The 2013 Analysis Coordinator Report

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Abstract This report presents the IVS Analysis Coordination issues of 2013. The IVS Analysis Coordinator is responsible for generating and disseminating the official IVS products. This requires consistency of the input data by strict adherence to models and conventions.

1 Changing of the Guard

In September 2012, Axel Nothnagel gave notice to the IVS Directing Board that he was resigning as the IVS Analysis Coordinator effective February 2013. Axel had been the Analysis Coordinator for 13 years. During this time, the IVS matured from a young, untried organization into a mature organization providing scientific data for use by geodesists and geophysicists. His contributions as Analysis Coordinator were many. The annual IVS Analysis Workshops were an important way for different groups to exchange information and to advance the VLBI technique. Axel's insistence on consistency of models used in different software packages, adherence to the IERS standards, and continual improvement in geophysical modeling resulted in high-quality VLBI data. Fortunately Axel is not going away; instead he took a position with more responsibility. At the IVS Directing Board meeting on March 8, 2014, Axel was elected chair of the IVS Directing Board, and I was elected Analysis Coordinator. I will endeavor to be as successful an Analysis Coordinator as Axel.

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2 IVS Analysis Workshop

Axel's last role as Analysis Coordinator was to chair the "14th IVS Analysis Workshop" held in Helsinki, Finland on Tuesday, March 5, 2013. As always, this workshop provided an informal means for everyone involved in VLBI data processing and analysis to exchange information, voice concerns, and decide how to proceed.

One of the items that surfaced at this meeting was the apparent reversal of time-tags in some recent databases. Explicitly, you would have a situation where two Scans A and B appear in this order in the schedule file, with Scan B starting after Scan A. However, the observations for Scan B had a time tag in the database before Scan A. Further investigation revealed that this only happened with databases that were processed using the DiFX software correlator. This was ultimately traced to the way the DiFX software correlators were handling time-tags; the epoch assigned to all observations in a scan was halfway through the longest observation in the scan. In contrast, the Mark IV correlator used a time-tag which was halfway through the shortest observation in the scan. Roger Cappallo agreed to modify the software difx2mk4 that converted correlator output into a format that could be read by fourfit. That would make the time-tags consistent with the old hardware correlator. Alessandra Bertarini agreed to reprocess some databases using the new time-tags. When these were analyzed using Calc/Solve, the Goddard VLBI group found a slight improvement in session fit. As a consequence of this, all sessions processed after mid-2013 with DiFX use the same time-tag convention as the Mark IV hardware correlator.

The above paragraph is a perfect example of how the IVS Analysis Workshop should run. An issue is raised and discussed. People volunteer to do some work. After further discussion and feedback the VLBI techhique is improved. I hope to encourage this sort of activity in future Analysis Workshops.

3 ITRF2013

In March 2013, Zuheir Altamini issued a call for participation in ITRF2013 made by Altamini. The last ITRF was generated in 2008. A major difference between the ITRF2008 and the ITRF2013 call for participation was the introduction of changes to the IERS standards. The new IERS standards have better models for high-frequency EOP, UT1 in particular. These include the effects of libration in UT1. The IERS2010 standards also have a different nutation model.

An area of controversy in generating solutions for ITRF2013 is the application of atmospheric pressure loading corrections. VLBI has been a leader in applying atmosphere loading effects, first using local pressure data in the early 1990s to develop empirical loading corrections [1] and then using numerical weather models to determine the a priori loading at a site [2]. In principal there are two ways of applying pressure loading corrections. You could determine the a priori pressure loading corrections at the epoch of the observations and apply them at the observation level. Alternately, you could determine the average pressure loading for a station and apply it a posteriori, after the analysis was done. As [3] shows, there are many arguments that applying a priori pressure loading at the observation level is the correct thing to do. This is exactly what the current generation of VLBI analysis packages does.

It was the strong desire of the IVS Directing Board that the VLBI contribution to ITRF2013 include atmosphere pressure loading effects at the observation level; however GPS does not do so. After extended conversations with Zuheir, I decided to recommend that the VLBI solutions also not apply a priori atmosphere pressure loading. One reason for not doing so was to makes it easier for Zuheir to combine results. If VLBI had applied a priori pressure loading, Zuheir would have had to remove the effect of pressure loading using the a posteriori correction before he combined our VLBI results with those of other techniques. By not including the effect of atmosphere pressure loading at the observation level, we reduce the chance that errors would be made in removing it.

In preparation for the VLBI solution to ITRF2013 I wrote submission instructions and a submission checklist. I drew upon instructions that Axel had sent out for ITRF2008. Unlike ITRF2008, I asked Analysis Centers to submit their solutions to the IVS Data Centers. That way all of the data submitted is publicly available. Frank Gomez at GSFC wrote and debugged scripts to handle the submissions. Karen Baver, also at GSFC, helped to design an ITRF2013 web page, http://lupus.gsfc.nasa.gov/IVS-AC_ITRF2013.htm which gathers all information related to VLBI submissions for ITRF2013.

4 Analysis Coordinator Web Pages

One of the first things I did as Analysis Coordinator was, together with Karen Baver, to design a set of IVS Analysis Coordinator Web pages, accessible through http://lupus.gsfc.nasa.gov/IVS-AC_contact.htm. Our starting point was the excellent AC Web site of Axel Nothnagel. My long term goal for these pages is to gather all VLBI data required or useful for VLBI solutions. Examples include information about the sources, stations, etc, as well as links to other sites, for example the IERS. If there is information that you think should be on this page, please let me know.

5 Conclusions

At the end of 2013, I completed my first ten months as the Analysis Coordinator, and I still have much to learn. This is a position with a lot of responsibility — both within IVS and outside of IVS. One goal is to promote the advancement of the VLBI technique with the IVS — making sure that we use the best models, making sure that our data is of high quality, and encouraging new ways of doing things. Another goal is to promote the use of VLBI data to the broader scientific community. This is an impossible task for one person to do alone, and I am aided in this by people both within Goddard and within the wider IVS community.

I welcome your support and suggestions on how I can do things better.

References

1. MacMillan, D. S. and J. M. Gipson, Atmospheric Pressure Loading Parameters from Very Long Baseline Interferometric Observations. J.Geophys. Res., 99, 1994. pp. 18,081.
2. Petrov L., J. P. Boy, Study of the Atmospheric Pressure Loading Signal in VLBI Observations, Journal of Geophysical Research Vol. 109, No. B03405, 2004.
3. Böhm, J., Heinkelmann, R., Cerveira, P., Pany, A., Schuh, H. Atmospheric Loading Corrections at the Observation Level in VLBI Analysis. Journal of Geodesy, 2009, 83: 1107-1113.