Abstract IUGG

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Abstract text

A better understanding of tropical weather processes is necessary to improve numerical weather models, which are not fully satisfactory in tropical regions. Water vapor has a key role in these atmospheric processes and precipitable water vapor (PWV) is a widely employed quantity to study these processes and compute water budgets. PWV can generally be retrieved with an accuracy of about 1 kg.m^{-2} from the zenithal wet delays (ZWD) estimated during GPS data processing. In Sahel, 90% of annual rainfalls are produced by Mesoscale Convective Systems (MCSs) and few meteorological instruments can provide precisely PWV during these extreme meteorological conditions.

In this study, we investigated the contribution of GPS estimates to better understand such extrem events. First, we identified 556 MCS events on 6 GPS tropical stations by analysing in situ meteorological data: temperatures fall, GPS PWV estimates reach a local maximum and GPS phase residuals show strong variations that are spatially and temporally correlated. We observed that under certain conditions, GPS phase residuals clearly reveal the passage of MCSs similarly as reflectivity measurements from MIT C-band Doppler radar. At inter-annual time scales, GPS phase residuals are sensitive to the displacement of the Intertropical Convergence Zone. Finally, we carried out sensitivity tests on GPS data processing strategies (network versus PPP) and on the Gauss-Markov process which constrains the temporal variability of the ZWD estimates. We concluded that GPS PWV estimates are clearly subject to caution during these intense events.