FFI Technology Development Center - Software Development

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Abstract

FFI's contribution to the IVS as a Technology Development Center focuses primarily on the development and validation of the GEOSAT software for a combined analysis at the observation level of data from VLBI, GPS and SLR. This report shortly summarizes the latest improvments of the GEOSAT software. FFI is currently Analysis Center for IVS and ILRS, Technology Development Center for IVS, and Combination Research Center for IERS.

1. The GEOSAT Software

The advantages of the combination of independent and complementary space geodetic data at the observation level is discussed in Andersen ([1]). The models of GEOSAT are listed in Andersen ([2]). The most important changes implemented in 2005 are described in the following.

The GEOSAT software is presently undergoing extensive development. The validation of GEOSAT with VLBI and SLR tracking data is completed with very promising results. Right now the GPS part of GEOSAT is in the validation phase.

Regarding SLR: The use of a detector-dependent center of mass correction, 3D raytracing, and taking into account a signal strength dependent range bias for some stations, led to a slight change in the value of GM as determined from SLR data. The use of multicolor laser data has been implemented and gives excellent post-fit residuals. This will be further investigated in 2006. Also the GNSS part of GEOSAT has undergone extensive changes, for instance with the inclusion of a second and third order ionospheric correction, absolute phase center corrections for all antennas etc.

The new version of GEOSAT is expected to be ready for routine processing within 1.5 years. The new version of GEOSAT will have two additional very useful features: 1) It can simultaneously combine data from virtually any number of VLBI, SLR, and GPS instruments at a co-located site either observing simultaneously or in different time windows. All information will contribute to the estimation of the migration of an automatically selected master reference point at each station. 2) The station-related solve-for model parameters in a combined processing of the VLBI + SLR + GNSS can either be instrument-dependent, technique-dependent, microwave-dependent, optical-dependent, site-dependent, satellite/spacecraft-dependent, or radio source-dependent. The switching between the different types is extremely simple. A typical application would be to, in a first run, treat the zenith wet delay parameters as instrument-dependent parameters. This means that, for example, a station with two GPS receivers and one VLBI instrument will have three estimates of these parameters. If the results look consistent, all these parameters can be estimated as one single parameter represented by a microwave-dependent parameter in a second run. The same can be tested for clock parameters for co-located clocks etc. Since the raytracing starts at the position of the phase center for each instrument/antenna, the effect of different antenna heights will automatically be accounted for to the level of accuracy of the numerical weather model rescaled by the in-situ observed pressure values from the surfmet data.

The GEOSAT software has recently been used for the calibration of the GLOBUS-II radar north in Norway. This radar is one of the most accurate radars available today. After calibration

using GEOSAT the performance in precision improved by one to two orders of magnitude!

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References

[1] Andersen, P. H. Multi-level arc combination with stochastic parameters. Journal of Geodesy (2000) 74: 531-551.

[2] Andersen, P. H. High-precision station positioning and satellite orbit determination. PhD Thesis, NDRE/Publication 95/01094.