

Position determination of the Tomakomai 11-m antenna VLBI station from Kashima-HOKT Geodetic VLBI experiment.

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Abstract

The 11-m VLBI antenna and backend system which had been equipped at Miura VLBI station until December 2000 was transported to the new site in the Tomakomai Experimental Forest of Hokkaido University. These facilities at Miura were used for the precise geodetic measurements under the so called Key Stone Project (KSP) conducted by the Communications Research Laboratory (CRL). One of the main objectives of the KSP was to monitor regional deformation and strain accumulation at plate boundary regions of the Kanto district. The new site is located in suburb of Tomakomai city where is located about 50 km SSE from Sapporo (We call the new site as 'Tomakomai site' hereafter). The facilities were successfully installed before the end of September 2001.

In November 2001, the first geodetic VLBI observation among Tomakomai, Kashima 34m, and Kashima 11m was performed to determine accurate station position of the Tomakomai site and the system check. In addition to the new Tomakomai VLBI station, 11-m antenna and 34-m antenna VLBI stations at Kashima Space Research Center of the CRL were used in the experiment. Kashima 11-m antenna station has been routinely used as one of the four KSP VLBI stations since 1995, and this station was regarded as the reference station in the data processing. Kashima 34-m antenna station has been participating in the global VLBI experiments since 1991 and the position of the station can be used to estimate the position of the Tomakomai station in the international terrestrial reference frame. The large aperture of the Kashima 34-m antenna station also allowed us to obtain high signal to noise ratio with two other relatively small antenna stations.

The experiment was performed by receiving two frequency bands at S-band and X-band. The K4 VLBI system was used for data recording and data processing. Observations were made with 16-channels and the sampling mode was 4-Mbps per channel and 1-bit per each sample, and therefore the total data rate was 64-Mbps. Before the first geodetic VLBI experiment was performed, test observations were carried out between Tomakomai 11-m antenna station and Kashima 34-m antenna station on November 20, 2001. After confirming there was no problem with observation systems by processing the test data, the geodetic VLBI experiment was carried out for 24-hours from November 21, 2001. Recorded data were processed by using the KSP correlator system at Kashima. Fringes were found between all stations and the band width synthesis processing have been carried out. We are expecting to analyze the processed data using Calc and Solve geodetic VLBI data analysis software developed by the Goddard Space Flight Center of NASA and to determine accurate station position of Tomakomai 11-m antenna station.

Observation

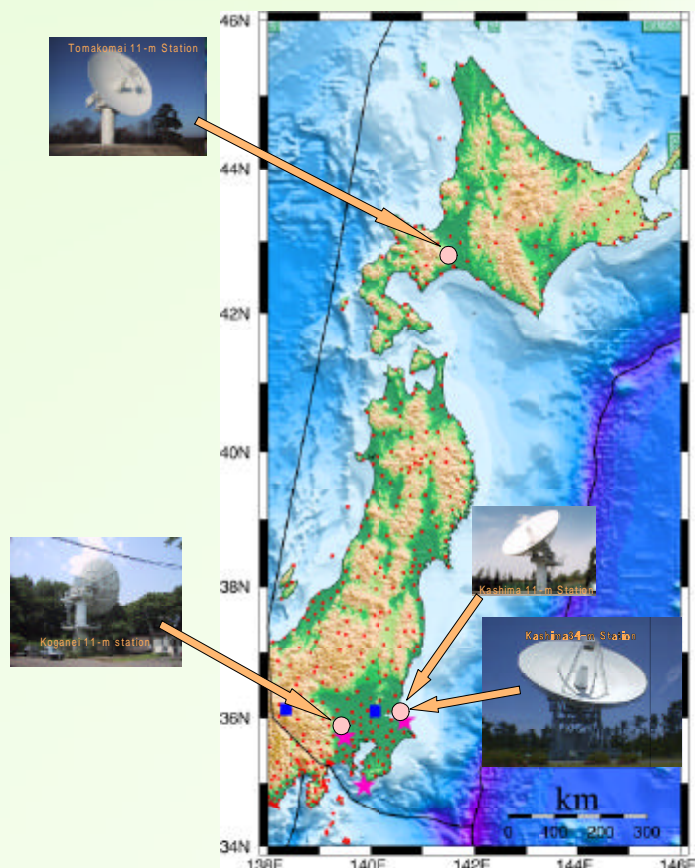
私たちは独立行政法人通信総合研究所から北海道大学に移設された苫小牧11mVLBI観測局と鹿島34m、11mアンテナとの間で2001年11月21日に最初のVLBI観測を成功させ、さらに2002年5月21日にも苫小牧局と鹿島11m、小金井11mアンテナとの間で2回目の実験を行いました。

2回目の実験に鹿島34mではなく小金井局を用いたのはアンテナ駆動速度の速い3台のアンテナで観測することで観測数を稼ぐためです。さらに高感度の観測をするために記録レートを4倍にまで高速にすることでさらに精度の高い測地解を得ることを目指しています。

Table 1 : Kashima-HOKT Geodetic VLBI experiment observation data

Experiment	Date	Participated stations	Recording Mode	Observation number
HOKT-01	2001/11/21	Kashima11-m, Tomakomai11-m, Kashima34-m	1Bit 4MHz Sample 16ch	262
HOKT-02	2002/ 5/21	Kashima11-m, Tomakomai11-m, Koganei11-m	1Bit 16MHz Sample 16ch	485

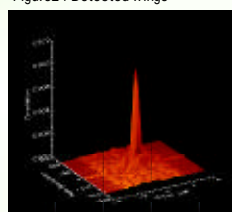
Figure 1 : Location of participated stations



Data Processing

2001年11月21日の観測データは独立行政法人通信総合研究所鹿島宇宙通信研究センターにあるKSP相関器によって相関処理が行われ、3局3基線の全てでフリンジが検出されました。なお第2回目の観測についてはデータ処理を行う時間が取れず観測結果は分かっています。

Figure2 : Detected fringe



相関処理されたデータはバンド幅合成処理が行われたあとデータベース化され、測地解析ソフトウェアsolve/calcによって解析され苫小牧11mVLBI観測局の位置が求められました。

Results

最終的に得られた苫小牧11m VLBI観測局の位置は以下の通りです。

Estimated Tomakomai 11-m VLBI station position

	Estimated Position	Formal Error
X	-3680586317.93 mm	13.310 mm
Y	2917515761.37 mm	11.414 mm
Z	4300987681.65 mm	13.879 mm

Future Plan

今後は月に1回程度、定期的に観測を実施して観測局の位置のモニターをしていく予定です。また新たに岐阜大学に移設された11mアンテナも次回からこの観測に参加する予定になっており観測ネットワークが拡大される予定です。

今後この観測からGPSとのコロケーション、WVRとの同時観測によって湿潤大気の影響による伝搬遅延の補正などの技術開発を行っていく予定です。なお苫小牧11m局に関しては2002年中に現在の2/8GHzから22GHzへの高周波化が予定されています。