IVS Analysis Center at Main Astronomical Observatory of National Academy of Sciences of Ukraine

Sergei Bolotin, Yaroslav Yatskiv, Svitlana Lytvyn

Abstract

This report summarizes the activities of VLBI Analysis Center at the Main Astronomical Observatory of the National Academy of Sciences of Ukraine in 2007.

1. Introduction

The VLBI Analysis Center was established in 1994 by the Main Astronomical Observatory (MAO) of the National Academy of Sciences of Ukraine (NASU) as a working group of the Department of Space Geodynamics of the MAO. In 1998 the group started its IVS membership as an IVS Analysis Center. The AC MAO is located in the Central office of the observatory in Kiev.

2. Technical Description

VLBI data analysis at the center is performed on two computers: a Pentium-4 1.9GHz box with 256 MB RAM and a 160GB HDD, and a Pentium-4 3.4GHz box with 1 GB RAM and two 200 GB HDDs. Both computers are running under the Linux/GNU Operating System.

The Main Astronomical Observatory improved its Internet connection in 2007. Now we have a 10 Mbps fiber channel with a 256 kbps backup on leased line.

For data analysis we use the software STEELBREEZE which was developed at the MAO NASU. The STEELBREEZE software is written in the C++ programming language and uses Qt widget library. STEELBREEZE makes Least Squares estimation of different geodynamical parameters with the Square Root Information Filter (SRIF) algorithm (see [1]).

The software analyzes VLBI data (time delay) of a single session or a set of multiple sessions. The time delay is modeled according to the IERS Conventions (2003) [2], as well as by using additional models (tectonic plate motion, nutation models, wet and hydrostatic zenith delays, mapping functions, etc). The following parameters are estimated: Earth orientation parameters, coordinates and velocities of a selected set of stations, coordinates of a selected set of radio sources, clock function and wet zenith delay.

3. Staff

The VLBI Analysis Center at Main Astronomical Observatory consists of three members:

Yaroslav Yatskiv: Head of the Department of Space Geodynamics; general coordination and support of activity of the Center.

Sergei Bolotin: Senior research scientist of the Department of Space Geodynamics; responsible for the software development and data processing.

Svitlana Lytvyn: A Ph.D. student who is involved in the activities of the AC. Her Ph.D. thesis concerns the stability of VLBI-derived celestial and terrestrial systems.

4. Current Status and Activities in 2007

In 2007 we performed regular VLBI data analysis to determine Earth orientation parameters. "Operational" solutions were produced and submitted to the IVS on a weekly basis. The IERS Conventions (2003) [2] models have been applied in the analysis. In the solution, coordinates of stations and Earth orientation parameters are estimated.

Also, this year we continued to participate in the IVS Tropospheric Parameters project. Estimated wet and total zenith delays for each station were submitted to IVS. The analysis procedure was similar to the one used for the operational solutions.

In the frame of preparing the next ICRF realization, the center produced global CRF solution `mao000a`. The catalog is based on the analysis of almost all available dual-band VLBI observations from 1980.04.11 to 2007.05.07, which are usable for simultaneous determination of TRF, CRF, and EOP. In total, 5,905,184 observations acquired on 3,548 VLBI sessions were processed. Coordinates of radio sources, positions of stations and velocities were estimated as global parameters; EOP were estimated as local parameters; clock function and tropospheric parameters (zenith delay and its gradients) were treated as stochastic parameters (random walk model). The CRF solution consists of coordinates of 2,541 radio sources.

For the same set of VLBI sessions time series of radio sources coordinates variations were estimated. For this solution, `mao000b`, we applied the results from previous global solution `mao000a` for initial coordinates and velocities of stations, source positions, and EOP. Coordinates of radio sources were estimated as local parameters. Clock functions and tropospheric parameters were estimated as stochastic parameters (random walk model).

5. Plans for 2008

MAO Analysis Center will continue to take part in operational EOP determination as well as updating the solutions of TRF and CRF from VLBI analysis of full data set of observations.

The improving of the SteelBreeze software will also be continued next year.

Acknowledgments

The work of our Analysis Center would be impossible without activities of other components of IVS. We are grateful to all contributors of the Service.

References

[1] Biermann, G.J., 1977, Factorization Methods for Discrete Sequential Estimation, V128, Mathematics in Science and Engineering Series, Academic Press.

[2] IERS Conventions (2003), IERS Technical Note 32, eds. D.D. McCarthy and G. Petit, Bundesamt für Kartographie und Geodäsie, Frankfurt am Main.