Comparison of UT1 and polar motion from IVS sessions derived from VieVS and Solve analysis

Minttu Uunila[a], Karen Baver[b], John Gipson[b], Tobias Nilsson[c]

[a]Aalto University Metsähovi Radio Observatory
[b]NVI, Inc., NASA Goddard Space Flight Center
[c]Vienna University of Technology

1. Introduction

We compare UT1 and Polar Motion results attained with Vienna VLBI Software (VieVS) and Calc/Solve from IVS sessions 2011. Results from both intensive (INT) and 24 hour (R) sessions are compared. We discuss the formal errors of the estimates, as well as the agreement of the two sets estimates with other EOP time series. Total of 48 INT and 28 R sessions were included in the analysis.

2. Configuration of software

In the analysis special attention was given to the configuration of the two softwares. It was important to make the modelling options as compatible as possible. In the case of intensive sessions the epoch was chosen to be the half point of a session, and in case of 24 hour sessions the midnight was chosen as the epoch. The modelling options based on the default settings of the softwares and the new configuration are listed in Table 1.

Table 1. Comparison of VieVS and Solve Solution Setup.

Comparison of VieVS and Solve Solution Setup				
	Default configuration		New configuration	
	VieVS	Solve	VieVS	Solve
Solution type	Group delay only	Group delay only	Group delay only	Group delay only
Number of sessions	One standalone	Int: one standalone 24-hr: combined solution	One standalone	Int: one standalone 24-h: combined solution
Elevation cutoff	0 deg	5 deg	0 deg	0 deg
Ephemerides	JPL 421	JPL 405	JPL 405	JPL 405
A priori EOP	IERS C04	Int: USNO finals 24-h: file from operational solution	IERS C04	IERS C04
Precession/nutation	IAU 2000A	IAU 2006	IAU 2000A	IAU 2000A
TRF	VTRF2008	Files from operational solution	VTRF2008	VTRF2008A
CRF	ICRF2	Files from operational solution	ICRF2	ICRF2
DUT1 interval, constraint	Int: 60 min, 0.0001 ms/day 24-h: 30 min, 0.0001 ms/day	Int: One offset, no constraints 24-hr: One offset and one rate, 3 ms and ms/day	Int: 60 min, 0.01 ms/day 24-h: 30 min, 0.0001 ms/day	Int: One offset, no constraints 24-hr: one offset and one rate, 3 ms and ms/day
Polar motion interval, constraint	Int: not estimated 24-h: 30 min, 0.0001 ms/day	Int: not estimated 24-hr: one offset and one rate apiece for X and Y, 45 mas and mas/day	Int: not estimated 24-h: 30 min, 0.0001 ms/day	Int: not estimated 24-hr: one offset and one rate for X and Y, 45 mas and mas/day
ZWD interval, constraint	60 min, 0.0001 ps²/s 24-h: 30 min, 0.0001 ps²/s	Int: One offset, no constraints 24-h: 20 min, 50 ps/hour	Int: 60 min, 0.0001ps²/s, 24-h: 30 min, 0.01 ps²/s	Int: One offset, 36 ps/hour 24-h: 20 min, 36 ps/hour
Weighting	No	Baseline weights from operational solution	No	Baseline weights from operational solution
Clock interval, constraint	Int: 1440 min, no constraints 24-h: 60 min, 0.5 ps²/s	Int: second order polynomial, no spline, no constraints 24-h: 60 min, 5 fs	Int: 1440 min, no constraints 24-h: 60 min, 0.5 ps²/s	Int: second order polynomial, no spline, 7 fs 24-h: 60 min, 7 fs
Mapping function	VM1	Int: NMF 24-h: VM1	VM1	VM1

Table 2. RMS values for dUT1 and polar motion estimates relative to the a priori EOPs for different configurations of VieVS and Solve.

Comparison of VieVS and Solve RMS values				
	Default configuration		New configuration	
	VieVS	Solve	VieVS	Solve
RMS of dUT1 estimate (μs), intensive solution	25.56 +/- 13.99	27.44 +/- 15.48	27.90 +/- 15.70	26.67 +/- 15.49
RMS of dUT1 estimate (μs), 24-hour solution	8.73 +/- 4.01	9.94 +/- 3.79	9.25 +/- 4.15	12.85 +/- 4.67
RMS of Xpol estimate (mas), 24-hour solution	0.31 +/- 0.15	0.18 +/- 0.11	0.35 +/- 0.16	0.24 +/- 0.14
RMS of Ypol estimate (mas), 24-hour solution	0.33 +/- 0.11	0.20 +/- 0.10	0.33 +/- 0.12	0.44 +/- 0.10
RMS difference of dUT1 estimates (μs), intensive solution	17.51 +/- 4.08		12.68 +/- 3.24	
RMS difference of dUT1 estimates (μs), 24-hour solution	12.32 +/- 1.48		17.40 +/- 2.34	
RMS difference of Xpol estimates (mas), 24-hour solution	0.25 +/- 0.058		0.25 +/- 0.098	
RMS difference of Ypol estimates (mas), 24-hour solution	0.29 +/- 0.045		0.35 +/- 0.058	

3. Results

Figures 1 and 2 show intensive and 24-hour adjustments to C04 05 UT1-UTC in microseconds. The results from both the original setups of the two softwares and the new setups are displayed. In Figure 3 and 4 Xpol and Ypol estimates are shown. The RMS values for the different setups and parameters are listed in Table 2 for both softwares.

4. Conclusions

As can be seen from Table 2, almost all of the RMS values worsen for both softwares when using the new configuration. When looking at the RMS difference of the solutions, it can also be noticed that they are only better with the new configuration in the intensive solution. More work is needed to bring the 24-h solution RMS difference smaller, and the configuration of VieVS and Solve closer to each other.

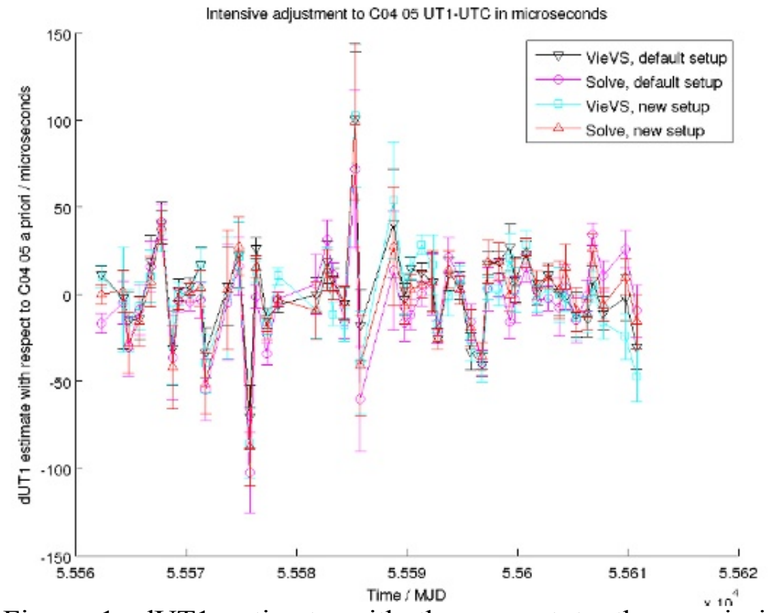

Figure 1. dUT1 estimate with the respect to the a priori IERS C04 05 calculated from IVS intensive sessions with VieVS and Solve softwares with default and new setups.

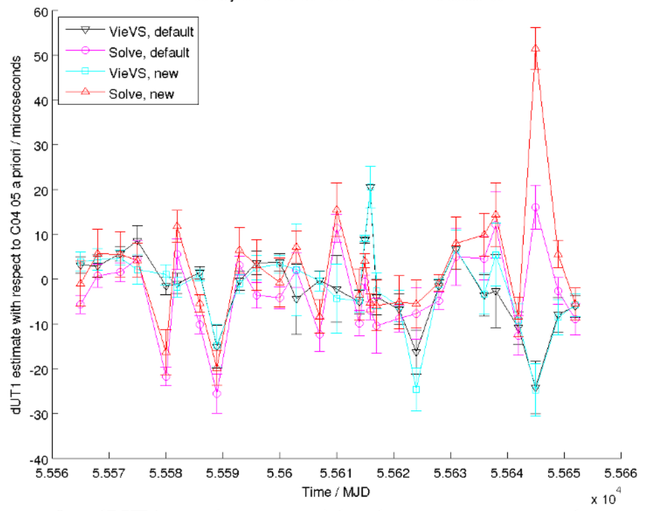

Figure 2. dUT1 estimate with the respect to the a priori IERS C04 05 calculated from IVS 24-hour sessions with VieVS and Solve with default and new setups.

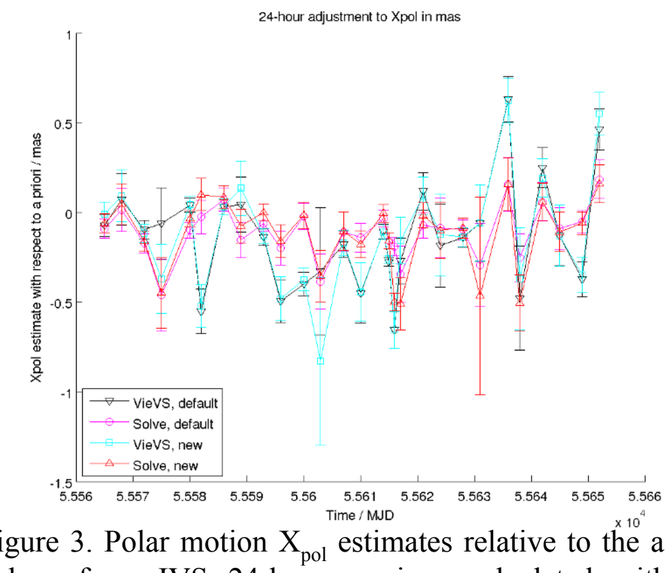

Figure 3. Polar motion X_{pol} estimates relative to the a priori values from IVS 24-hour sessions calculated with both VieVS and Solve with default and new setups.

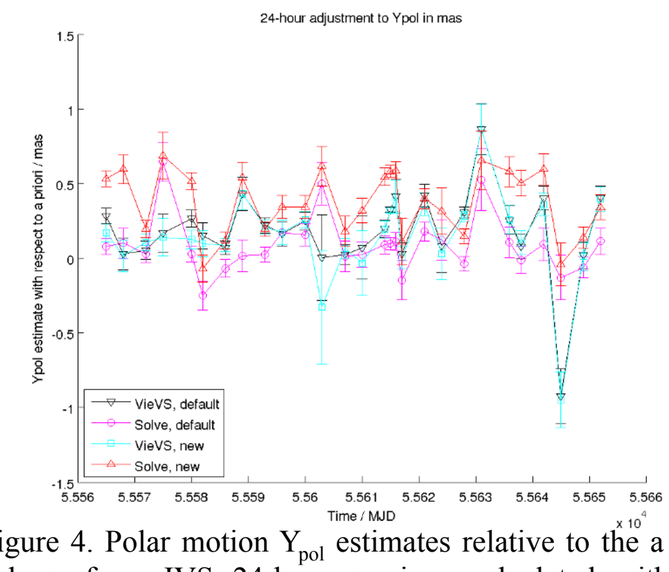

Figure 4. Polar motion Y_{pol} estimates relative to the a priori values, from IVS 24-hour sessions calculated with both VieVS and Solve with default and new setups.