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GNSS ambiguity resolution for precise point positioning in static and kinematic applications

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Precise Point Positioning (PPP) has been demonstrated being a powerful tool widely used for very precise deformation monitoring, as well as for precise positioning of moving platforms. However, their results are still suggested to be improved by integer ambiguity fixing, which is, up to now, prevented by the presence of the uncalibrated phase delays (UPD) originating at receivers and satellites. In the network mode, ambiguity fixing dramatically improves especially results for kinematic applications or static positioning with short observation time. In expecting a similar improvement for PPP, its ambiguity fixing is considered as one of the innovative issues for GNSS research and applications in the next ten years.

In this paper, it is shown that UPDs are rather stable in time and space, and can be estimated with high accuracy and reliability through a statistical analysis of the estimated ambiguities from a reference network. An approach is implemented to estimate the fractional parts of the single-difference (SD) UPDs between satellites in wide- and narrow-lane from a global reference network. By applying the obtained SD-UPDs as corrections to the SD-ambiguities at a single station, the corrected SD-ambiguities have naturally integer feature and can therefore be fixed to integer as usually done for the double-difference ones in the network mode.

With data collected at 450 IGS stations, the efficiency of the presented ambiguity-fixing strategy is demonstrated by an 30% improvement in repeatability and consistency with IGS weekly solutions. Significant improved results for short observing time as well as for kinematic positioning will presented in details too.