# 2017–2018 Analysis Coordinator Report

John Gipson

**Abstract** I summarize some of the important issues related to IVS Analysis over the last two years.

## 1 Transition to vgosDB

For many years the IVS had been working on transitioning from the MK3-database format to the vgosDB format. By the end of 2017 most of the IVS correlators could produce both MK3-DB and vgosDB versions of the data, and most of the analysis software could process vgosDB. In the Spring of 2018, the computer at the Bonn correlator which produced MK-DB failed. Instead of trying to resurrect the computer, or to install the software on a new computer, the Bonn correlator group made the decision to only produce vgosDB going forward. This forced the IVS to abruptly transition to the vgosDB format which was all to the good. Because of the abrupt transition, not all components of IVS were completely ready, and ad hoc arrangements were made to keep the data flowing.

- Most IVS Analysis Centers start with Version 4 datathe data has been edited and the ambiguities removed. However only the USNO and Goddard analysis groups were able to produce V4 vgosDB. Because of this the Goddard analysis group agreed to temporarily take on the responsibility for the remaining sessions.
- The IVS data centers were not ready to handle vgosDB. Because of this the Goddard VLBI group gathered the vgosDB sessions and made them publicly available for IVS use. CDDIS worked on updating their ingest software to be able to process vgosDB, but this software was not in place by the end of 2018, although it did become in available in early 2019.

As I write this the IVS has been using vgosDB for over a year, although there are still outstanding issues in the data processing.

## 2 HF-EOP

One of the outgrowths of the 2017 IERS Unified Analysis Workshop in Paris, France, was the formation of a working group to evaluate models of tidally driven daily and sub-daily variation of EOP (HF-EOP), and to make a recommendation to the IERS for adoption of a new model. I was chair of this working group. The working group identified 10 potential models. At the conclusion of 2018 these models had been evaluated by several VLBI groups. Some of the models had been evaluated in GPS processing. The two most promising models was one derived empirically from VLBI data (Gipson) and a model due to Desai and Sibois of JPL. The working will make a recommendation by the summer of 2018.

## 3 Galactic Aberration

The IVS Aberration Working Group on Galactic Aberration (WG8) began its work in 2016 with the goal of investigating issues related to incorporating Galac-

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tic aberration in IVS analysis. Over time scales of several decades of geodetic observing, the circular motion of the solar system around the Galactic center causes a secular aberration drift. The results from WG8 were discussed in the IVS final report of the working group (MacMillan et al. 2018) and in an Astronomy and Astrophysics paper to be submitted in 2019. Using the data set (1979 - May 2018) that was to be used for the ICRF3 solution, the working group estimated a galactocentric acceleration constant of 5.8 as/yr in the direction of the galactic center. This value was adopted by the ICRF3 working group for the final ICRF3 solution. The estimated aberration acceleration vector was within 8 (less than 2 sigma) of the direction of the galactic center. This could be due to non-galactocentric acceleration or unmodeled source structure effects, but this will require future investigation.

## 4 ICRF3 Work

The third realization of the International Celestial Reference Frame (ICRF3) by VLBI was generated by a working group of the International Astronomical Union (IAU), composed mostly of IVS members. It was adopted by the IAU at its August 2018 meeting and became the official ICRF on January 1, 2019. ICRF3 contains precise catalogs of compact extragalactic radio sources at three frequencies: X/S (8.4/2.3 GHz) band (4536 sources), K (24 GHz) band (824 sources) and X/Ka (8/32 GHz) band (678 sources). Noise floors were determined at X/S band of 30 micro-arc-sec in RA and Declination and at K band of 30/50 micro-arc-sec in RA/Dec. The effect of galactic abberation was modeled in the three catalogs, using a galactic aberration constant of 5.8 micro-arc-sec/year, as was solved for using the ICRF3 X/S dataset. It was desired that the ICRF3 defining sources be as uniformly distributed around the sky as possible. To accomplish this, the celestial sphere was sub-dividing into 324 sectors of equal area and the best suitable source in each sector was picked. Defining sources from 303 sectors were selected, with 21 sectors having no suitable source. Using these 303 defining sources, the axis stability of ICRF3 is estimated to be approximately 10 micro-arc-sec.

The ICRF3 catalogs are available at https://iers.obspm.fr/icrs-pc/newwww/icrf/.

## 5 Preparation for ITRF2020

In 2017 Zuheir Altamimi published a call for participation in ITRF2020, and the IVS began preparing for this. There will be several changes compared to ITRF2014. Two of these apply to all of the techniques:

1. The new pole-tide mode which was introduced at the 2017 UAW.
2. The new HF-EOP which will be recommended by the IERS WG on HF-EOP. This model will become part of the IERS standards.

The following model change which apply only to VLBI.

1. Galactic aberration applied as an a priori correction to source positions.
2. Use of models of the gravitational deformation of VLBI antennas.

This IVS submission will differ from previous submissions in that the SINEX files will include source coordinate information. In addition, there is a proposal underway that the IVS could submit SINEX files where pressure loading is applied as a priori, as long as the effect can be removed a posteriori. The exact mechanism for doing this is unclear, but this has the advantage that it would save the IVS the trouble of having to generate special solutions for ITRF2020.

## 6 IVS Analysis Centers and Analysis Software

I am pleased to report that number of IVS Analysis Centers continues to increase. Currently there are over 30 IVS Analysis Centers using around 10 different VLBI analysis packages. Fifteen of these ACs regularly submit solutions to the IVS combination center. In addition, numerous groups have developed, or are developing, new VLBI analysis. I am a firm believer that this sort of friendly competition can only be beneficial to the IVS.

## References

1. Evaluating predicted diurnal and semidiurnal tidal variations in polar motion with GPS-based observations, Shailen D. Desai1 and Aurore E. Sibois, JGR. DOI: 10.1002/2016JB013125 DESAI AND
2. Galactic Aberration in VLBI Analysis: Findings of the IVS WG8, D. S. MacMillan and IVS WG8, in IVS 2018 General Meeting Proceedings, D. Behrend, K. D. Baver, K. L. Armstrong (editors), 2018.