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ORIGINAL ARTICLE

URTK: undifferenced network RTK positioning

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Abstract Standard network RTK has been widely used since it was proposed in the mid-1990s. Rovers can obtain high-precision estimates of position by resolving double-differenced (DD) ambiguities. The focus of this study is a new undifferenced network RTK method, abbreviated as URTK hereafter, based on undifferenced (UD) observation corrections whose single-differenced (SD) ambiguities between satellites can be resolved in several seconds. The tools for studying the real-time realization of the new method are our developments of logical schemes that have the capability for the real-time modeling of a reference network and the instantaneous resolution of SD ionosphere-free (IF) ambiguities at a single station. This research demonstrates the validity of modeling regional UD-unmodeled errors on the ground and examines the maximum differences when compared to modeling the errors using ionospheric pierce points (IPP). With data collected at 48 stations from a CORS network in Shanxi Province (SXCORS) in China through May 21, 2010, the efficiency of the presented real-time strategies is validated using IGS final products in a postprocessing mode. The results verify that more than 83 % of SD wide-lane (WL) ambiguity can be fixed with 5 s of observation data, and the average resolution time of all the WL tests is 4.96 s. More than 80 % of SD L1 ambiguity can be fixed within 5 s, and the average resolution time is only 6.66 s. Rovers could gain rapidly centimeter-level absolute positioning service, comparable to standard network RTK. In addition, the URTK method transforms the fixed DD-ambiguities of the reference network into UD-ambiguities, and it does not need to set the base station and base satellite. Since the UD-corrections are modeled for each common visible satellite, it breaks down the connections between stations and satellites of the DD-corrections in the current network RTK. The UD-corrections can be broadcast by the base station and automatically selected and optimized by a rover during the real-time kinematic processing, thus avoiding ambiguity in reinitialization due to the change of reference, so it should be very flexible and useful for a wide range of applications.

Keywords GNSS · Network real-time kinematic positioning · Undifferenced corrections · Integer ambiguity resolution

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Introduction

Network real-time kinematic positioning (NRTK) and precise point positioning (PPP) have been commonly used by GNSS rovers for real-time precise positioning. PPP needs a rather sparse global network of about 50 stations to provide real-time orbit and clock corrections for global positioning services, but at least 20 min of data are required