3.6.2.10 Institute of Applied Astronomy (IAA)

Research groups and staff

Two research groups of the Institute of Applied Astronomy of the Russian Academy of Sciences (IAA) were involved in 2003 in the IERS CRC related activity:

1. Laboratory of Space Geodesy and Earth Rotation (LSGER)
   Dr. Zinovy Malkin, Head; Natalia Panafidina
   Contact: malkin@quasar.ipa.nw.ru
2. Laboratory of Ephemeris Astronomy (LEA)
   Prof. George Krasinsky, Head; Nadia Shuygina
   Contact: nvf@quasar.ipa.nw.ru

LSGER group

Comparison and combination of EOP series

During the last year we continued to develop software for comparison and combination of EOP series. This software is routinely used in the framework of every-day IAA EOP Service activity for the control of data and result quality and for the study of systematic errors of various EOP series.

A special study was performed to investigate possible approaches to the optimal modelling of systematic differences between the EOP series submitted to the IERS (Malkin, 2003).

Combination of weekly EPN solutions of individual analysis centers

In 2003 we finished the first stage of this work - the recomputation of the official weekly EPN solutions using the method described in the previous report (IERS Annual Report 2002). This series is submitted on a regular basis to the EPN Central Bureau in the framework of the EPN Geodynamical Project.

A new IAA combined coordinate time series for GPS stations of the EPN network has been started. For this computation we use all available weekly solutions of individual Analysis Centers. To obtain a weekly combined solution we use the following approach.

In the first step the Analysis Centers' specific constraints are removed from the individual solutions using a priori coordinates and covariance matrices contained in the SINEX files (Brockmann, 1996). Then covariance matrices of deconstrained solutions are rescaled in order to obtain homogeneous solutions. Rescaling is done in such a way that the mean error of the input solution computed for non-fiducial stations equals the mean error of deconstrained solution computed for the same set of stations.

In the second step all deconstrained individual solutions are transformed to ITRF2000 using Helmert transformation. Now we use 6 parameters computed using all stations of the individual solutions. Then all the solutions are combined using sequential least squares estimation. Weighting factors are introduced for individual solutions to account for their different accuracy.

For outlier detection we compute differences between individual solutions and the combined one, and stations with differences greater

than three mean errors for a given GPS week are rejected. Then the combination procedure is redone without these stations.

This work is supposed to be continued for a TRF+EOP combination.

LEA group

Determination of EOP from combination of SLR and VLBI data

A combined analysis of VLBI and SLR measurements at the observation level is carried out for improving the accuracy and time resolution of EOP. Both SLR and VLBI observations are processed by the same software ERA, using the same astronomical constants and models for different kinds of measurements.

At the first stage condition equations for VLBI and SLR observations are obtained from independent processing of each technique. For VLBI measurements the zenith component of troposphere delay and its gradients are adjusted as stochastic signals for each day of observation. Both coordinates of quasars and site coordinates are not improved in this solution. For SLR data we used laser ranges to geodetic satellites LAGEOS, LAGEOS 2, and Etalon 1 and 2. The short arc technique with an arc length of 7 days is applied to all SLR measurements to adjust orbital parameters along with the radiation pressure coefficient and along-track acceleration, which are considered as non-stochastic.

At the second stage the SLR and VLBI condition equations are mixed to determine corrections to parameters mentioned above along with five Earth rotation parameters. A Kalman filtering procedure is used to solve the system of condition equations. Combining SLR and VLBI measurements on one-day arcs makes it possible to improve the standard deviations of pole coordinates in comparison with those obtained by each technique separately (Shuygina, 2004). Applying the Kalman filtering method also allows to derive EOP variations with subdiurnal periods.

References

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