

Ten year comparisons between GPS and radiosonde retrieved precipitable water vapors over the Japanese Islands

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We performed almost 10 year comparisons of precipitable water vapor (PWV) retrieved from ground-based GPS stations of GEONET with those estimated from the closest 18 radiosonde stations from the GPS stations. GIPSY-OASIS II software developed by JPL with precise point positioning (PPP) strategy was used because 5 min. satellite clock dataset is available from JPL in the comparison period from 1996.

Although there were some events of instrument changes in GPS and radiosonde, both PWV agreed with 0.6 mm of mean bias (GPS minus radiosonde) and 2.7 mm of standard deviation. There is a small decrease of GPS PWV at the antenna replacement events, and it was corrected by using the PWV difference between GPS and radiosonde by assuming that newer antenna is the reference because the newer GPS antenna (choke-ring antenna) has much smaller phase center variations depending on azimuth angle than the old antenna (micro-center antenna). The correction helped to see good agreement of increase of PWV in the 10 years.

We found scale dry biases of about 3% in radiosonde observation in daytime operation of 09 LST. The origin is considered as dry biases of humidity sensor of the radiosonde due to sunshine radiation, as suggested in previous researches. The results suggest that GPS PWV can be considered as one of the climatological benchmark (reference) for PWV observation, and thus GPS is used for climatological researches such as re-analysis experiments with historical archived dataset, monitoring long-term water vapor variations. Also, a correction of scale biases in humidity profile of radiosonde is important to reduce humidity biases in the analysis field of numerical weather model because the primal moisture data for the model has been provided from radiosonde observation.