3.6.2.9 Institute of Applied Astronomy (IAA)

Research groups and staff

Two labs of the Institute of Applied Astronomy of the Russian Academy of Sciences (IAA) were involved in 2004 in the IERS CRC related activity:

1. Laboratory of Space Geodesy and Earth Rotation (LSGER)

Dr. Zinovy Malkin, malkin@quasar.ipa.nw.ru
Natalia Panafidina, nap@quasar.ipa.nw.ru

2. Laboratory of Ephemeris Astronomy (LEA)

Nadia Shuygina, 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 EOP series.

On the basis of this researches, we have been performing experimental computation of combined EOP series (LOD, UT1, PM) based on VLBI, GPS and SLR series routinely computed at the IAA in the framework of the regular IAA EOP Service. This job is planned to be fulfilled in several steps:

- UT1(VLBI) solution with daily resolution obtained from combination of 24h and intensive VLBI series;
- LOD(Sat) solution with daily resolution obtained from combination of GPS and SLR data;
- UT1(Sat) series computed by means of integration of LOD(Sat);
- final combined UT1 series obtained from the VLBI and satellite solutions;
- PM(Sat) solution with daily resolution obtained from combination of GPS and SLR data;
- final combined PM series obtained from the VLBI and satellite solutions.

Combination of EPN Analysis Centres' solutions

The observations from the European Permanent GPS Network (EPN) are processed by a set of Analysis Centres and official combined coordinate solutions are available on weekly basis. The fiducial approach used in the processing and changes of the reference frame can cause jumps in coordinates and distortion of the network. For that reason a new combined coordinate solution for stations of EPN was obtained with the minimum constraint approach.

The combination is done in three steps: first the stated constraints on coordinates are removed from the individual solutions of the Analysis Centres using a-priori information provided in SINEX files. Then de-constrained solutions are aligned to ITRF2000 using a 7-parameters Helmert transformation, catalogue velocities were used here

for propagating ITRF2000 stations' coordinates from the catalogue's epoch 1997.0 to each GPS week. Finally all individual solutions are combined using a sequential Least-Squares Adjustment method.

All data from the week 900 till the week 1302 were used. An investigation of the stability of the new combination was performed. Time series of transformation parameters from the new combined solution into ITRF2000 were expected to be stable, with no linear trends since here also for each GPS week the catalogue coordinates were propagated to the epoch of the respective week. Some systematic components occur in the time series for y-translation and scale. This effects can be caused by an insufficient constraints removal, and decreasing of the number of common EPN and ITRF2000 stations to the end of the interval of processing.

This work is supposed to be followed by a TRF+EOP combination in the framework of the IERS activity.

LEA group

Determination of EOP from combination of SLR and VLBI data

The main goal of this investigation is to determine EOP series from the analysis of VLBI and SLR measurements at the observation level. Laser ranges to the geodetic satellites Lageos, Lageos-2, Etalon-1, and Etalon-2 obtained on one month period are processed along with the 4 sessions of VLBI measurements of extragalactic sources obtained in the NEOS-A campaign at the same time interval. A Kalman filtering procedure was used for modelling time variations of all Earth Orientation Parameters. It appears that combining SLR and VLBI measurements makes it possible to get standard deviations of parameters evaluated 1.3 times smaller to compare with those obtained by means of each technique separately. Comparison with EOP (IERS) C04 shows that root mean square residuals of this monthly series of EOP are the following: 0.16 mas for Xp, 0.20 mas for Yp, 0.013 ms for UT1–UTC, 0.27 mas and 0.23 mas for the coordinates of the celestial pole. It is important that applying the Kalman filtering permits us to derive Earth Rotation Parameters with a subdiurnal resolution.

Zinovy Malkin, Natalia Panafidina, Nadia Shuygina