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

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Abstract

This report summarizes the activities of the VLBI Analysis Center at the Main Astronomical Observatory of the National Academy of Sciences of Ukraine in 2008.

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: an Intel Core 2 Duo 3.1 GHz box with 4 Gb RAM and a 1 TB HDD, and a Pentium-4 3.4 GHz 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 a leased line.

For data analysis we use the SteelBreeze software which was developed at the MAO NASU. The SteelBreeze software is written in the C++ programming language and uses the 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: Engineer of the Department of Space Geodynamics; investigates the stability of VLBI-derived celestial and terrestrial systems.

4. Current Status and Activities in 2008

In 2008 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 solutions, 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 `mao005a`. The catalog is based on the analysis of almost all available dual-band VLBI observations from 1979.08.03 to 2008.09.29, which are usable for the simultaneous determination of TRF, CRF, and EOP. In total, 6,599,550 observations acquired from 3,850 VLBI sessions were processed. Coordinates of radio sources and 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 1,151 radio sources.

For the same set of VLBI sessions, time series of radio source coordinate variations were estimated. For this solution, `mao006a`, we applied the results from previous global solution `mao005a` to obtain 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).

Also, a combined catalog `maoC05b` has been created. The solution is based on individual solutions of six VLBI Analysis Centers (GSFC, IAA, MAO, OPAR, SHAO and USNO) which have participated in the ICRF2 project. The Kiev arc method was used for constructing the combined catalog.

5. Plans for 2009

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

Acknowledgments

The work of our Analysis Center would be impossible without the 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.