Over the last decade, Global Navigation Satellite Systems (GNSS) have emerged as a precise and cost-effective tool for studying the composition of the atmosphere. The GNSS-derived information about the tropospheric delay on experienced by GNSS signals, namely the zenith total delay (ZTD), can be converted to integrated water vapour (IWV) at the equator than in mid-to-high latitudes. Aligning the processing strategies, i.e. network double differencing (DD) and precise point positioning (PPP), each have their own strengths and weaknesses. For example, while PPP stations, which are in the atmosphere helps in the improvements of weather forecasts and climate monitoring. It is widely known that the propagation delay observed from single station observations and are mainly affected by the quality of orbit/rock-solid DD solutions, on the other hand, are based on differenced observations between the stations in a network and the dependency on products is much smaller, DD results are somewhat influenced by the distance between stations, especially between remote stations at mid-ocean islands.

In this study, the differences between the ZTD estimates obtained through the PPP and DD strategies have been investigated. Two PPP solutions (namely IGFT and PPUL) and one DD solution (namely DDUL) have been used to conduct the comparison. IGFT is the IGS Final Troposphere product, whereas PPUL and DDUL are the solutions generated at the University of Luxembourg (UL). Table I lists the processing characteristics of the three solutions. The comparisons are based on 76 globally distributed stations from the IGS08 network and a time span of one year, i.e. 2011. The DDUL solution has been used as the reference and ZTD estimates from the two PPP solutions have been compared to those from DDUL.

ZTD Time Series

Figure 1 shows the ZTD time series for four stations (HOFN, KOKK, MCCM, and YEBE) obtained from the three solutions as an example. Figure 2 shows the ZTD time series for four stations for which the time series have been shown for three time periods (i.e., a month, a week and a day) for different latitudes. It can be seen that the ZTD time series from all three solutions follow the same pattern, however, some stations show a bias and some PPP solutions have a jump in ZTD at the day boundaries where the latter is an effect of the daily processing batch.

Conclusions

The ZTD estimates from two PPP solutions namely IGFT and PPUL were compared to those from the DDUL solution using a global network of stations and a time period of one year. Both the PPP solutions showed good agreements with the DD solution and the ZTD time series from all three solutions were observed to follow the same pattern.

When compared to DDUL, the IGFT solution showed a mean bias of -0.86 ± 1.98 mm in ZTD (r = 0.41 ± 0.33 kg/m² IWV) with an RMS of 2.12 mm (r = 0.36 kg/m² IWV) whereas the PPUL solution showed a mean bias of 0.01 ± 0.70 mm (r = 0.00 ± 0.12 kg/m² IWV) with an RMS of 0.89 mm (r = 0.11 kg/m² IWV). The larger differences of the IGFT solution are due to different processing settings. The RMS of the bias between the PPP and DD solutions was observed to have a large dependency and was found to be largest at the equator and smaller in high latitudes. Aligning the processing strategy of PPP to IGFT (7th elevation cut-off angle) improved the RMS agreement for Antarctic stations by 1.44 mm.