Geophysical Research Abstracts
Vol. 16, EGU2014-12497, 2014
EGU General Assembly 2014

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Abstract: At present, it is a trend to introduce multi-frequency technique to global navigation satellite system (GNSS). The new generations of GNSS all transmit three or more carriers, for example, the modernizing GPS introduce the L5 signal, besides the existing L1 and L2 signals, the upcoming European Galileo system is designed to transmit L1, E6, E5B, E5A signals, and the developing Chinese BeiDou navigation satellite system (BDS) is transmitting B1, B2, and B3 signals. The extra frequencies are expected to benefit the precise GNSS data processing, especially for carrier phase ambiguity resolution (AR). By the end of 2012, the Chinese BDS has achieved the second phase, realizing regional service for Asian-Pacific area. More than 16 BDS satellites are transmitting triple-frequency signals, which is much more than GPS and Galileo. How much do the triple-frequency signals contribute to AR? To answer this question, we collected the simultaneous BDS triple-frequency observations for baselines with different lengths. These simultaneous observations were double differenced for each baseline to resolve the baseline components and the double-differenced (DD) ambiguities. We resolved the DD ambiguities in two steps. Firstly, the extra-wide-lane (EWL) and wide-lane (WL) ambiguities were resolved in the geometry-free observation model. Secondly, ambiguities of the original carrier-phase observations were estimated in the geometry-based model along with the baseline components, in which, the fixed EWL and WL ambiguities are used to constraint the original carrier-phase ambiguities. Since the AR performance is strongly dependent on the baseline length, we investigated the AR success rate and time to first fix for each baseline, and evaluated the AR improvement brought by the triple-frequency signals.

Keywords: GNSS, BDS, Triple-frequency ambiguity resolution, AR