On a wide-band bandwidth synthesis III

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1. Introduction

An algorithm for wideband bandwidth synthesis (WBWS) exceeding a band width of 10 GHz has been developed. The algorithm has been verified by processing actual wideband VLBI observation data. We have succeeded in a wideband bandwidth synthesis, and then the correctness of the algorithm has been confirmed. The baseline length (about 50km) is too short to investigate an ionospheric effect on a WBWS, therefore the verification of ionospheric correction has been carried out by using VLBI data simulating an ionospheric effect, and its effectiveness has been confirmed.

2. Processing algorithm

The processing algorithm is as follows.

1) Reference scan: define one scan observing a strong source as a reference for an inter-band delay correction and an inner-band phase correction.

2) Inter-band delay correction data: process each frequency band data by a conventional method and get a delay residual of each frequency band. These delay residuals are inter-band delay correction data.

3) Inner-band phase correction data: process each frequency band data by a conventional method and get a cross spectrum of each frequency band. These phase spectra are inner-band phase correction data.

4) WBWS process: combine multiple frequency bands by correcting inter-band delay using "inter-band delay correction data" and by correcting inner-band phase by using "inner-band phase correction data", and get delay residual and a wideband cross spectrum.

5) Ionospheric delay correction: Delta TEC (total electron content) is estimated from a wideband cross spectrum obtained by step 4). Delta TEC obtained this way is used for an ionospheric correction of correlated data of each frequency band, then step 4) is repeated to get a final result.

3. Results

WBWS software is applied to true wide-band VLBI observation data obtained by an experiment conducted on Kashima-Ishioka baseline (about 50km length) in Jan. 16, 2015. We could a good result for a wideband bandwidth synthesis. As for the ionospheric correction, the baseline length is too short to investigate the effectiveness of a correction. We, therefore, evaluated it by using data simulating an ionospheric effect on VLBI data, and we could confirm its effectiveness.

4. Summary

We have been developing an algorithm of wideband bandwidth synthesis and have established a practical algorithm. As for the verification of the ionospheric correction described here, it is not enough. We are therefore planning to verify it by using longer baseline data such as an intercontinental experiment. Lastly, the data used for WBWS are those obtained by a test experiment with GSI's Ishioka station. We would like to express our appreciation to GSI VLBI staff members for their kind support and cooperation for the experiment.

Keywords: VLBI, wideband bandwidth synthesis, ionospheric correction

