CORE Operation Center Report

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Abstract

This report gives a synopsis of the activities of the CORE Operating Center from March 1999 to December 2000. The report forecasts activities planned for the year 2001. The outlook summarizes the evolution of the different CORE programs.

1. CORE Program Description

The continuous observations of the rotation of the Earth (CORE) program was initiated by the geodetic very long baseline interferometry (VLBI) community in 1997. The program is being carried out using geodetic VLBI stations for data acquisition and VLBI analysis centers for data processing and analysis. The CORE program will evolve over the period 1997-2003.

The goal of the CORE program is to generate a continuous high accuracy Earth rotation data set for Earth science and global change research. The program will produce basic observational data for studies of the continuous momentum exchange among the solid Earth, the atmosphere, and the hydrosphere, enabling exciting research areas that heretofore have been impossible.

The current Earth orientation parameter goal of the pre-CORE Mark III experiments is to attain precision of at least 3.5 μs for UT1 and 100 μas in pole position. The full CORE program has the potential for a typical precision of 2-2.5 μs in UT1 and 30-40 μas in pole position, for daily sessions with a 6-station network.

The availability of continuous, high accuracy Earth rotation data will be possible due to the Mark IV technology that became available during the third quarter of 2000. The Mark IV correlator became as efficient as the Mark III correlator during the last quarter of 2000. Improved sensitivity of the Mark IV data acquisition system together with the high playback efficiency of the Mark IV correlator are both necessary to produce the expected results for CORE.

CORE sessions were run with five basic network configurations: CORE-A, CORE-B1, CORE-B2, and CORE-B3 during 1997 and 1998. During 1999, the networks of the CORE-B sessions changed and the sessions were named CORE-B4, CORE-B5, and CORE-B6. The CORE-A sessions were simultaneous with NEOS sessions and CORE-B and NEOS sessions were on sequential days during both 1998 and 1999. During 2000, the CORE-3 sessions started in July and were performed in Mark IV mode. It was decided that the CORE-A/NEOS series of 76 sessions was sufficient for the analysis of EOP estimated from different networks and it was therefore ended. To start the process of filling in the observing week that will eventually be continuous in CORE, the CORE-A network was moved from Tuesdays to Mondays and renamed CORE-1.

2. CORE Sessions During April 1999 to December 2000

This section displays the purpose of the CORE-A, CORE-B, CORE-1 and CORE-3 sessions. It also lists other programs used by CORE.

- CORE-A/CORE-1: These experiments validated the CORE concept of measuring EOP continuously using different networks.

The network for CORE-A included Fairbanks, HartRAO, Hobart, Algonquin, Matera and Westford during 1998. During 1999 the network consisted of three constant stations: Fairbanks, HartRAO, and Algonquin. The other three stations consisted of Medicina, Westford, Tsukuba, Matera, and Hobart.

In 2000, the CORE-As were scheduled once per month until July. In July, the CORE-As were moved to Mondays and renamed CORE-1 because Algonquin was added to the NEOS weekly sessions. The network for the CORE-A and CORE-1 was Algonquin, Fairbanks, HartRAO, Matera, Tsukuba, and Hobart.

- CORE-B: The purpose of these sessions is to provide additional data for comparison of EOP measurements, to obtain long 48-hour data sets for geophysical studies and to provide observing sessions during which the stations can demonstrate their performance and their ability to participate in future regular CORE sessions.
- CORE-3: These sessions started in July of 2000 and were observed monthly. The CORE-3 series was named for the third day of the work week since it is scheduled for Wednesdays following the NEOS sessions. The CORE-3 sessions were the first of the regular, operational CORE sessions, recorded in a Mark IV mode.

There is data from other programs established by Bonn (IRIS-S, CORE-OHIGGINS, and EUROPE), USNO (NEOS, NAVEX, CRF), and GSI (APSG) that are used by the CORE program. Some of the data is used to help determine the direction of the CORE program during its evolution.

3. Current Analysis of CORE

Comparisons of daily EOP estimates made by the CORE-A and NEOS networks show that there are biases at the level of about 50 μas in polar motion and 2 μs in UT1 between simultaneous CORE-A and NEOS measurements. The wrms differences are 232 μas, 165 μas, 9.8 μs between X, Y, and UT1 estimates, respectively. The source of these differences is most likely unmodeled or mismodeled site motion, which we are currently investigating.

One of the measures of performance of the CORE experiments is the size of the formal EOP uncertainties. The uncertainties range from about 70-100 μas for X-pole, 50-100 μas for Y-pole, and 2.5-3.5 μs for UT1. Based on the observed differences between simultaneous CORE-A and NEOS sessions, the formal EOP precisions should be multiplied by about a factor of 1.5. The observed uncertainties are generally less than the minimal goal of 100 μas for PM and 3.5 μs for UT1.

4. The CORE Family

Table 1 lists the key technical personnel and their responsibilities so that everyone reading this report will know who to contact about their particular question.

5. Evolution of CORE

As of the end of 2000, the CORE observing program for 2001 and the Mark IV correlator plans were proceeding.

- The CORE-1 sessions have been scheduled monthly and will be observed in a Mark IV mode.

- The CORE-3 sessions have been scheduled bi-weekly during the year. In addition, a second CORE-3 network will begin bi-weekly starting July of 2001.
- The correlator has been operating as efficiently as the Mark III Correlator.

Table 1. Key Technical Staff of the CORE Operations Center

Name	Responsibility	Agency
Tom Buretta	Recorder and electronics maintenance	Haystack
Brian Corey	Analysis	Haystack
Irv Deigel	Maser maintenance	HTSI
Frank Gomez	Software engineer for the Web site	Raytheon/STX
David Gordon	Analysis	Raytheon/STX
Ed Himwich	Network Coordinator for CORE stations	NVI, Inc./GSFC
Chuck Kodak	Receiver maintenance	HTSI
Cindy Lonigro	Analysis	Raytheon/STX
Dan MacMillan	Analysis	NVI, Inc./GSFC
Leonid Petrov	Analysis	NVI, Inc./GSFC
David Shaffer	Sources and antenna parameter maintenance	Radiometrics/NVI, Inc.
Dan Smythe	Tape recorder maintenance	Haystack
Cynthia Thomas	Coordinate master observing schedule and prepare CORE experiments observing schedules	NVI, Inc./GSFC
Nancy Vandenberg	Organizer of CORE program and sked manager	NVI, Inc./GSFC
William Wildes	Procurement of materials necessary for CORE operations	GSFC/NASA

The tentative CORE evolution plan for the next few years is summarized in Table 2.

Table 2. Planned CORE Evolution

Start Date	Experiment Name	Avg Days per Week	Notes
1-Feb-2000	CORE-A monthly	2.0	Mark IV Correlator efficiency < Mark III Correlator
1-Jul-2000	CORE-3 monthly	2.0	Discontinued CORE-A
1-Jan-2001	CORE-1 monthly	2.4	
1-Jan-2001	CORE-3 bi-weekly	2.4	
1-May-2001	CORE-C 8 sessions	2.5	
1-Jul-2001	CORE-3 weekly	2.8	two different CORE-3 networks

We are working on identifying the participating stations for each new CORE network. We will need more antenna observing to fulfill this plan. The goal for CORE is continuous observing but we

recognize that it will be very difficult to fill in the weekend days for CORE-5, -6, and -7. Weekend observing is costly both in funding and in inconvenience to operators. We would appreciate any ideas you have about how to attack this problem. Volunteers for weekend observing would be very welcome!

6. CORE Review Panel

A panel, co-sponsored by NASA and IVS, met in early 2001 to review the CORE program and make recommendations about the best way VLBI can contribute to space geodesy programs. The report of the panel will be input to the master schedule planning for 2002 observing.

References

[1] Clark, T.: CORE White Paper, June 2, 1997