Tsukuba VLBI Analysis Center

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Abstract

The aim of activities at Tsukuba VLBI Analysis Center is to examine the VLBI data processing and analysis method to obtain EOP values within the shortest possible time after the VLBI observing session. The most successful result in 2011 was an ultra-rapid dUT1 measurement during the CONT11 session, which is a campaign of 15 days of continuous VLBI sessions. In this article, the improved data processing/analysis system and the results of our analysis activities are reported.

1. General Information

The Tsukuba VLBI Analysis Center is located at the Geospatial Information Authority of Japan (GSI). We became an IVS Operational Analysis Center on April 7, 2010 and started to submit an ultra-rapid dUT1 solution of IVS-INT2 sessions to IVS in January 2011. The rapid solution has been used for the calculation of USNO EOP daily solutions. We have also implemented the ultra-rapid dUT1 experiments during IVS 24-hour sessions in cooperation with the National Institute of Information and Communications Technology (NICT) and Onsala Space Observatory (OSO) in Sweden since 2007. These experiments were a good opportunity to improve the data processing/analysis program for ultra-rapid dUT1 measurement. In 2011, most of the experiments succeeded, and we could obtain dUT1 solutions during the 24-hour observing sessions.

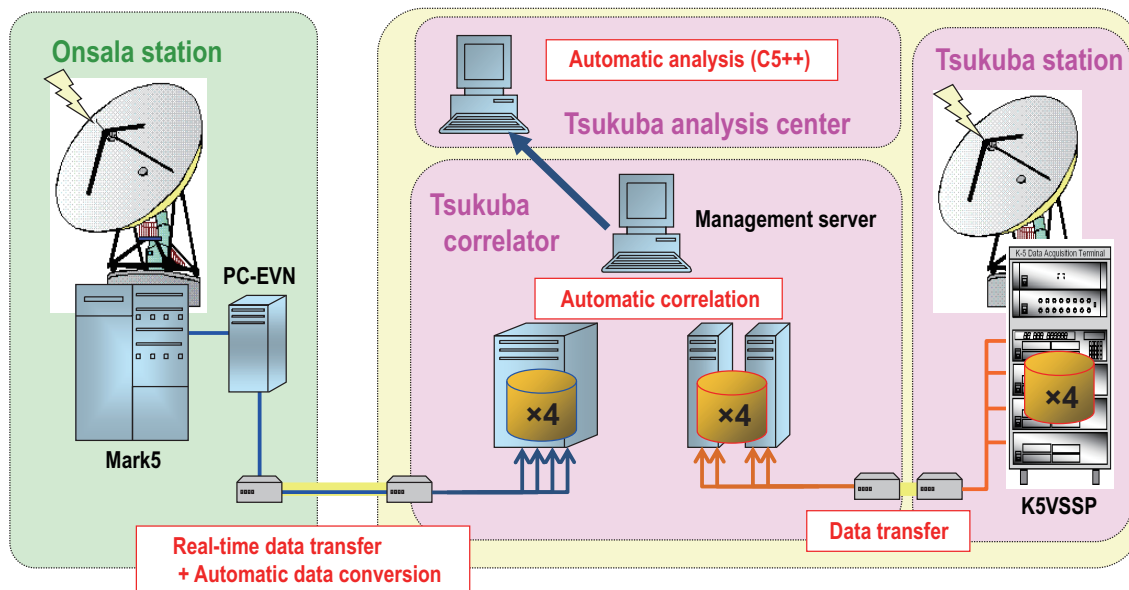## 2. Data Proccessing and Analysis System for Ultra-rapid Measurement

Figure 1. Ultra-rapid dUT1 measurement system.

The data processing system for the ultra-rapid dUT1 measurement is shown in Figure 1. The data of the foreign observatories, such as Wettzell, Onsala, or Hobart, is transferred in real-time

during the observation. The data from the Onsala or the Hobart station are converted to K5/VSSP format after the data transfer because the format of the transferred data is Mark 5B. On the other hand, the format of the transferred data from Wettzell is VDIF, and it is converted to K5/VSSP format with a real-time data transfer system developed by NICT at the same time of recording on a data server at Tsukuba correlator. It enables us to reduce the latency of VLBI sessions.

The converted data is correlated as soon as the data conversion is completed. We use about 16 servers for the correlation process, and the processes are completed within a few minutes after the observing session. When the correlation results for all of the data, or enough data for dUT1 analysis, are ready, the analysis program "c5++" developed by NICT runs automatically, and we can obtain a dUT1 solution within five minutes after the observing session. All of the programs run automatically, so we do not have to type any commands during the session. If any error occurs during data processing, the programs send any error e-mail messages to the operators. We used the data processing system for ultra-rapid dUT1 measurement on IVS-INT2 sessions, some of the 24-hour sessions, and CONT11 sessions.

3. Results of Our Activities

The Tsukuba VLBI Analysis Center implements three different kinds of ultra-rapid dUT1 measurements. This section shows the results of these dUT1 measurements.

3.1. Ultra-rapid dUT1 Measurement in INT2 Sessions

The Tsukuba VLBI Analysis Center has implemented the ultra-rapid dUT1 measurement in INT2 sessions in 2009 and started to provide the solution "eopi" file to the IVS Data Center at the end of January, 2011. All of the solutions were analyzed by c5++, and results were provided within seven hours after the observing sessions. It is possible to provide the dUT1 solution within a few minutes after the observing sessions on the Tsukuba-Wettzell baseline session, but it is not possible to provide the solution so quickly for the sessions with the Kokee-Wettzell baseline, because the data from the Kokee station are not transferred in real-time. As the data transfer is completed about six hours after the session, the submission of the dUT1 solution is about seven hours after the observing session on the Tsukuba-Wettzell baseline. The automated data transfer or the data analysis program sometimes stopped due to some kinds of error, so we could not submit the dUT1 solution the same day in about 30% of the sessions. We try to solve the problem of this program every time the ultra-rapid dUT1 measurement fails.

3.2. Ultra-rapid dUT1 Measurement in IVS 24-hour Sessions

In 2011, we also implemented the ultra-rapid dUT1 measurement in 18 IVS 24-hour sessions (e.g., R1, RD, and T2) in which the Tsukuba, Onsala, Wettzell, or Hobart station participated. In the case of 24-hour sessions, we can obtain a number of dUT1 values during the observing session because the data analysis is done every several tens of scans. We sometimes failed in the data transfer process from the Onsala station but succeeded in ultra-rapid dUT1 measurement in most of the sessions. Most of the failure is due to human error, so we may have to make a check sheet or automated check program for the preparation of data transfer.

The new approach in 2011 was that we implemented the ultra-rapid EOP experiment with the Onsala and Hobart stations. We processed the data of North-South baselines for estimating X/Y

parameters of polar motion and East-West baselines for dUT1 measurement. We implemented the experiment in the RD1106 session and an additional session named "UREO01" at the end of November. Although we had some problems with the data transfer, all of the data processing was completed within 24 hours after the observing session. We plan to improve the system and want to process all of the data without any problem with the next experiment. The solution of dUT1 and X/Y parameters of polar motion estimated from the UREO01 session are shown in Figures 2, 3, and 4.
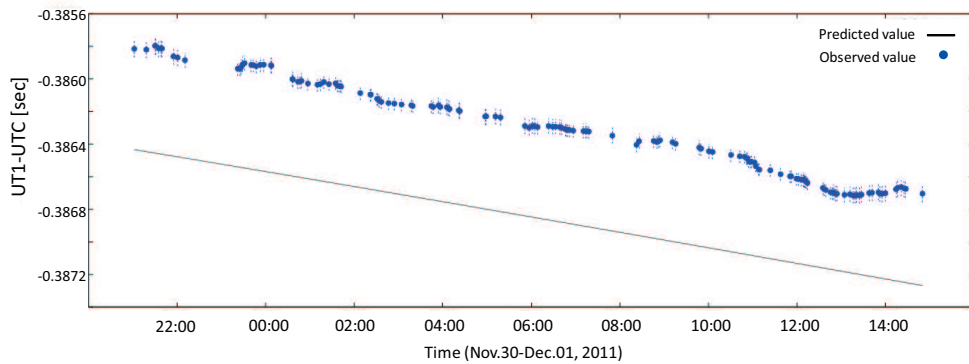

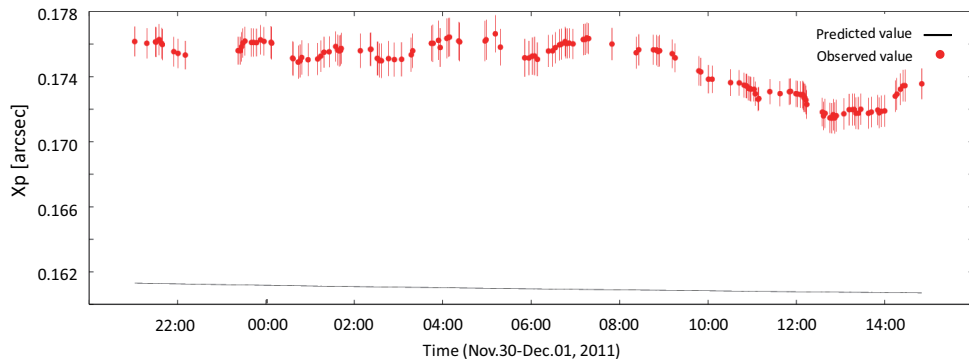Figure 2. dUT1 values estimated from the "UREO01" session.

Figure 3. X-parameter of polar motion estimated from the "UREO01" session.
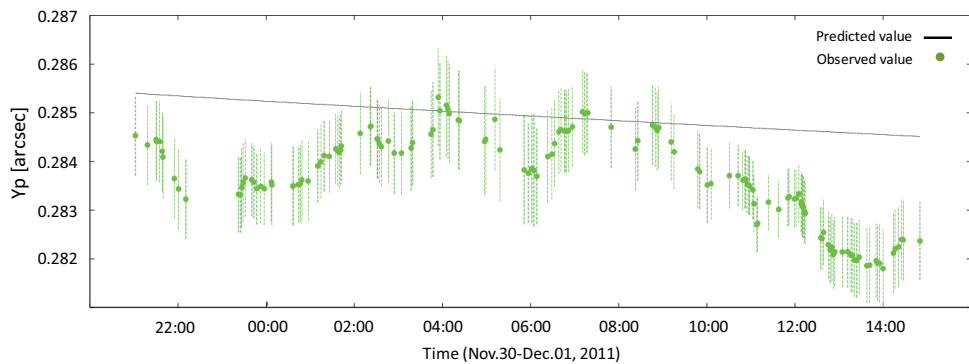

Figure 4. Y-parameter of polar motion estimated from the "UREO01" session.

3.3. Ultra-rapid dUT1 Measurement in the CONT11 Session

The ultra-rapid dUT1 measurement during the CONT11 campaign was performed on the Tsukuba-Onsala baseline. The data was transferred to the Tsukuba correlator, correlated, and analyzed in near real-time during the session. As CONT11 was a campaign of 15 days of continuous VLBI sessions, we could obtain continuous dUT1 values for 15 days about 30 minutes after the observation of each scan. Unfortunately, we were forced to stop the ultra-rapid dUT1 measurement for about one day from September 21 to September 22, because the Tsukuba station was affected by a big typhoon. We failed in data transfer from Onsala and could not analyze the data for about three hours on September 25 and 26, but we succeeded in the ultra-rapid dUT1 measurement for most of the scans of CONT11. The estimated dUT1 values are shown in Figures 5 and 6.
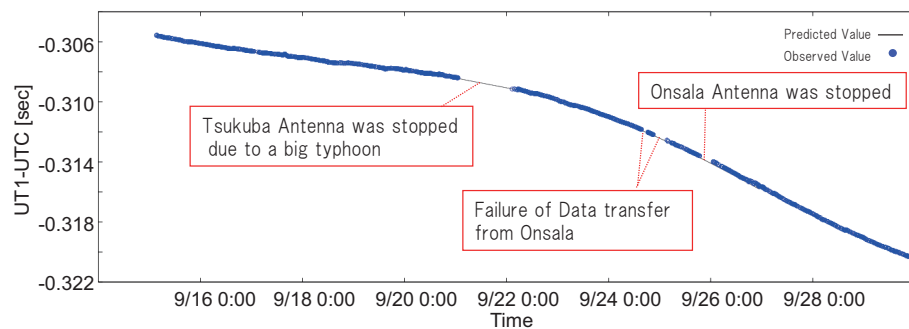

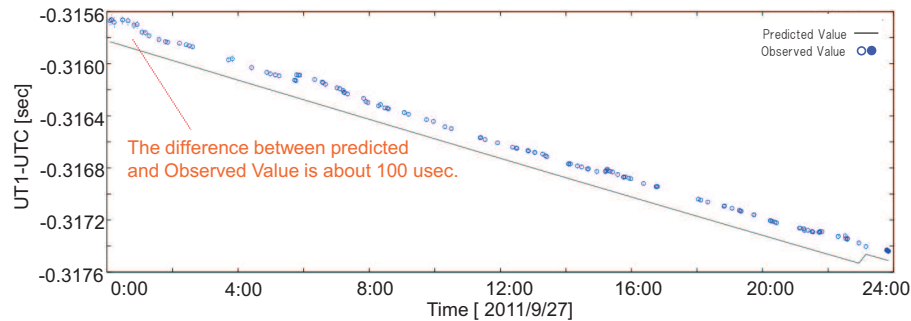Figure 5. dUT1 values of the ultra-rapid dUT1 experiment during CONT11.

Figure 6. dUT1 values of the ultra-rapid dUT1 experiment on September 27.

4. Staff

- Kensuke Kokado (GSI): Correlation Chief, Management of overall activity
- Kentaro Nozawa (AES): Main operator of the analysis work

5. Plan for 2012

We will continuously implement an ultra-rapid dUT1 or EOP measurement with selected IVS 24-hour sessions and try to submit the rapid solutions to the IVS data center. In addition, we plan to analyze the data to determine the optimum analysis method for each 24-hour session.