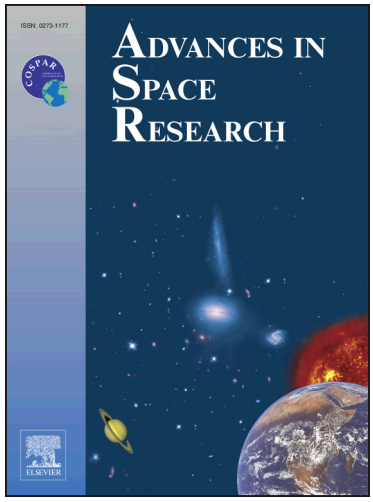

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Performance Analysis of BDS/GPS Precise Point Positioning with Undifferenced Ambiguity Resolution

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Abstract

The undifferenced ambiguity resolution has been proved to be an effective method to shorten the initialization of precise point positioning (PPP) solution and improve the positioning accuracy. Several techniques were proposed for undifferenced ambiguity resolution with GPS observations. However, for BeiDou navigation satellite system (BDS), the satellite-induced variation in pseudorange observation changes the chararistics of Melbourne-Wűbbena (MW) combination observation, which leads to unacceptably low fixing rate of undifferenced ambiguity. Besides, the characteristics of satellite-induced variations in BDS observations vary with orbit type of satellite, which should be considered in correction effort. In this paper, the BDS fractional cycle biases (FCBs) are estimated with least-squares estimation method using the float undifferenced ambiguity collected from the network of reference stations. Based on the analysis of weekly stability of widelane FCBs and the distribution of fractional ambiguity parts, it is proven that the satellite-induced variation correction is necessary for the FCB estimation for IGSO and MEO satellites. Contaminated by relatively large orbit error, the ambiguities of GEO satellites should be skipped for ambiguity resolution attempt. Resolving BDS ambiguities in BDS/GPS combined PPP could significantly shorten the time needed for the first correct ambiguity resolution (FCAR). The experiment results of static PPP demonstrate that 90.6% of all sessions accomplish FCAR within 1350 s with only GPS observations. Meanwhile, by adding BDS ambiguities to the subset of ambiguity resolution, 91.9% of all sessions accomplish FCAR with only 870 s.

***Key words*:** BDS; GPS; Precise Point Positioning; Undifferenced ambiguity resolution; Fractional cycle biases

1. Introduction

Precise Point Positioning (PPP) has become a standalone precise positioning technique that is widely adopted in many applications. The major advantages of this technique include great operational flexibility, high accuracy of positioning results, simple access of the results to international reference frame and no need for users to construct their own reference network. Meanwhile, the drawbacks of traditional PPP is as clear as its advantages and the most prominent one is the long initialization time. Typically, tens of minutes are required to obtain position solution with centimeter-level accuracy (Bisnath and Gao, 2009). In recent researches, undifferenced ambiguity resolution is proposed to shorten the initialization period and improve the positioning accuracy (Bertiger et al., 2010; Collins et al., 2010; Ge et al., 2008; Laurichesse et al., 2009). The ambiguities of undifferenced carrier phase absorb the fractional cycle biases (FCBs) and thus lose their integer property. Fortunately, the FCBs are hardware-related and could keep stable over a certain time period, i.e. one day for widelane FCB and

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