STATUS OF THE GLORIA GEODETIC VLBI ANALYSIS SOFTWARE PACKAGE

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ABSTRACT. Initiated in the 1990s in and around the Paris Observatory, GLORIA (GLObal Radio Interferometric Analysis) has been used several times in the past for O–C comparisons (e.g., during the test phase of the IAU 2000 models) and was operational for the analysis of intensive sessions. Late 2010, I proposed to develop the software with the objective of being operational in a near future. Here is a short report on the current status of this software package.

1. GENERAL STRUCTURE

GLORIA allows one to compute the theoretical, build up observation equations, and solve for the parameters. It looks for the relevant information in the GSFC data base files as submitted to the IVS data centers. Note that the current version treats single frequency observations only: the ionosphere calibration is not handled yet and taken from the database. Observations with DELUFLAG=2 are eliminated. As well, in the current version, observations with missing meteorological data are eliminated.

It returns partials with respect to the five EOP (polar motion, UT1, and X, Y coordinates of the celestial pole), baseline and source coordinates, wet and dry zenith troposphere delays, wet and dry East and North troposphere gradients, and the post-Newtonian relativistic parameter. The theoretical delay and delay rate are computed using the most recent astronomical and geophysical models (see Table). Especially, GLORIA implements the non-rotating origin based transformation between celestial and terrestrial reference frames.

2. PARAMETERIZATION AND SOLUTION SCHEME

GLORIA implements various constraints: minimal constraints (no-net rotation and translation for the stations, no-net rotation for the sources), absolute and relative constraints for EOP, clocks, and atmosphere parameters. Source and station coordinates, and the post-Newtonian parameters can be estimated as offsets. EOP and troposphere (ZTD and gradients) time behavior can be modeled as piecewise linear functions. Clock drift can be modeled as degree-2 polynomials. The time interval on which each parameter is estimated is chosen by the user.

For the analysis, SHELL scripts successively call various routines. First, an O–C file is created, containing observed and theoretical delays, as well as partials. Second, after a preliminary solution with a standard parameterization, the residuals are investigated so that big outliers are eliminated. Data are iteratively reweighted so that the χ^2 converges reasonably close to unity. Finally, the system is inverted again with reweighted data and using the desired parameterization to get the final estimates.

An operational-like solution has been set up with a classical parameterization: session-wise EOP, rates and station coordinates, 3-hr ZTD and 6-hr gradient estimates, and up-to-date modeling and mapping. Figure 1 compares the pole coordinates, UT1–UTC, and celestial pole coordinates with the a priori data. Rms of the difference is of ~ 1 mas for the pole and 0.34 ms for UT1. The figure shows no systematics. However, the reweighting and/or inversion scheme, as well as the constraint weights, should be further investigated to improve these results.

Plate motion	NNR-NUVEL1A
Ephemerides	DE 405/ELP 2000
Tidal displacement	IERS Conv. 2003
Nutation and precession	IAU 2000A/IAU 2006
Ocean loading	FES 2004
Atmospheric loading	APL (Wijaya et al. 2011)
Mapping functions	VMF1 (Böhm & Schuh 2007)
Antenna thermal deformation	Nothnagel (2009)
Antenna axis offsets	IVS Analysis Coordinator's office
Troposphere gradients	Chen & Herring (1997)
A priori EOP	IERS EOP 08 C 04
A priori station positions/velocities	VTRF 2008A
A priori source coordinates	ICRF2

Table 1: Most recent astronomical and geophysical models available in GLORIA.

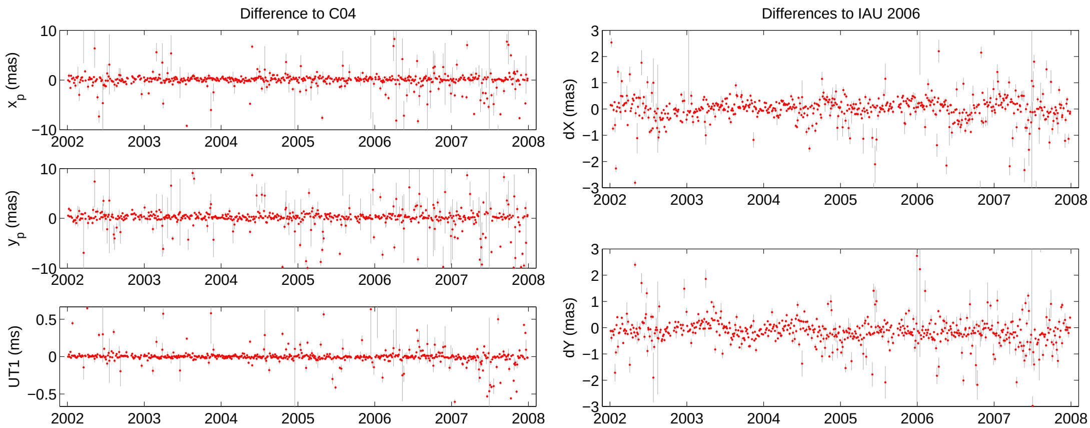

Figure 1: Session-wise estimates of EOP using IVS rapid sessions between 2002 and 2008.

3. REFERENCES

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Nothnagel, A. 2009, J. Geod., doi:10.1007/s00190-008-0284-z

Wijaya, D. D., Böhm, J., Schindelegger, M., et al. 2011, submitted to J. Geophys. Res.