GPS Meteorology: Under Estimation of IPWV by Ground Based GPS system in some meso-scale Thunder storms – A case study.

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Abstract: Water vapour is an important atmospheric gas. The concentration of water vapour in the atmosphere is highly variable both spatially and temporally. In normal atmospheric condition nearly 50% of water vapour in the atmosphere is between sea level and 1.5 km above sea level. Less than 5 % is between 5 to 12 km above sea level and less than 1% in the stratosphere. Horizontally, average Precipitable water is less than 5 mm near the poles and greater than 50 mm near the equator. Active weather is strongly correlated to the water vapour distribution in the atmosphere. The conventional method of measurements of water vapour does not normally have a resolution high enough to resolve these variations. Its accurate measurement is very important when making weather forecasts and nowcasting. In recent years techniques have been developed for remote sensing of integrated precipitable water vapour between the ground based Global positioning system (GPS) receivers and the GPS satellites with an accuracies of the order of less than 1.5 mm comparable to radiosondes and water vapour radiometers. In the present work we have studied three similar meso-scale thunderstorm events that occurred over the GPS station during Indian summer monsoon in which GPS underestimate precipitable water in one of the events which is of the order of more than 20 mm (or of the order of 130 mm in ZWD). We have analysed various source of error such as azimuthal symmetry of the atmosphere, error in determining the mean temperature of the atmosphere, the hydrostatic approximation, horizontal gradients etc. We conclude for the fast developing thunder clouds the number of GPS satellites which are spanning the atmosphere and the size of the thunder cells play a major role in determining the accuracy of precipitable water vapour using GPS.

Key words : GPS Precipitable water, Zenith total delay, Zenith wet delay, Slant wet Delay, thunderstorms.

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