

SAI VLBI Analysis Center Report 2010

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Abstract

This report presents an overview of the SAI VLBI Analysis Center activities during 2010 and the plans for 2011. The SAI AC analyzes all IVS sessions for computation of the Earth orientation parameters (EOP), investigates time series of source positions within the context of new realizations of the ICRF, makes submissions of data and analysis products, and performs research and software development aimed at improving the VLBI technique.

1. General Information

The SAI VLBI Analysis Center is located at Sternberg State Astronomical Institute of Lomonosov Moscow State University in Moscow, Russia. The Analysis Center participates in geodetic and astrometric VLBI analysis, software development, and research aimed at improving the VLBI technique.

2. Component Description

The SAI AC performs data processing of all kinds of VLBI observation sessions. For VLBI data analysis we use the ARIADNA software package developed at SAI. All reductions are performed in agreement with IERS Conventions (2003).

The package uses files in NGS format as input data.

The latest version is installed on the correlator of the AstroSpace Center in support of the Radioastron mission.

3. Staff

- Vladimir Zharov, Prof.: development of the ARIADNA software, development of the methods of parameter estimation
- Mark Kaufman, scientific researcher: development of the ARIADNA software, solution and analysis
- Dmitry Duev, post-graduate student: VLBI data processing, troposphere modeling
- Nikolay Voronkov, scientific researcher: global solution
- Svetlana Nosova, engineer: VLBI data processing

4. Current Status and Activities

- **Software development for VLBI processing**

The ARIADNA software is being developed to provide contributions to IVS products. The software is used for calculating all types of IVS products.

The latest version of software can be used for the solution of many tasks during the Radioastron mission: calculation of delay and delay rate for the space-ground interferometer, orbit

determination of the space telescope by numerical integration of the differential equations of motion, and use of Doppler tracking, laser ranging, and VLBI observations for improvement of the Radioastron orbit based on the Kalman filter.

- **Routine analysis**

During 2010 the routine data processing was performed with the ARIADNA software using the least-squares method with rigid constraints. SINEX files for both IVS 24-hour and Intensive sessions were generated. But an attempt to use these files for estimation of the EOP was unsuccessful due to the rigid constraints. In 2011 a new approach with non-rigid constraints will be developed for the generation of SINEX files.

The SAI AC operationally processed the 24-hour and Intensive VLBI sessions. VLBI database creation and processing of all sessions is fully automated. The EOP series `sai2010a.eops` and `sai2010a.eopi` were calculated. These series were computed with the ITRF2005 catalog of station positions and velocities.

Experimental series `sai2010c.eops` and `sai2010c.eopi` were calculated for the experimental catalog of the radio sources whose positions and velocities were estimated in 2009. Analysis of these series is being performed.

- **Global solution**

N. Voronkov re-wrote software for the supercomputer of the Moscow State University to obtain a global solution. The radio source coordinates and velocities, and the station coordinates and velocities were estimated as global parameters. EOP, troposphere wet zenith delay (approximated as a polynomial function), troposphere gradients, and station clocks (approximated as a polynomial function) were estimated as arc parameters for each session.

- **Troposphere modeling**

At the stations with missing meteorological data we used surface data files (temporal coverage: 4-times daily, spatial coverage: 2.5 degree latitude x 2.5 degree longitude global grid) from NCEP/NCAR Reanalyzes (<http://www.cdc.noaa.gov/data/gridded/data.ncep.reanalysis.surface.html>) for calculating air temperature, pressure, and relative humidity. For that purpose a program was written to interpolate these data to the given coordinates of the station at the time of observation.

5. Future Plans

- Continue investigations of VLBI estimation of EOP, station coordinates, and troposphere parameters and continue comparison with satellite techniques.
- Continue studies concerning the Third Realization of the ICRF.
- Further improve algorithms and software for processing VLBI (ground and space-ground) observations.