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Network Determination and Timeliness of the Rapid Sessions

Cynthia C. Thomas, Dirk Behrend, John M. Gipson, Daniel S. MacMillan

NVI, Inc.

Contact author: Cynthia C. Thomas, e-mail: cynthia.c.thomas@nasa.gov

Abstract

About ten years ago the IVS introduced the rapid turnaround sessions IVS-R1 and IVS-R4 with the goal of providing EOP (Earth Orientation Parameter) results twice weekly within a 15-day period from the end of recording to results. The networks chosen for the rapid sessions were determined by station availability as well as network simulations. Both session series were successful in accomplishing the latency goal most of the time. The IVS-R1s experienced a start-up problem in 2002 and had weaker years in 2007 and 2011 w.r.t. the timeliness goal. The timeliness performance of the IVS-R4s maintained a good success rate over the full first decade.

1. Introduction

With the start of the observing year 2002, the IVS established the observation of the rapid turnaround sessions IVS-R1 and IVS-R4. The IVS-R1 sessions were scheduled for observation on Mondays and the IVS-R4 sessions on Thursdays; hence the names R1 and R4, respectively. The introduction of the rapid sessions followed a recommendation of IVS Working Group 2 'IVS Product Specification and Observing Programs', and their observation continues to this day. The main goals of the rapid sessions are to provide EOP (Earth Orientation Parameter) results twice weekly within a 15-day period from the end of observing to results. During the first decade, 26 participating stations agreed to ship their data to the correlators as rapidly as possible, a total of 1,020 sessions were recorded, and 6,854 station days were utilized. In this paper we review the first decade of data in terms of networks being used and the actual timeliness of the sessions.

2. Station Networks of the IVS-R1 and IVS-R4 Sessions during 2002–2011

The individual station networks for the IVS-R1 and IVS-R4 sessions were determined by station availability as well as network simulations for optimal EOP determination (see [1] for the observing year 2010). The network sizes increased over the years from about six stations to nine stations per session on average. For each session type a set of core network stations was augmented by two to three additional stations to form the final networks. Figures 1 and 2 give an overview of the station usage in the IVS-R1 and IVS-R4 sessions for the past ten years. The plots display how frequently the stations were used. For the IVS-R1 sessions, selected core stations were Gilcreek (Gc), Ny-Ålesund (Ny), Tigo (Tc), Tsukuba (Ts), Westford (Wf), and Wettzell (Wz). For the IVS-R4, selected core stations were Algonquin Park (Ap), Badary (Bd), Fortaleza (Ft), Gilcreek (Gc), Kokee (Kk), Matera (Ma), Ny-Ålesund (Ny), Svetloe (Sv), Tigo (Tc), Wettzell (Wz), and Zelenchukskaya (Zc). The plots also show when stations started or ended operations, or when they had operations interruptions. For instance, Fortaleza (Ft) and HartRAO (Hh) went down for repairs from fall 2009 to spring 2011 and from fall 2008 to summer 2010, respectively. While VLBI

operations were discontinued at Gilcreek (Gc) at the end of 2005 and at Algonquin Park (Ap) in summer 2006, several new stations came online: Zelenchukskaya (Zc) in 2006, Badary (Bd) in 2007, Hobart 12-m (Hb) in 2010, and Warkworth (Ww) in 2011.

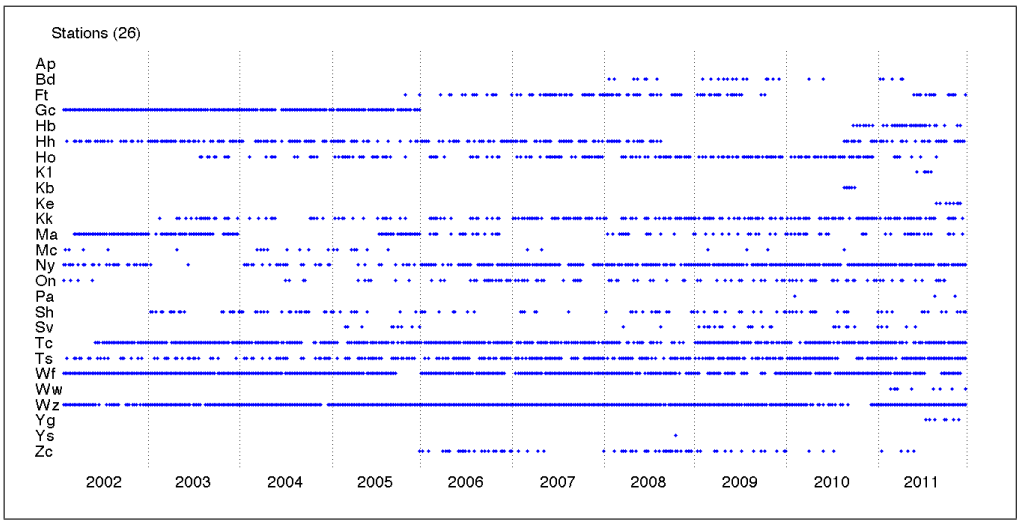

Figure 1. Station networks of the IVS-R1 sessions during 2002–2011.

Figure 2. Station networks of the IVS-R4 sessions during 2002–2011.

3. Timeliness of the IVS-R1 and IVS-R4 Sessions

From 2002 through 2006, the correlation of the IVS-R1 sessions was shared between the Bonn, Haystack, and Washington Correlators. Starting in 2007, the IVS-R1 sessions were processed only by the Bonn Correlator. The IVS-R4 sessions were always processed by just the Washington Correlator.

Figures 3 and 4 show the latency numbers of the IVS-R1 and IVS-R4 sessions as well as the annual and decadal percentages of sessions completed within 15 days. The decadal success rate amounts to 77.2% for the IVS-R1 sessions and to 89.2% for the IVS-R4 sessions. Most of the IVS-R1 sessions were processed within 13–14 days, while the IVS-R4 sessions were processed within 11–12 days.

YEAR	# of SESSIONS	6-7 DAY DELAY	8 DAY DELAY	9 DAY DELAY	10 DAY DELAY	11-12 DAY DELAY	13-14 DAY DELAY	15 DAY DELAY	16-17 DAY DELAY	18-19 DAY DELAY	20+ DAY DELAY	% Completed within 15 days
2002	49	0	0	0	2	0	11	16	5	0	15	59.2%
2003	52	1	1	4	4	3	18	9	6	0	6	76.9%
2004	52	2	7	5	15	0	7	12	0	0	4	92.3%
2005	49	0	4	13	5	1	17	7	1	0	1	95.9%
2006	52	0	1	3	7	3	21	10	2	0	5	86.5%
2007	52	0	0	2	5	1	18	4	11	0	11	57.7%
2008	50	0	1	3	8	4	17	7	6	1	3	80.0%
2009	52	0	0	0	4	1	20	14	7	1	5	75.0%
2010	52	0	0	1	4	5	29	5	4	1	3	84.6%
2011	50	0	1	6	4	1	16	4	11	0	7	64.0%
	510											77.2%

Figure 3. Latency numbers of the IVS-R1 sessions for the period of 2002-2011.

YEAR	# of SESSIONS	6-7 DAY DELAY	8 DAY DELAY	9 DAY DELAY	10 DAY DELAY	11-12 DAY DELAY	13-14 DAY DELAY	15 DAY DELAY	16-17 DAY DELAY	18-19 DAY DELAY	20+ DAY DELAY	% Completed within 15 days
2002	49	0	1	0	3	29	11	0	1	2	2	89.8%
2003	51	0	0	0	6	20	15	0	2	4	4	80.4%
2004	52	7	2	1	13	22	5	0	0	2	0	96.2%
2005	50	4	0	0	7	25	10	0	0	2	2	92.0%
2006	52	17	0	0	15	11	4	0	1	0	4	90.4%
2007	52	13	3	0	11	16	4	0	0	3	2	90.4%
2008	51	14	0	1	11	14	2	1	0	3	5	84.3%
2009	52	1	4	0	11	19	7	1	2	2	5	82.7%
2010	52	4	0	0	17	22	5	0	1	1	2	92.3%
2011	49	1	1	0	4	21	18	1	2	1	0	93.9%
	510											89.2%

Figure 4. Latency numbers of the IVS-R4 sessions for the period of 2002-2011.

The IVS-R1 sessions experienced some start-up problems in 2002, and 20 sessions (40.8%) were delayed. The timeliness improved for the next few years until 2006. In 2007, 22 sessions (42.3%) were delayed mainly because of a two-step transmission process for the Tsukuba data: the data was first e-transferred to Haystack and then physically shipped to Bonn. The timeliness regained previous levels in July 2007 when Bonn and Tsukuba established a direct e-connection. The timeliness slipped again in 2011 when 18 sessions (36%) were delayed. The delays can be attributed mostly to start-up problems with the DiFX Software Correlator. The IVS-R4 sessions kept a more or less constant timeliness level over the decade.

Figure 5 shows that, on average, the latencies for the IVS-R1s and the IVS-R4s met the 15-day processing goal. Only in 2002 was the annual latency average above 15 days for the IVS-R1s. The IVS-R4 sessions were usually processed faster than the IVS-R1 sessions.

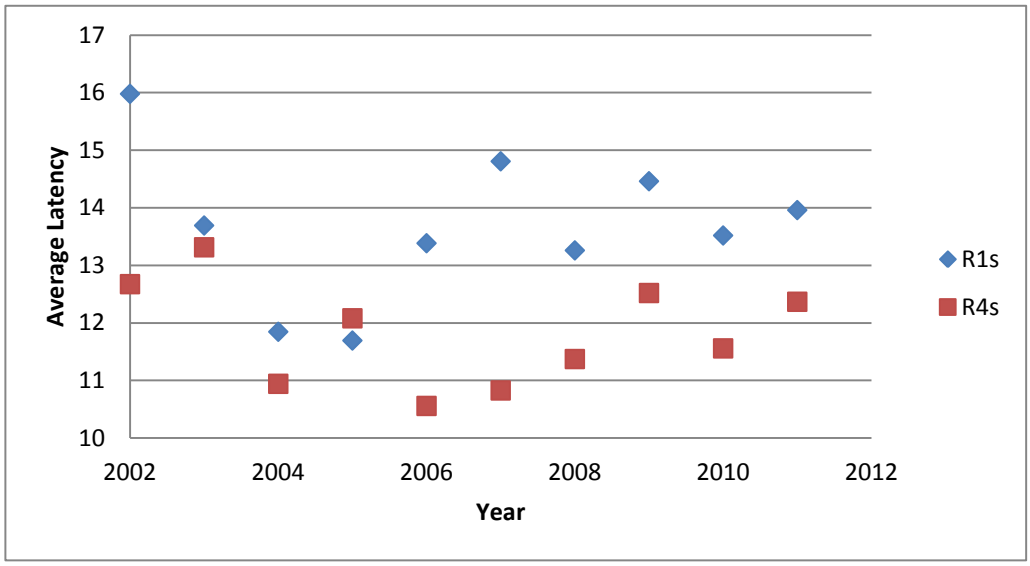

Figure 5. Annual averages of the latency numbers of the IVS-R1 and IVS-R4 sessions for the period of 2002–2011.

With the exception of three years, the annual percentages of sessions completed in more than 15 days over the past 10 years (failure rate, see Figure 6) were 25% or less. During 2002, 2007, and 2011 the IVS-R1 sessions were completed in over 15 days in up to 43% of the sessions. These high latencies could be attributed to the above mentioned circumstances: a) start-up problems (2002), b) Tsukuba data transfer to Bonn (2007), and c) problems with the new DiFX correlator (2011)) and are not likely to occur again. Figure 7 shows the success rates for the 15-day processing target plus an imaginary success rate if the processing target had been ten days. With the latter success rate ranging between 10–60%, work is still needed before the 15-day processing goal can be reduced to ten days.

4. Conclusions

We have shown the networks and timeliness of the IVS rapid sessions during the first decade of their observation. In general, the set goals have been accomplished. The few exceptions to the timeliness goal have been understood. In order to get to a higher timeliness goal (e.g., ten-day processing goal) the high success rates for 2004 and 2006 could be analyzed. In those years the IVS-R1s and IVS-R4s were processed within ten days in over 50% of the sessions. The increased use of e-transfer of data will likely lead to improved timeliness values. Improved timeliness is essential for the success of the VLBI2010 Global Observing System (VGOS).

Acknowledgements

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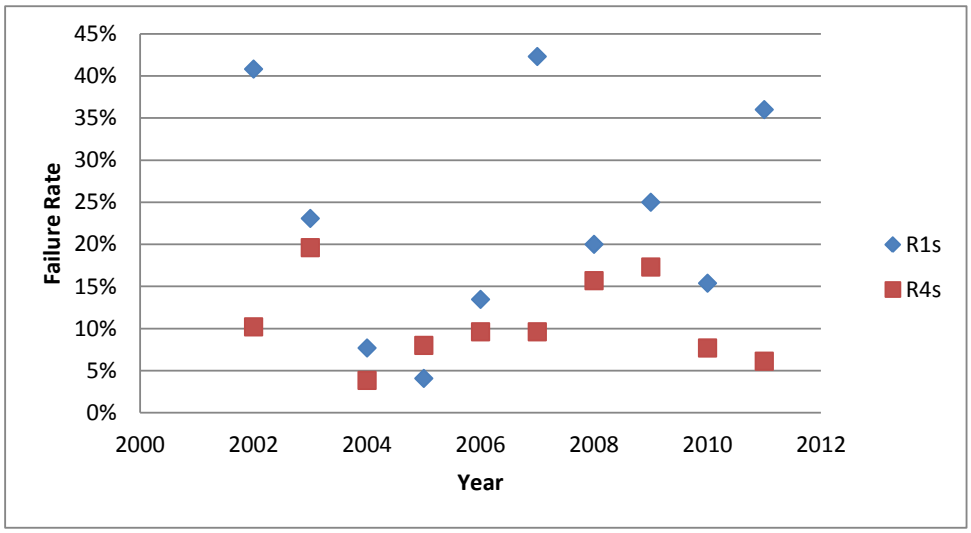

Figure 6. Annual percentage of sessions that exceeded the 15-day processing goal in the time span from 2002 through 2011.

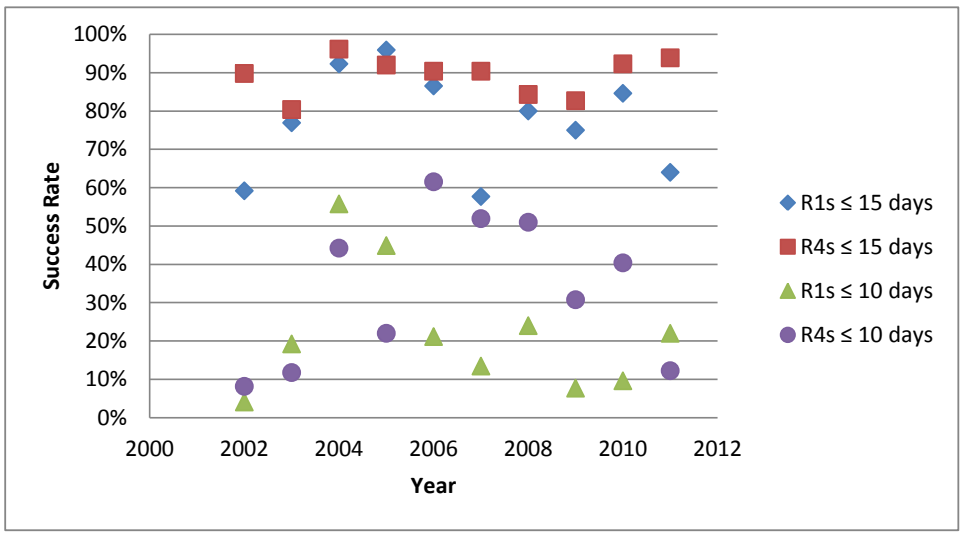

Figure 7. Annual percentage of sessions that fulfilled the 15-day and 10-day processing target during the period of 2002 through 2011.

References

[1] Thomas, C., D. Behrend, D. MacMillan, The Composition of the Master Schedule, In: International VLBI Service for Geodesy and Astrometry 2010 General Meeting Proceedings, NASA/CP–2010-215864, D. Behrend and K. D. Baver (eds.), 85–89, 2010.