

# U.S. Naval Observatory VLBI Analysis Center

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## Abstract

This report summarizes the activities of the VLBI Analysis Center at the United States Naval Observatory for calendar year 2003. Over the course of the year, Analysis Center personnel analyzed biweekly diurnal experiments with designations IVS-R1 and IVS-R4 for use in-house and continued timely submission of IVS-R4 databases for distribution to the IVS. In addition, Analysis Center personnel analyzed and submitted databases for Celestial Reference Frame (CRF) experiments: CRF-17 through CRF-24, CRF-MS7, and CRF-DS5 through CRF-DS9. During the 2003 calendar year, the USNO Analysis Center produced two periodic global Terrestrial Reference Frame (TRF) solutions with designations usn2003a and usn2003b. Earth orientation parameters based on these solutions, updated by the diurnal (IVS-R1 and IVS-R4) experiments, were submitted to the IVS. The VLBI Analysis Center personnel at USNO completed ICRF Extension 2, and produced global CRF solutions designated crf2003a and crf2003b. This report also describes activities planned for the 2004 calendar year.

## 1. Introduction

The USNO VLBI Analysis Center is supported and operated by the United States Naval Observatory (USNO) in Washington, DC. The primary services provided by the Analysis Center are the analysis of diurnal experiments, the production of periodic global Terrestrial Reference Frame (TRF) and Celestial Reference Frame (CRF) solutions, and the submission to the IVS of session-based Earth orientation parameters (EOP-S) based on USNO global TRF solutions. Analysis Center personnel maintain the necessary software required to continue these services to the IVS including periodic updates of the GSFC CALC/SOLVE software package. In addition to operational VLBI analysis, USNO personnel engage in research aimed at developing the next generation ICRF. Information on USNO VLBI analysis activities may be obtained at:

<http://rorf.usno.navy.mil/vlbi/>.

## 2. Current Analysis Center Activities

### 2.1. Experiment Analysis and Database Submission

During the 2003 calendar year, personnel at the USNO VLBI Analysis Center continued processing of diurnal (IVS-R1 and IVS-R4) experiments for use in internal USNO global TRF and CRF solutions. USNO is also responsible for the timely analysis of the IVS-R4, and the resulting databases are submitted within 24 hours of correlation for dissemination by the IVS. In addition, Analysis Center personnel continue to be responsible for the analysis and database submission for the periodic IVS-CRF experiments. The primary goal of these experiments is the densification of ICRF sources in the Southern Hemisphere. In 2003, USNO scheduled and analyzed 14 CRF experiments including CRF-17 through CRF-24, CRF-MS7, and CRF-DS5 through CRF-DS9. The analyzed databases were submitted to the IVS for dissemination to the community.

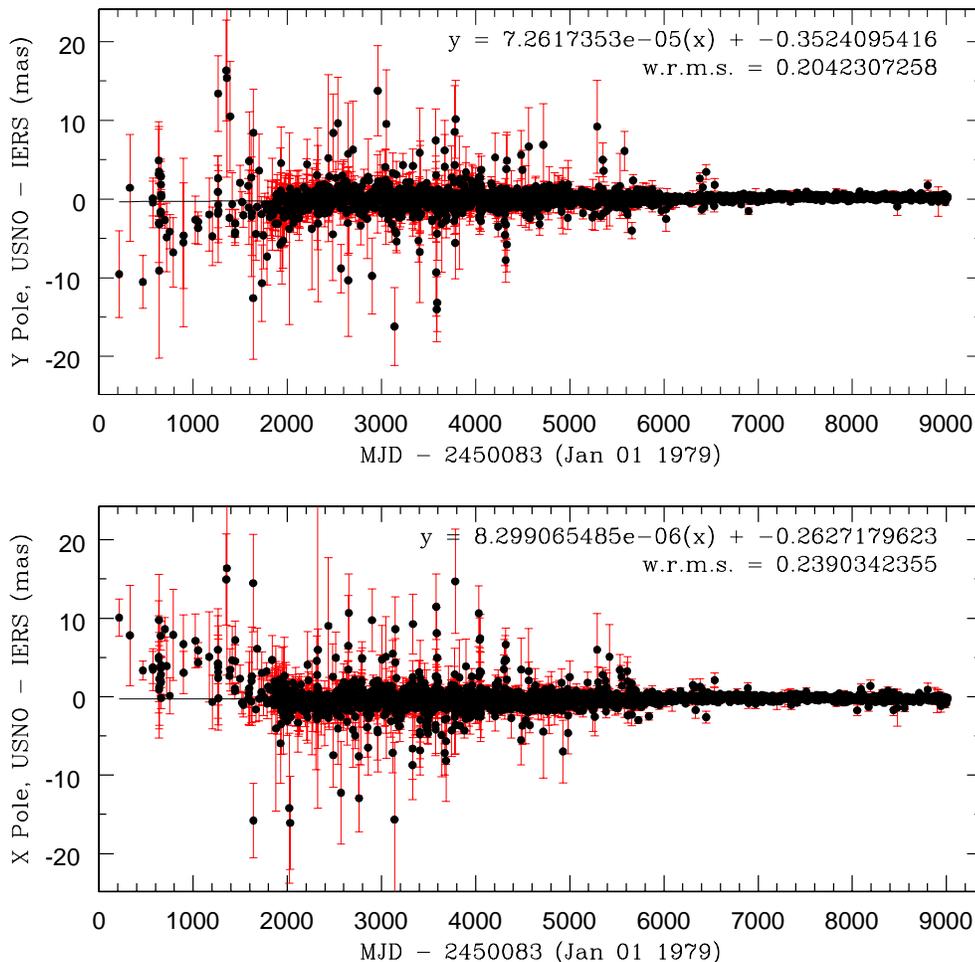


Figure 1. Differences between pole positions estimated from the usn2003b TRF solution and the IERS-C04 time series. A weighted least squares linear fit to the data and the weighted RMS are shown in the upper right corner of each plot.

## 2.2. Global TRF Solutions and EOP Submission

USNO VLBI Analysis Center personnel continued to produce periodic global TRF solutions (usn2003a and usn2003b) over the course of the 2003 calendar year. All USNO global TRF solutions including the most recent solution may be found at:

<http://rorf.usno.navy.mil/solutions/>.

Session-based Earth orientation parameters derived from these TRF solutions were compared to those derived from GSFC periodic TRF solutions and with the IERS-C04 time series prior to submission to the IVS. Figure 1 shows an example of the comparison information available at the

web site mentioned above. In this figure, differences in pole position estimates derived from the usn2003b solution and the IERS-C04 time series are plotted.

EOP-S based on the global TRF solutions were continuously updated with new data from the IVS-R1/R4 experiments prior to the introduction of the next global solution. These updated EOP-S files were submitted to the IVS twice weekly within 24 hours of the experiment correlation. Analysis Center personnel also worked to produce suitable SINEX format files based on the 24-hr experiments for the IVS Pilot Program to produce a combination for a Time Series of Baseline Lengths by the group at BKG.

### 2.3. Global CRF Solutions and ICRF-Ext.2

During the calendar year 2003, personnel at the USNO VLBI Analysis Center completed work on Extension 2 of the ICRF, and a paper reporting the results has been submitted. The primary objective of ICRF-Ext.2, is to provide positions for extragalactic radio sources observed since the definition of the ICRF (July 1995) and its first extension (April 1999) and to refine the positions of candidate and other sources using additional observations. The data added to the ICRF in ICRF-Ext.2 spanned May 1999 through May 2002 and was obtained from both geodetic and astrometric observing programs coordinated through the IVS. Approximately 1.2 million new observations from approximately 400 sessions were added along with 50 new sources. For the first time, data from the Very Long Baseline Array (VLBA) experiments with the designation RDV were included. The 30 station RDV experiments added over 652,000 delay observations ( $\sim 20\%$  of the total number of delays) to the solution.

During 2003, Analysis Center personnel continued work on global CRF solutions including crf2003a and crf2003b. These solutions were compared to the current ICRF. As an example, Figure 2 shows the differences between USNO CRF2003b source positions and the corresponding ICRF-Ext.2 positions.

### 3. Staff

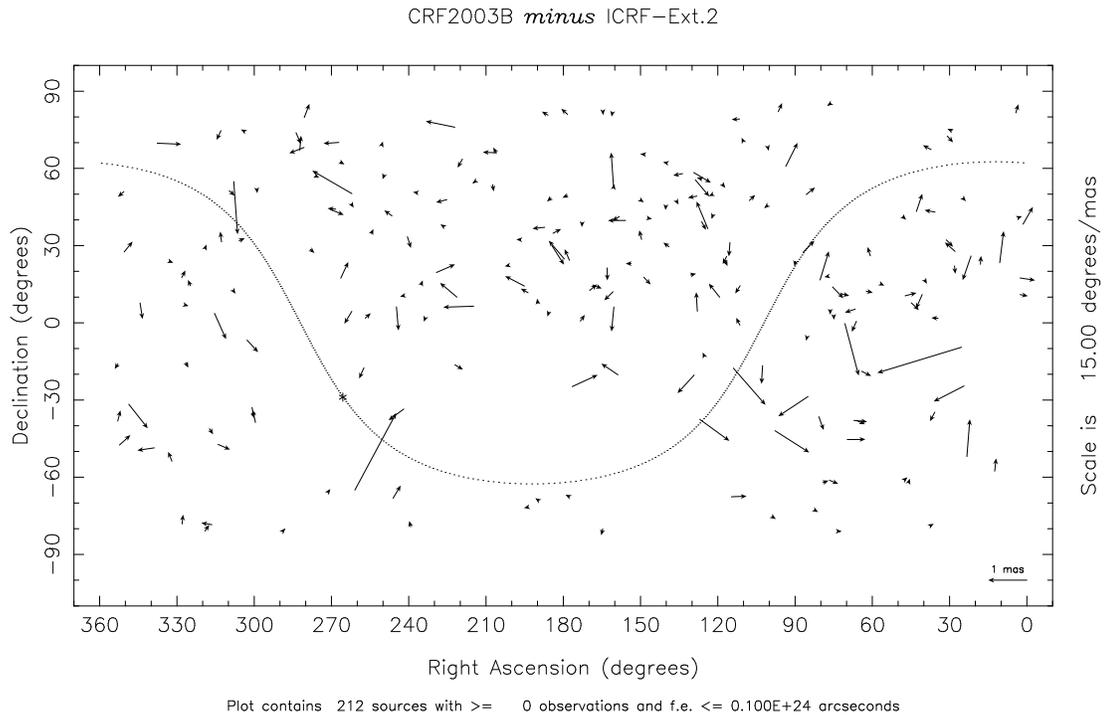
The staff of the VLBI Analysis Center is drawn from individuals who work at the USNO. The staff and their responsibilities are:

Name	Responsibilities
David A. Boboltz	Quarterly global TRF solutions, solution comparisons, web page design and administration, VLBI data analysis.
Alan L. Fey	Quarterly global CRF solutions, solution comparisons, web page design and administration, VLBI data analysis.
David M. Hall	VLBI data analysis and database submission, IVS EOP submission.
Kerry A. Kingham	Correlator interface, VLBI data analysis

### 4. Future Activities

For the upcoming year January 2004–December 2004, USNO VLBI Analysis Center personnel plan to accomplish the following activities:

- Continue the processing of biweekly IVS-R1/R4 experiments for use in internal TRF and



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Figure 2. Differences in the source positions as derived from the USNO CRF2003b solution and the ICRF-Ext.2 solution. Plotted are all 212 defining sources of the ICRF. The dotted line represents the galactic equator. The differences are due primarily to the fact that the ICRF defining source positions have not changed since the definition of the ICRF.

CRF global solutions.

- Continue the submission of databases for IVS-R4 experiments for dissemination by the IVS.
- Continue the analysis and database submission for all IVS-CRF experiments.
- Continue the production of periodic global TRF solutions and the submission of EOP-S estimates to the IVS updated by the IVS-R1/R4 experiments.
- Begin the submission of Sinex format files based on USNO databases for dissemination by the IVS.
- Begin the submission of EOP-I estimates based on the intensive experiments to the IVS.
- Begin the analysis of intensive experiments for use in USNO internal EOP-I time series estimates.
- Continue the production of periodic global CRF solutions.
- Make additional astrometric observations in the Southern Hemisphere in collaboration with ATNF partners.