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Predicting Atmospheric Biases for Rapid Re-initialization in PPP

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After applying integer ambiguity resolution to Precise Point Positioning (PPP), ambiguities could be fixed to their correct integer numbers successfully, the initialization and re-initialization time could be shortened to some extent with respect to PPP float solution. Ambiguity-fixed PPP solution will be more reliable and accurate than float solution. However, signal interruption such as unavoidably cycle slips and loss lock results in data gaps of phase arc in practical application, especially in operation at urban areas. Such signal interruption disconnects the continuousness of phase arc, and then new ambiguities will be generated. In order to fix the new ambiguities, approximate 15 minutes would be required to complete the re-initialization in PPP fixed solution. It is unfeasible for the PPP user to wait such long time to complete the re-initialization in real-time applications. In this paper, a novel rapid re-initialization method was developed. In this method, the atmospheric biases can be estimated epoch by epoch in a fixed PPP solution with the observations of a continuous phase arc before data gap occurrence. A linear bias model based on sliding window is applied to predict the atmospheric biases accurately for a short time. The predicted atmospheric biases can be used to correct the observations of a new arc after signal interruption. The new ambiguities can be fixed instantaneously with a distinct WL-LX-L3 (LX denotes anyone of L1,L2 and L4)cascade ambiguity resolution strategy. Comprehensive experiments show that the proposed method and strategy can fix the zero-difference integer ambiguities successfully by using only a single-epoch observation. It works well even when all satellites are interrupted at the same time. The data gap span could be possibly extended longer if more precise temporally atmospheric biases prediction is generated or OTF technology is applied. Based on the proposed method, real-time PPP with integer ambiguity fixing could be feasible in practice.