Analysis Coodinator Report

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Abstract I discuss some notable work over the prior two years.

1 IVS Contribution to ITRF2020

In the beginning of 2021 the IVS submitted its contribution for ITRF2020. Eleven Analysis Centers (ACs) using six different software packages contributed to this effort. Each AC submitted SINEX files containing the unconstrained normal equations for station position and source coordinates. These files were vetted by the IVS Combination Center. For each session the IVS Combination Center combined the files from the different ACs. For more details see Hellmers et al.

Table 1 Institute and the software used.

Institute	Software
ASI CGS	Calc/Solve
BKG	Calc/Solve
DGFI-TUM	DOGS-RI
GFZ-Potsdam	PORT
IAA	Quasar
GSFC	Calc/Solve
NMA	Where
Paris Observatory	Calc/Solve
Onsala	ASCOT
TU Wien	VieVS
USNO	Calc/Solve

NVI, Inc./NASA Goddard Space Flight Center

IVS Analysis Coordinator

IVS 2021+2022 Biennial Report

Compared to ITRF2014, there were four significant model changes:

1. A new high-frequency EOP model,
2. A new mean pole tide model,
3. Incorporation of Galactic aberration,
4. Use of models for gravitational deformation of antennas.

The first two models are used by all of the geodetic techniques. The last two are specific to VLBI. It is interesting to note that these affect the extreme ends of the signal path. Galactic aberration models reduce errors in estimates of source position, while gravitational deformation models reduce errors in estimates of station position.

ITRF2020 was also notable in that it was the first ITRF which used data from VGOS antennas.

1.1 Investigation of Preliminary ITRF2020

In the spring of 2022 Zuheir Altamimi produced a preliminary version called ITRF2020P. Several IVS Analysis Centers participated in investigating different aspects of this. Table 2 below summarizes the contributions.

The general conclusion was that ITRF2020P was much better than ITRF2014, especially for stations that had little data for ITRF2014. In particular, the Post-Seismic Deformation (PSD) models fit the data better, and the velocities were better.

Zuheir Altamimi noticed that there appears to be a drift in the VLBI scale with respect to ITRF2020 after around 2014. Many IVS Analysis Centers confirmed this scale drift. However, some ACs reported that if an

Table 2 Contributions to ITRF2020P.

Person	Institute	Contribution
John Gipson/ IVS Analysis Coordinator	NVI, Inc./NASA	Summary
Minghui Xu	Aalto University Metsähovi Radio Observatory	Ties
Sadegh Modiri Hendrik Hellmers Sabine Bachmann Daniela Thaller	BKG IVS Combination Center	Scale Scale Scale Scale
Matthias Glomsda Kyriakos Balidakis Henryk Dobslaw	DGFI-TUM GFZ German Research Centre for Geosciences	EOP Scale
Tobias Nilsson	Lantmäteriet	Comparison of ITRF2014 with ITRF2020/ Scale
Hana Krásná	TU Wien	Scale

a priori reference frame was derived from VLBI, the scale drift was absent. This area is still under investigation.

2 New Gravitational Deformation Models

Since the IVS contribution to ITRF2020, several more antennas have been surveyed to determine gravitational deformation models. A model for Ny-Ålesund became available in late 2020, too late for inclusion in ITRF2020. Because Ny-Ålesund and Kokee Park are structurally identical, the gravitational deformation model applies to both. Other antennas which were surveyed and whose models are now available are 1) the Onsala twins, 2) Wettzell 20-m, and 3) the Wettzell twins. The IVS thanks the institutions which host these antennas for making the effort to perform the surveys and reduce a source of systematic error.

3 Operational Transition to ITRF2020

The IVS will transition to using ITRF2020 for the a priori in the first quarter of 2023.

- For this purpose, the IVS Analysis Centers will use the Post-Seismic Deformation models from ITRF2020.
- Because of the issues with VLBI scale with respect to ITRF2020, and also because there is much more data available for VGOS stations, the a priori reference frame will be derived from VLBI data only.
- The IVS will also use the expanded list of stations with a gravitational deformation model.

All of the IVS Analysis Centers are supposed to submit solutions to the IVS Combination Center by February 28, 2023. The Combination Center will vet the solutions and provide feedback to the ACs. By the end of March, the IVS Combination Center will produce a new combined solution. Henceforth all of the ACs are expected to use the new models.

4 New S/X Intensives

In the last two years two Intensive series have been scheduled on an R&D basis. The ‘midnight Intensives’ involve the Kokee–Wettzell baseline, currently run two days per week, and are centered around 00:00 UT. An advantage of these Intensives is that you do not need to do any interpolation to compare results with EOP from other techniques or with EOP time series such as C04.

The Southern Intensives run on Monday at 06:30 UT and use the Hobart–HartRAO baseline. These are unique in that they use only Southern Hemisphere stations. See Böhm et al.

5 VGOS Intensives

The last four years have seen an increase in the cadence of both 24-hour and Intensive VGOS sessions. The Intensive VGOS sessions are particularly interesting because in principle the turnaround time for observing, correlation, and analysis can be less than 24 hours. Below is a list of the current VGOS Intensives.

The VGOS-INT-A series uses the VGOS antennas at Kokee and Wettzell and is scheduled on the same days and at the same time as the S/X Intensives. This allows a direct comparison of the estimated UT1. Comparison with the R1 sessions and the R4 sessions, as well as with external series, indicates that the

Table 3 Intensive sessions, their baselines, and their scheduled times.

Intensive	Baseline	Time
VGOS-INT-A	K2-Ws	Mon-Fri @ 18:30-19:30
VGOS-INT-B	Is-Oe-Ow	Sat-Sun @ 07:00-08:00
VGOS-INT-C	Is-Oe-Ow	Sat-Sun @ 08:45-09:45
VGOS-INT-S	Mg-Ws	Tue @ 19:45-20:45
VGOS-INT-Y	Gs-Sa-Yj	Tue @ 14:00-15:00

VGOS Intensives perform better than the S/X Intensives. These results have not been published.

The VGOS-INT-B and VGOS-INT-C Intensives use the Ishioka–Onsala baseline. These two series differ in the selection of the sources. See Haas et al. for a description of the VGOS-INT-B and VGOS-INT-C Intensives. The scatter of the difference in the UT1 estimates from that of C04 is comparable to the S/X Intensives. For further information see Haas et al.

The VGOS-INT-S and VGOS-INT-Y series were designed to study the effects of using shorter baselines. The thought here is that because the baseline is shorter, the area of mutual visibility will be larger than for the longer baselines. This might allow the selection of better sources. Results from these sessions are being written up for publication.

6 IVS Analysis Workshops

During 2021–2022, there were four Analysis Workshops. Workshops were held each year in the spring/early summer and in the fall. The spring/early summer workshops were held in conjunction with the 2021 EVGA Working Meeting and the 2022 IVS General Meeting. All of the workshops were held virtually using Zoom. With the return to normalcy, the next IVS Workshop is scheduled to be held in person as a splinter meeting at the 2023 EVGA Working Meeting.

Several concrete recommendations came out of these workshops. Here this list mentions a few.

1. Claudia Flohrer of BKG proposed a new format for EOP files which was discussed and accepted. This new format provides additional information about the EOP solution—e.g., what constraints were implemented. The IVS Combination Center and the USNO Earth Orientation Center are currently accepting files in both formats.
2. Chris Dieck of USNO headed an ad hoc working group that specified a new format for the master schedules and a new convention for the session names. The previous format for the master schedule was designed over 30 years ago when there were not as many sessions. With the possibility of having many Intensive sessions per day, a new format was required.
3. It was proposed and agreed upon to have Principal Investigators (PIs) for each IVS session type. This has always been the case informally, but this agreement formalizes this relation. The PIs have ultimate responsibility for each session type. This includes things such as the observing strategy and choice of sources. The PIs are also responsible for communication with the correlators about how to correlate the data.

References

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2. R. Haas, E. Varenius, P.-K. Diamantidis, S. Matsumotu, M. Schartner, T. Nilsson. “VGOS Intensives Ishioka-Onsala”, In: Proceedings of the EGU General Assembly 2021 (2021), DOI:10.5194/egusphere-egu21-12916.
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