CORE Operation Center Report

Cynthia C. Thomas, Daniel MacMillan

Abstract

This report gives a synopsis of the activities of the CORE Operation Center from January 2010 to December 2010. The report forecasts activities planned for the year 2011.

1. Changes to the CORE Operation Center's Program

The Earth orientation parameter goal of the IVS program is to attain precision at least as good as 3.5 μs for UT1 and 100 μas for pole position.

The IVS program, which started in 2002, used the Mark IV recording mode for each session. The IVS program began using the Mark 5 recording mode in mid-2003. By the end of 2007, all stations were upgraded to Mark 5. Due to the efficient Mark 5 correlator, the program continues to be dependent on station time and media. The following are the network configurations for the sessions for which the CORE Operation Center was responsible in 2010:

IVS-R1: 52 sessions, scheduled weekly and mainly on Mondays, five to nine station networks

RDV: 6 sessions, scheduled evenly throughout the year, 13 to 16 station networks

IVS-R&D: 5 sessions, scheduled monthly, six to eight station networks

2. IVS Sessions from January 2010 to December 2010

This section displays the purpose of the IVS sessions for which the CORE Operation Center is responsible.

- IVS-R1: In 2010, the IVS-R1s were scheduled weekly with five to nine station networks. During the year, 17 different stations participated in the IVS-R1 network, but there were only seven stations that participated in at least half of the scheduled sessions—Ny-Ålesund (47), Westford (48), Tigo (41), Tsukuba (38), Hobart-26m (34), Kokee (33), and Wettzell (29). After being down for almost two years, HartRAO started participating in the IVS-R1s again in mid-August. Also the new Hobart-12m antenna was tagged along to several sessions during 2010.

  The purpose of the IVS-R1 sessions is to provide weekly EOP results on a timely basis. These sessions provide continuity with the previous CORE series. The "R" stands for rapid turnaround because the stations, correlators, and analysts have a commitment to make the the time delay from the end of recording to the results as short as possible. The time delay goal is a maximum of 15 days. Participating stations are requested to ship discs to the correlator as rapidly as possible. The "1" indicates that the sessions are mainly on Mondays.

- RDV: There are six bi-monthly coordinated astrometric/geodetic experiments each year that use the full 10-station VLBA plus up to 8 geodetic stations.

  These sessions are being coordinated by the geodetic VLBI programs of three agencies: 1. USNO performs repeated imaging and correction for source structure; 2. NASA analyzes this data to determine a high accuracy terrestrial reference frame; and 3. NRAO uses these sessions to provide a service to users who require high quality positions for a small number of sources. NASA (the CORE Operation Center) prepares the schedules for the RDV sessions.

- R&D: The purpose of the five R&D sessions in 2010, as decided by the IVS Observing Program Committee, was to improve the scheduling technique of the Intensive sessions.

3. Current Analysis of the CORE Operation Center's IVS Sessions

Table 1 gives the average formal errors for the R1, R4, RDV, and T2 sessions from 2010. The R1 sessions' formal uncertainties are generally at the level of the 2008-2009 averages, but somewhat better than in 2009. The R4 X-pole uncertainty for 2010 sessions is clearly worse than for 2008-2009. This must be caused by poorer network geometry due to the loss of several stations during the year. For example, Fortaleza was down and not available to participate during 2010. In addition, Svetloe's and Wettzell's participation was cut by 50 percent when compared to the two stations' participation during 2009. The other EOP parameter uncertainties are at the level of the 2008-2009 average. The R4 uncertainties are clearly significantly worse than the R1 uncertainties, because the global geometry of the R1s is better. RDV uncertainties are not significantly different in 2010 than in the preceding two years. Clearly the RDV formal errors are significantly better than any of the other experiment series. This must be due to the larger number of RDV stations as well as better global geometry.

Table 2 shows the EOP differences with respect to IGS for the R1, R4, T2, and RDV series. The WRMS differences were computed after removing a bias, but estimating rates does not affect the residual WRMS significantly. Of all the series, the RDV series has the best WRMS agreement of X-pole and Y-pole with IGS in 2010 as well as for all sessions since 2000. Both the R1 and R4 series show worse WRMS agreement of X-pole for 2010 than for the R1 and R4 series since 2000, but not much difference for Y-pole. This is consistent with the formal error trend for the R4s. It is not clear why the agreement is worse for the R1s. For all session types, LOD WRMS agreement with IGS for 2010 is somewhat better than the agreement for each full series since 2000. There are some significant biases greater than 100 mas between the VLBI and GPS series that should be investigated. Formal uncertainties of the bias estimates are not shown, but the polar motion biases are all several sigma.

Table 1. Average EOP Formal Uncertainties for 2010

Session Type	Num	X-pole (μas)	Y-pole (μas)	UT1 (μs)	DPSI (μas)	DEPS (μas)
R1	51/52	60(61,57)	59(63,52)	2.3(2.4,2.5)	117(129,114)	47(52,44)
R4	51/52	98(73,80)	88(79,90)	3.3(2.9,3.5)	178(192,194)	73(73,79)
RDV	5/6	41(40,43)	45(42,45)	1.9(1.7,2.2)	69(70,79)	29(28,31)
T2	3/7	75(79,56)	72(91,66)	4.3(4.1,2.9)	158(171,139)	65(69,58)

Values in parentheses are for 2009 and then 2008. For the number of sessions in 2010, both the number of processed sessions as of the end of January 2011 and the number of sessions observed are given.

Table 2. Offset and WRMS Differences (2010) Relative to the IGS Combined Series.

		X-pole		Y-pole		LOD	
Session Type	Num	Offset (μas)	WRMS (μas)	Offset (μas)	WRMS (μas)	Offset (μs/d)	WRMS (μs/d)
R1	51(459)	-54(-1)	132(98)	166(121)	96(95)	1.9(0.3)	15(17)
R4	51(458)	-35(-42)	132(112)	183(120)	117(114)	4.0(1.9)	16(19)
RDV	5(65)	10(45)	77(81)	160(154)	44(90)	6.6(0.3)	14(15)
T2	3(69)	-203(-6)	192(145)	423(98)	151(146)	23.8(0.9)	11(20)

Values in parentheses are for the entire series (since 2000) for each session type

4. The CORE Operations Staff

Table 3 lists the key technical personnel and their responsibilities so that everyone reading this report will know whom to contact about their particular question.

Table 3. Key Technical Staff of the CORE Operations Center

Name	Responsibility	Agency
Dirk Behrend	Organizer of CORE program	NVI, Inc./GSFC
Brian Corey	Analysis	Haystack
Irv Diegel	Maser maintenance	Honeywell
Mark Evangelista	Receiver maintenance	Honeywell
John Gipson	SKED program support and development	NVI, Inc./GSFC
Frank Gomez	Software engineer for the Web site	Raytheon/GSFC
David Gordon	Analysis	NVI, Inc./GSFC
Ed Himwich	Network Coordinator	NVI, Inc./GSFC
Dan MacMillan	Analysis	NVI, Inc./GSFC
David Rubincam	Procurement of materials necessary for CORE operations	GSFC/NASA
Braulio Sanchez	Procurement of materials necessary for CORE operations	GSFC/NASA
Dan Smythe	Tape recorder maintenance	Haystack
Cynthia Thomas	Coordination of master observing schedule and preparation of observing schedules	NVI, Inc./GSFC

5. Planned Activities during 2011

The CORE Operation Center will continue to be responsible for the following IVS sessions during 2011.

- The IVS-R1 sessions will be observed weekly and recorded in a Mark 5 mode.
- The IVS-R&D sessions will be observed ten times during the year.
- The RDV sessions will be observed six times during the year.