Analysing GPS L2 Tracking Biases using the Wind-up Effect

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The reception of the circular polarized GPS signal creates a dependency of the phase measurement on the orientation of the transmitting and receiving antenna. A complete rotation of an antenna will cause a difference of one cycle in the measured phase assuming no loss of lock. This effect is called the wind-up, which is of relevance for certain application.

The magnitude of the wind-up effect is theoretically known and can be used e.g. in a controlled experimental setup to investigate the tracking characteristic of receivers. The single differences of the original L1 and L2 observable can be ideally combined to give an absolute reference measure for e.g. the GPS tracking.

The GPS tracking technology developed several different techniques to circumvent anti-spoofing (AS) and obtain the full phase observable wavelength for L2. However, depending on the used tracking method, the implementation and individual settings of advanced tracking loop parameters differences in the GPS observable on L2 are present. Such differences in the observable might have influence on dynamic and kinematic applications, but also on the ionospheric observable and consequently on other correction constituents in GPS modeling.

An experimental setup uses a short baseline with a reference station and one antenna executing rotational acceleration/deceleration and velocities of different magnitude. The signal of the rotated antenna is splitted and tracked by two different receivers in a zero-baseline configuration. The GPS data of the two examined receivers is evaluated independently together with a reference station using an undifferenced GPS processing approach.

The paper will present results from the experimental investigations of the single difference L2-L1 phase for different brands of geodetic receivers. The analysis focuses on errors in dynamic applications and model errors of the ionospheric component in GPS data processing.

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