00000
				-0.0207	0.0145	0.0093	0.0002 0.0001 0.0002		
40101M003	CTVASTJ	VLBI	7625	2612545.6338	-3426878.7431	4686756.0955	0.0098 0.0160 0.0190	02:318:00000	05:279:00000
				-0.0162	-0.0052	0.0105	0.0020 0.0033 0.0040		
40405S019	DSS15	VLBI	1515	-2353538.8943	-4641649.4443	3676669.9662	0.0042 0.0083 0.0105	88:312:00000	92:179:00000
				-0.0181	0.0059	-0.0023	0.0002 0.0002 0.0002		
40405S019	DSS15	VLBI	1515	-2353538.8931	-4641649.4623	3676669.9694	0.0012 0.0021 0.0018	92:179:00000	05:180:00000
				-0.0181	0.0059	-0.0023	0.0002 0.0002 0.0002		
50103S010	DSS45	VLBI	1545	-4460935.5178	2682765.7047	-3674381.0603	0.0020 0.0014 0.0018	88:199:00000	05:334:00000
				-0.0369	0.0008	0.0450	0.0002 0.0001 0.0002		

TRF catalogue in a standard format is created automatically in **VieVS/OUT/GLOB/**

TRF/*TEST_OUT*/trf_catalogue_*TEST_LEVEL2*.txt

Results

```
Created on 22.03.2014 at 04:24:42 local time
VieCRF13
Included data: January 1984 - December 2013
Created by Hana Krasna, Vienna University of Technology
```

ICRF Designation	IERS Des.	Inf.	Right Ascension J2000.0 h m s	Declination J2000.0 o m as	Uncertainty R.A. s	Uncertainty Dec. as	Corr. RA-Dc	Mean MJD of observation span	First MJD of observation span	Last MJD of observation span	Nb sess.	Nb obs.
ICRF J000108.6+191433	2358+189		00 01 08.62156700	19 14 33.8017416	0.00000196	0.0000420	0.104	54696.3	52767.8	56624.9	89	1015
ICRF J000435.6-473619	0002-478	D	00 04 35.65548267	-47 36 19.6038219	0.00001082	0.0001584	0.089	52992.7	49481.7	56503.7	8	42
ICRF J000435.7+201942	0002+200		00 04 35.75829995	20 19 42.3176671	0.00002031	0.0002261	0.084	52980.3	52977.8	52982.8	2	30
ICRF J000504.3+542824	0002+541		00 05 04.36340829	54 28 24.9246572	0.00002514	0.0001924	0.173	56392.8	56392.8	56392.8	1	65
ICRF J000557.1+382015	0003+380		00 05 57.17538836	38 20 15.1490362	0.00000362	0.0000477	-0.024	52716.2	50378.7	55053.7	17	399
ICRF J000613.8-062335	0003-066		00 06 13.89288927	-06 23 35.3352538	0.00000067	0.0000146	0.120	53075.3	49497.8	56652.8	1202	16994
ICRF J001031.0+105829	0007+106	D	00 10 31.00590975	10 58 29.5041970	0.00000190	0.0000249	-0.010	52555.8	48564.8	56546.8	46	1189
ICRF J001033.9+172418	0007+171		00 10 33.99065925	17 24 18.7612067	0.00000497	0.0000728	-0.003	52409.8	49575.9	55243.7	11	189
	0008-311		00 10 34.90971883	-30 54 15.2987949	0.00001776	0.0006007	0.013	55965.8	55965.8	55965.8	1	72
ICRF J001101.2-261233	0008-264	D	00 11 01.24674919	-26 12 33.3769610	0.00000414	0.0000574	-0.013	54455.2	52253.7	56656.7	20	348
ICRF J001135.2+082355	0009+081		00 11 35.26959498	08 23 55.5863547	0.00001212	0.0003718	-0.341	53251.9	52895.6	53608.3	2	108
ICRF J001331.1+405137	0010+405	D	00 13 31.13020144	40 51 37.1441907	0.00000245	0.0000399	-0.114	53098.8	49575.9	56621.7	28	730
ICRF J001611.0-001512	0013-005	D	00 16 11.08855495	-00 15 12.4454265	0.00000302	0.0000595	0.020	53092.3	49610.9	56573.7	46	433
ICRF J001937.8+202145	0017+200		00 19 37.85449868	20 21 45.6446046	0.00000219	0.0000288	0.028	54774.2	52895.6	56652.8	23	937
ICRF J001945.7+732730	0016+731	D	00 19 45.78636046	73 27 30.0176153	0.00000181	0.0000101	0.190	51952.2	47282.8	56621.7	512	55403
ICRF J002232.4+060804	0019+058	D	00 22 32.44121259	06 08 04.2689629	0.00000151	0.0000274	0.157	53161.8	49666.9	56656.7	138	1803
ICRF J002427.3+243926	0021+243		00 24 27.33053015	24 39 26.2295036	0.00001362	0.0002098	-0.205	53165.7	53024.7	53306.8	9	44
ICRF J002829.8+200026	0025+197		00 28 29.81848307	20 00 26.7439984	0.00000236	0.0000515	0.021	54813.3	52988.8	56637.8	44	840
ICRF J002914.2+345632	0026+346		00 29 14.24268498	34 56 32.2477136	0.00024900	0.0029902	0.842	49077.8	48496.8	49658.8	2	3
ICRF J003814.7-245902	0035-252		00 38 14.73550662	-24 59 02.2351753	0.00000232	0.0000278	-0.046	55678.8	54719.8	56637.8	103	880
ICRF J003824.8+413706	0035+413	D	00 38 24.84358691	41 37 06.0002674	0.00000259	0.0000372	0.040	53019.8	49421.9	56617.8	27	814
ICRF J003939.6+141157	0037+139		00 39 39.61958422	14 11 57.5566228	0.00001414	0.0002640	-0.256	52794.7	52396.8	53192.7	3	42
ICRF J004057.6-014632	0038-020		00 40 57.61159531	-01 46 32.0268445	0.00001054	0.0003892	-0.413	56497.8	56497.8	56497.8	1	42
ICRF J004204.5+232001	0039+230		00 42 04.54517156	23 20 01.0620540	0.00000366	0.0000707	-0.082	53079.3	49532.8	56625.8	14	223
ICRF J004847.1+315725	0046+316		00 48 47.14147959	31 57 25.0849253	0.00000348	0.0000774	-0.137	52800.8	50302.8	55298.7	20	315
ICRF J004937.9+512813	0046+511		00 49 37.99122658	51 28 13.6919624	0.00001066	0.0001594	-0.034	56424.3	56301.8	56546.8	2	131
ICRF J004943.2+023703	0047+023		00 49 43.23594065	02 37 03.7786702	0.00000510	0.0001800	-0.092	55552.8	54607.8	56497.8	13	205

CRF catalogue in a standard format is created automatically in **VieVS/OUT/GLOB/**

CRF/*TEST_OUT*/crf_catalogue_*TEST_LEVEL2*.txt