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On a wide-band bandwidth synthesis II

KONDO, Tetsuro[1*] ; TAKEFUJI, Kazuhiro[1]

[1]National Institute of Information and Communications Technology

1. Introduction

Bandwidth synthesis of wideband observation data exceeding a band width of 10 GHz has been studied since last year. We are now investigating the correction of phase characteristics in a band, inter-band delay correction, and ionospheric delay correction on a wide-band bandwidth synthesis.

2. Phase correction in a band

Total band width is at most 1 GHz in a conventional band-width synthesis. In the wide-band observation system discussing here, each band has a bandwidth of 1GHz or wider. Therefore phase correction in a band corresponds to the phase correction in the conventional band-width synthesis. In the wide-band system phase calibration signals (PCAL signals) are also injected at a frontend like a conventional system. However PCAL signals may not have good performance at higher frequencies such as 10 GHz or higher, so that we are investigating a realistic method as follows.

1) Obtain phase data from cross spectrum of a strong source and apply them as reference phases like PCAL signals for phase calibration in a band.

2) Time variation is compensated by using a couple of true PCAL signals in a band.

3. Inter-band correction

A wide-band bandwidth synthesis, instrumental delays among different bands should be compensated. In case of an observation on a short baseline like a 100 km distance, the effect of ionospheric delay is very small. Hence an inter-band correction is considered as follows.

1) Observed VLBI delay is determined by each band by using a strong source data. In this case, phase correction in a band is carried out in advance.

2) Inter-band delay obtained this way is applied to a wide-band bandwidth synthesis. Set inter-band phase difference zero in this case.

3) Get inter-band phase difference from a cross spectrum after wide-band bandwidth synthesis.

4) Do wide-band bandwidth synthesis again by using inter-band phase difference obtained by step 3).

4. Ionospheric delay correction

Ionospheric delay is inversely proportional to the square of the frequency, so that it affects phase characteristics in a band at lower frequencies (less than about 4 GHz). It also affects an inter-band delay. We are now investigating whether the method described below can be applied to true data.

1) Get phase correction data and inter-band correction data for a certain scan as reference data.

2) Get phase deviation from the reference data obtained by step 1) for another scan and assume it as an ionospheric correction.

5. Summary

As described above, we are investigating a practical method regarding phase correction in a band, inter-band correction, and ionospheric delay correction. As for a short baseline observation, we have already succeeded in a wide-band bandwidth synthesis. This result and ionospheric correction will be presented.

Keywords: VLBI, wide-band bandwidth synthesis