CORE Operation Center Report

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Abstract

This report gives a synopsis of the activities of the CORE Operation Center from January 2012 to December 2012. The report forecasts activities planned for the year 2013.

1. Changes to the CORE Operation Center's Program

The Earth orientation parameter goal of the IVS program is to attain precision of at least 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 had been 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 2012:

- IVS-R1: 52 sessions, scheduled weekly and mainly on Mondays, five to eleven station networks
- RDV: Six sessions, scheduled evenly throughout the year, 15 to 16 station networks
- IVS-R&D: Ten sessions, scheduled monthly, seven to eight station networks

2. IVS Sessions from January 2012 to December 2012

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

- IVS-R1: In 2012, the IVS-R1s were scheduled weekly with five to eleven station networks. During the year, 18 different stations participated in the IVS-R1 network, but there were only eight stations that participated in at least half of the scheduled sessions—Wettzell (52), Tigo (50), Ny-Ålesund (46), Tsukuba (44), Fortaleza (44), Westford (36), HartRAO (29), and Kokee (28). Urumqi was tagged along to one IVS-R1 session for testing in preparation for joining the IVS-R1 network during 2013.

  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 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 disks to the correlator as rapidly as possible or to transfer the data electronically to the correlator using e-VLBI. 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 six 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 ten R&D sessions in 2012, as decided by the IVS Observing Program Committee, was to support observations close to the Sun.

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 2012. The R1 session formal uncertainties are not significantly different from the 2010-2011 errors. The R4 uncertainties for 2012 sessions are much better than for 2011 or 2010. This improvement is due in part to the better performance of stations in 2012; in 2012, 22 sessions lost one or more stations from the original scheduled network, while there were 37 such sessions in 2011. R1 uncertainties for 2012 (as well as for 2011) are worse than for 2010. This is most likely due to the contribution of TSUKUB32 to the EOP solution estimates. Since the Japanese earthquake in March 2011, we have been estimating the position of TSUKUB32 for each observing session. This weakens its contribution to EOP. If we use a GPS a priori model to obtain the post-earthquake behavior at Tsukuba, then the formal uncertainties are reduced by 10-20%. We will be applying this model in the next GSFC operational quarterly solution.

RDV uncertainties are not significantly different among the three years from 2010 to 2012. The RDV formal errors are significantly better than the formal errors from any of the other experiment series. This is due to the larger number of RDV stations as well as better global geometry. T2 EOP uncertainties are markedly better in 2012 than for 2010-2011. For comparison, we also included the formal uncertainties for the CONT11, which are much better than any of the networks discussed above that observed in 2012.

Table 2 shows EOP differences with respect to the IGS series for the R1, R4, RDV, T2, and CONT11 series. The WRMS differences were computed after removing a bias, but estimating rates does not affect the residual WRMS significantly. The R1 and R4 series show approximately the same WRMS agreement in x-pole and y-pole for 2012 as for these series since 2000. The R1s are worse for x-pole, which is most likely due to the treatment of TSUKUB32 in solutions as discussed above. Adopting the improved GPS a priori model strategy mentioned above improves the agreement with IGS by 20%. The polar motion biases of the R1 and R4 sessions relative to IGS differ by 10-20 μas, which is at the level of the uncertainty (1-2 sigma) of the bias estimates. The biases for the six RDV sessions are significantly smaller. Perhaps there is a network bias between the RDV and the R1/R4 networks, but this would require further investigation. Of all the series, the RDV series has the best WRMS agreement of x-pole and y-pole with IGS estimates in 2012 as well as for all sessions since 2000. There are really too few RDV and T2 sessions to give significance to the WRMS differences for 2012 compared with the difference for full series from 2000-2012. For comparison with the 2012 sessions discussed here, we included the statistics for the 15 CONT11 sessions. The WRMS agreement with IGS is much better because 1) the network has better geometry; 2) short-term scatter is always smaller than long-term scatter, and 3) the performance of stations was most likely better because of the increased station checkout that is done for the R&D continuous session experiments.

Table 1. Average EOP Formal Uncertainties for 2012.

Session Type	Number	X-pole (μas)	Y-pole (μas)	UT1 (μs)	DPSI (μas)	DEPS (μas)
R1	51 (52)	73(67,62)	63(65,58)	3.4(3.1,2.4)	110(113,116)	44(46,46)
R4	5l (52)	70(84,96)	67(75,85)	2.8(3.2,3.3)	124(161,172)	49(65,70)
RDV	3 (6)	48(49,44)	48(46,44)	2.5(2.6,2.1)	68(75,67)	28(30,28)
T2	4 (7)	91(100,93)	69(107,101)	4.5(5.0,5.2)	166(216,192)	63(79,75)
CONT11	15 (15)	39	38	1.7	42	17

For the number of sessions in 2012, the number of sessions processed at this time is given, with the number of observed sessions in parentheses. For the other columns, the values in parentheses are for 2011, followed by the values for 2010.

Table 2. Offset and WRMS Differences (2012) Relative to the IGS Combined Series.

		X-pole		Y-pole		LOD	
Session Type	Number	Offset (μas)	WRMS (μas)	Offset (μas)	WRMS (μas)	Offset (μs/d)	WRMS (μs/d)
R1	52(562)	-64(9)	107(95)	42(13)	88(88)	1.5(0.3)	14(16)
R4	52(560)	-42(-23)	109(113)	32(15)	113(111)	3.4(1.8)	17(18)
RDV	6(78)	15(59)	97(82)	24(5)	55(66)	0.3(-0.5)	10(14)
T2	4(81)	-80(3)	234(145)	152(2)	61(122)	13.8(1.7)	11(20)
CONT11	15	42	36	9	29	7.0	7

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 readers will know whom to contact about their particular question.

5. Planned Activities during 2013

The CORE Operation Center will continue to be responsible for the following IVS sessions during 2013.

- 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.

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
Ricky Figueroa	Receiver maintenance	ITT Exelis
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
Katie Pazamickas	Maser maintenance	ITT Exelis
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