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Near real-time monitoring of the Earth's rotation angle with VLBI

Rüdiger Haas (1) and the Fennoscandian-Japanese Ultra-Rapid VLBI Team

(1) Chalmers University of Technology, Onsala Space Observatory, SE-439 92 Onsala (Sweden), (rudiger.haas@chalmers.se), (2) T. Hobiger, M. Sekido, Y. Koyama, T. Kondo, H. Takiguchi: National Institute of Information and Communications Technology, Koganei, (Japan), (3) S. Kurihara, K. Kokado, D. Tanimoto: Geospatial Information Authority of Japan, Tsukuba (Japan), (4) K. Nozawa: AES Co.,Ltd., Tsukuba (Japan), (5) J. Wagner, J. Ritakari, A. Mujunen: Aalto University, Metsähovi Radio Observatory, Metsähovi (Finland)

Geodetic VLBI is unique among the geodetic space techniques since it provides a direct connection between the international terrestrial reference frame and the international celestial reference frame. The Earth rotation angle, usually expressed as UT1, can be determined directly from geodetic VLBI observations. Accurate information about the Earth rotation angle is necessary and important for navigation purposes, in particular for satellite missions and space navigation. A near real-time knowledge of UT1 with high accuracy is therefore highly desirable.

During the last few years the advances in data transfer over high-speed optical fibre lines have made it possible to electronically send the observational data from a VLBI radio telescope on one side of the globe in real-time to a VLBI correlator on the other side of the globe. Thus, data of two telescopes on opposite sides of the Earth, forming a long east-west oriented baseline, can be correlated in near real-time. Furthermore, advances in automated processing of the correlation results have made it possible to derive the Earth rotation angle UT1 in near real-time. Since 2007, the VLBI research groups in Sweden, Finland and Japan collaborate to derive UT1 in near real-time. Several dedicated so-called ultra-rapid UT1-sessions with 1-2 hours duration were performed. It was shown that final UT1-results can be derived within a few minutes after the end of an observing session (Sekido et al., 2008; Matsuzaka et al., 2008). The quality of the UT1-results is on the same level as the so-called IERS rapid solutions, but with a much lower latency (Haas et al., 2010).

Recently, the ultra-rapid approach has been applied to standard 24 hour long VLBI observing sessions that are organized by the International VLBI Service for Geodesy and Astrometry (IVS). The long east-west baseline between Onsala (Sweden) and Tsukuba (Japan) is used to derive UT1 with a sliding window approach already during the ongoing IVS-session. The data processing and analysis is performed with a fully automated analysis software (Hobiger et al., 2010).

We present results from the ultra-rapid UT1-sessions, both, from dedicated one-baseline sessions, as well from 24-hour ultra-rapid sessions during standard IVS-experiments. The near real-time UT1 results are compared to corresponding post-processing results, and results from independent analyses and techniques.

References

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