Abstract

An investigation of the effect of signal obstructions using simulated and real obstruction scenarios has been performed. The preliminary results confirm that the effect of the obstructions is to a large degree site-specific and latitude-dependent. The rate estimates due to the obstruction scenario.

Conclusions:

An investigation of the effect of signal obstructions using simulated and real obstruction scenarios has been performed. The preliminary results confirm that the effect of the obstructions is to a large degree site-specific and latitude-dependent. The rate estimates due to the obstruction scenario.

Effects on Coordinate Time Series

We have processed two PPP solutions from 2008 to 2014. The first solution is based on the real (unobstructed) observations while the second one is based on the same observations but with the applied obstruction scenario P111 (as an example). To investigate the effect of the obstructions, position difference time series between the unobstructed and obstructed solutions were computed. We assume that all common signals and biases will cancel from the difference, highlighting the effect of the obstruction scenario. Figure 4 shows the coordinate difference time series of the up component for 11 selected stations. The figure shows, that the effect varies from station to station. Constant up bias (removed from the difference time series) caused by the obstructions reaches 10 mm for nearly all stations. Rate estimates for the difference time series range from -1.43 m/yr (TIX) to 0.00 m/yr (DGR).

Benefits from Multi-GNSS Solutions

To assess the benefits of the GPS-only solution, we have selected 10 stations in a regional network (Figure 2, blue stations) and processed the whole network by implementing scenario P123 at one station at a time. For this test we used the PNP strategy as described in Figure 3c. A reduction of the daily formal errors for the up component is observed as the number of GLONASS satellites increases from the GPS-only solution to the GPS+GLONASS solution (Figure 7). The lower part of Figure 6 indicates that the reduction of the errors is more pronounced when the station is obstructed. For obstructed stations, the apparent periodic variations and scatter increase. The large formal errors in Figure 7 from the GPS+GLONASS solution on some days are due to the failures in GLONASS ambiguity resolution.

Figure 7 shows the ratio of the formal errors for the GPS-only and GPS+GLONASS solutions. The figure confirms that the reduction of the errors due to the inclusion of GLONASS is more pronounced for obstructed stations. Without the obstruction the daily error reduction for the up component reaches on average 0.3 mm, which is in agreement with Frisè et al. (2014). However, for obstructed stations (scenario P123), the average daily error reduction for the up component reaches 1 mm (Table 1).

Table 1: Daily formal error reduction for up component for station ONSA with and without obstruction scenario P123.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Without Mask</th>
<th>With Mask</th>
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<tbody>
<tr>
<td>GPS-only</td>
<td>0.3 mm/day</td>
<td>0.3 mm/day</td>
</tr>
<tr>
<td>GPS+GLONASS</td>
<td>0.2 mm/day</td>
<td>0.0 mm/day</td>
</tr>
</tbody>
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Figure 6: Daily formal error for the up component for station ONSA with and without obstruction scenario P123.