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GPS-sensed diurnal and semidiurnal variability of the water vapour content in the tropics

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We study the mean diurnal and semidiurnal variations of the atmospheric water vapour content in the tropical region using Global Positioning System (GPS) data. In total 12 IGS (International GNSS Service) stations located between 20°S and 20°N in latitude and between 70°E and 170°E are chosen. This region experiences high amounts of atmospheric water vapour due mainly to high evaporation and a long period of monsoon influences every year. Data sets, 2–7 years long from 1998–2004, are processed and resampled to 5 minute resolution for the zenith total delay (ZTD) using the GIPSY/OASIS-II software. The ZTD estimates were then used to infer the Integrated Precipitable Water Vapour (IPWV) averaged to 30 minutes using ground pressure data from the NCEP/NCAR (National Centers for Environmental Prediction/National Center for Atmospheric Research) model. We focus on three month periods during the wet and dry seasons. For comparisons of the phase and the amplitude of diurnal variations we used IPWV data available four times per day from the NCEP/NCAR and the European Centre for Medium-Range Weather Forecasts (ECMWF) model. Additionally, the IPWV estimates acquired from nearby radiosonde launch site were also compared to the GPS results. We find amplitudes up to 2.4 mm in the diurnal component of the IPWV during the wet season and up to 1.4 mm during the dry season. The phase of the diurnal component, at the sites were it is significant, typically peaks in the late afternoon during the wet season, whereas no preferred phase is seen for the dry season. The amplitudes obtained for the semidiurnal component are significantly smaller, typically a few tenths of a millimetre. Further work includes an assessment of the impact from the used model of ocean loading on these results.