

VLBI Analysis at the U.S. Naval Observatory

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Abstract

The United States Naval Observatory (USNO) is currently producing a periodic global Terrestrial Reference Frame (TRF) solution updated twice a week using the IVS-R4 and IVS-R1 experiments. The USNO analysis center is responsible for the daily solutions and submission of the IVS-R4 and CRF experiment databases to the IVS. Here we present the results of our VLBI analysis with comparisons to other EOP series. Additional information regarding VLBI analysis at the USNO and the periodic solutions can be found at <http://rorf.usno.navy.mil/vlbi/>.

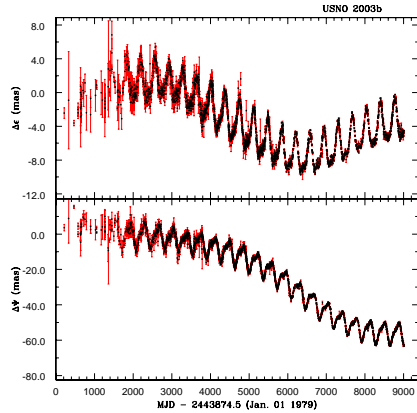
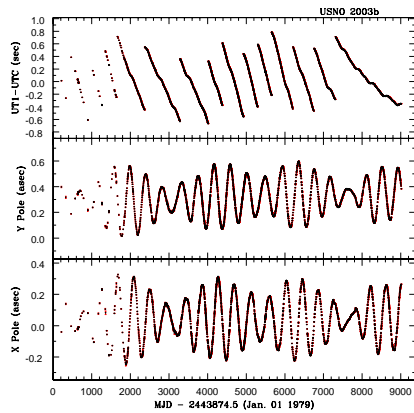
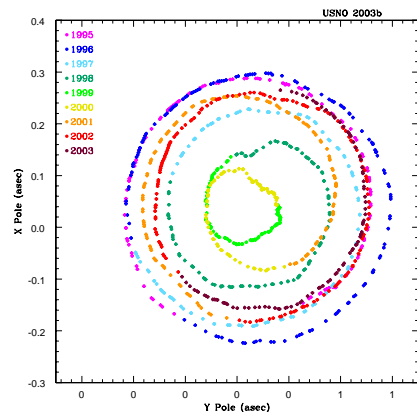
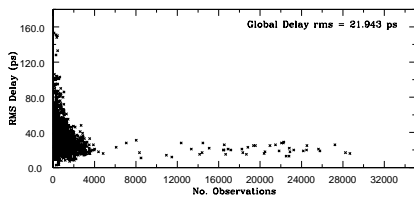
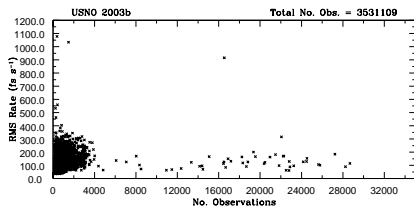
1. Analysis Center Activities 2003

- Continued analyzing weekly IVS-R4 and IVS-R1 VLBI sessions for use in internal USNO global solutions.
- Continued producing periodic global TRF solutions for use in estimating Earth orientation parameters. Global TRF solutions (USNO 2003a and USNO 2003b) can be found at: <http://rorf.usno.navy.mil/solutions/>.
- Compared EOP-S estimates obtained from the periodic TRF solutions to those obtained from the GSFC quarterly solutions and with the IERS-C04 time series.
- Assumed scheduling, analysis, and IVS data submission responsibilities for all CRF experiments, which are designed to densify the ICRF in the Southern Hemisphere. For 2003 this includes CRF-17 to CRF-24.
- Began producing periodic global CRF solutions designed to reproduce and extend the current generation ICRF.
- In collaboration with the group at the Australia Telescope National Facility (ATNF), conducted six 24-hr astrometric observing sessions, CRF-MS7 and CRF-DS5 to CRF-DS9, for the explicit purpose of densifying the ICRF in the Southern Hemisphere.

2. USNO 2003b Global Solution

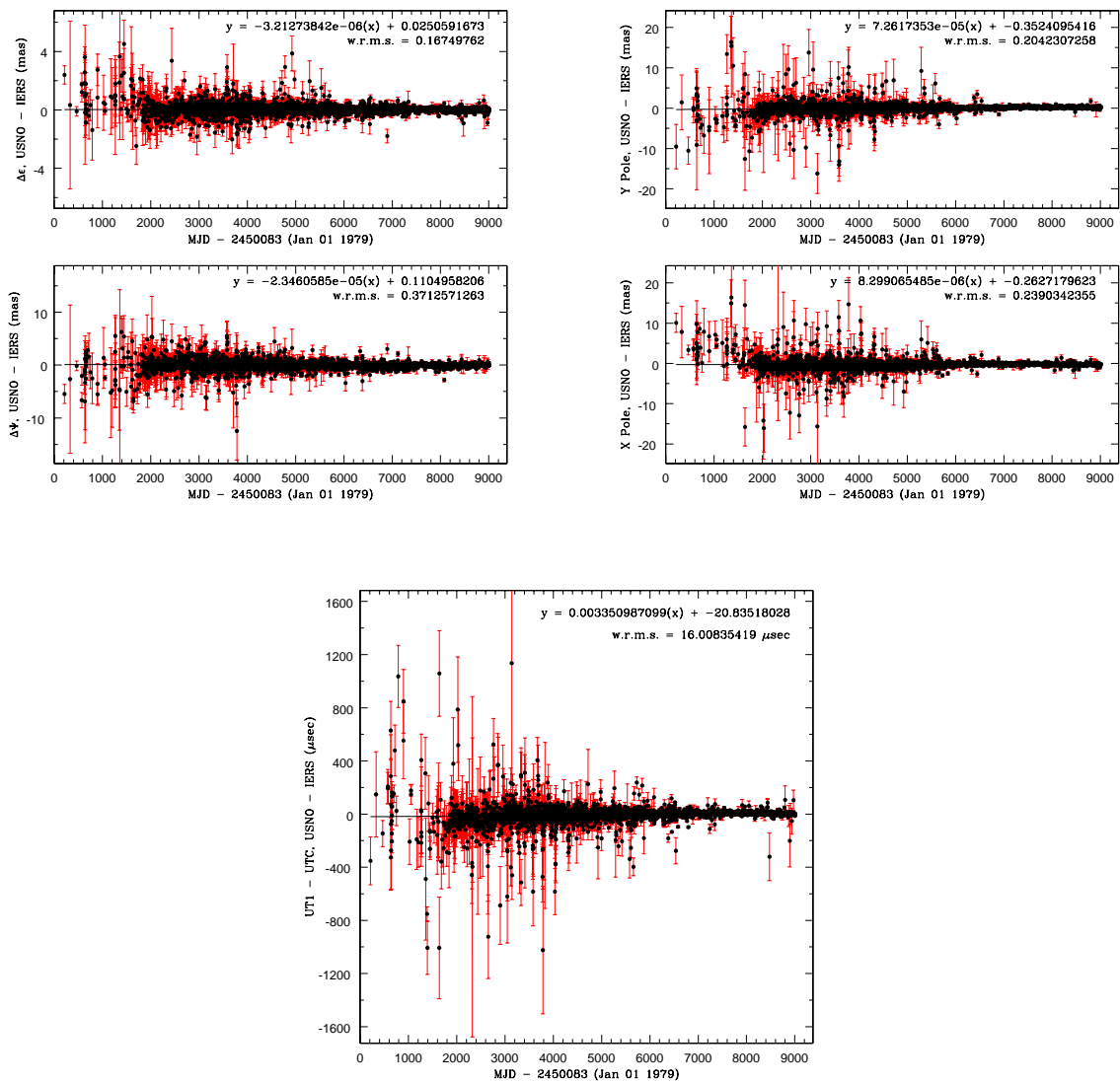
- The Batch SOLVE solution used all available multi-baseline VLBI observations at 8.4 GHz (X-band) and 2.2 GHz (S-band) from 3 August, 1979 through 6 September, 2003.
- This included a total of 3045 diurnal sessions and 3,531,109 measurements of group delay.
- The Earth Orientation parameters: X and Y pole positions and rates, UT1 angle and rate, and daily offsets in nutation (longitude and obliquity) were estimated for each session separately.

- Positions of 485 sources were estimated as global parameters.
- Positions for an additional 251 sources were estimated independently as local parameters (arc-sources).
- Of these 251 sources, 147 were treated as arc-sources due to weighted RMS position errors > 1.5 or chi-square per degree of freedom > 2.5 in either right ascension or declination as determined in the USNO CRF2003b solution.
- The remaining 104 arc-sources had fewer than 40 observations or were observed in only one experiment.
- A total of 114 sources were eliminated due to bad data or insufficient number of observations.
- Positions of 129 stations and velocities for 118 of those stations were estimated as global parameters.
- Shown below are plots from the USNO 2003b solution. Clockwise from upper left are the experiment rms delays and rates, X vs. Y pole position, nutation offsets as a function of time, and pole position and UT angle as a function of time.



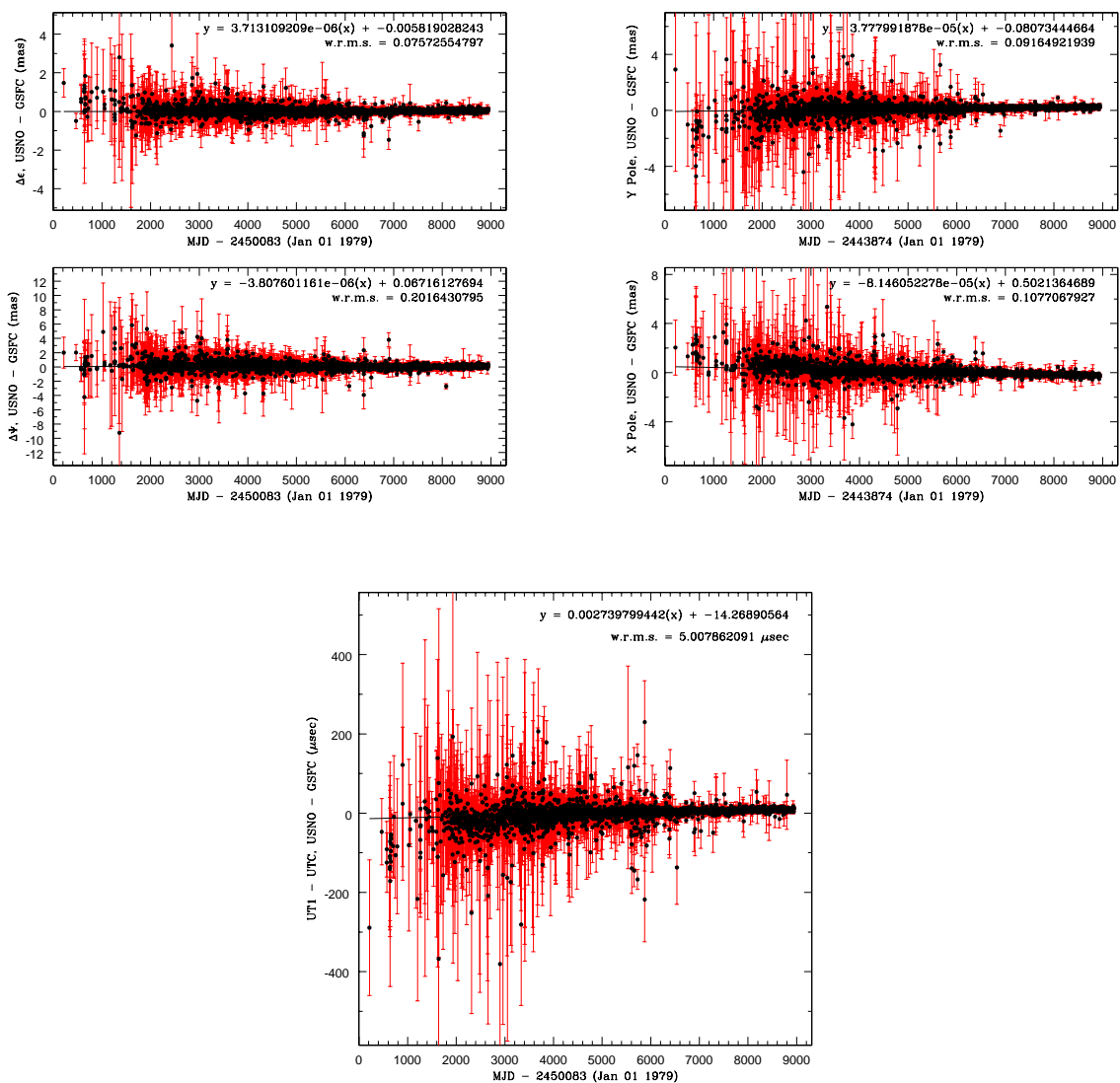
3. Comparison with IERS-C04

- Shown here is a comparison of the EOP estimates from the USNO 2003b solution with the IERS C04 time series from 1979 to 2003.
- Plotted are the differences for pole position, UT angle, and nutation offset.
- A weighted least-squares linear fit to the differences and the weighted rms are shown on each plot.



4. Comparison with GSFC 2003c

- Shown here is a comparison of the EOP estimates derived from the USNO 2003b solution with those derived from the GSFC 2003c solution from 1979 to 2001.
- Plotted are the differences for pole position, UT angle, and nutation offset.
- A weighted least-squares linear fit to the differences and the weighted rms are shown on each plot.



5. Future Plans

- Continue processing of weekly IVS-R4 and IVS-R1 experiments for use in internal USNO global solutions.
- Continue analysis and database submission for all IVS-CRF experiments.
- Continue production of periodic global TRF solutions and submission of EOP-S estimates to the IVS updated bi-weekly with IVS-R1 and IVS-R4 experiments.
- Continue production of periodic global CRF solutions.
- Make additional astrometric observations in the Southern Hemisphere in collaboration with ATNF partners.