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An alternative method for determining GPS receiver phase biases

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Precise Point Positioning (PPP) is used in a broad variety of applications to determine very economically high precision parameters for positioning, navigation and timing. In comparison to traditional differential approaches, PPP with undifferenced phase measurements is highly attractive, since the effort on the user side can be reduced to minimum, e.g. due to an unnecessary reference station. The quality of obtained position solutions is comparable to those obtained from a differential approach.

One of the most important limiting factor is the long integration time to determine (float) ambiguities. Furthermore, it is critical to consider adequately all occurring error sources. In this context, receiver phase biases are one of the limiting factors and very complex to model. At least they are highly correlated with the ambiguities during the estimation process, (Laurichesse et al. 2009).

This contribution presents an alternative method to estimate carrier phase biases of different GPS/GNSS receivers and signals w.r.t. a reference receiver. Receiver phase biases are estimated on a zero baseline and in combination with a very stable and precise clock (H-Maser) using single differences. The presented method will be discussed in detail. This includes a critical look to the estimability of bias values for several GPS/GNSS receivers as well as a discussion on the stability and universality of these bias values. Finally relative phase biases are quantified and it will be discussed how GPS/GNSS observation equations have to be extended, to take these bias values correctly into account.

References:
Laurichesse D., Mercier F., Berthias J.P., Broca P., Cerri L. (2009): Integer ambiguity resolution on undifferenced GPS phase measurements and its application to PPP and satellite precise orbit determination, In: NAVIGATION, Journal of the Institute of Navigation, Volume 56, Number 2, pages: 135 - 149