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Comparative studies for the assessment of the quality of NRT GPS neutral atmospheric parameters

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Accurate and frequent sampling of atmospheric parameters such as water vapour is important for enabling reliable weather forecasts and global climate studies over a wide range of spatial and temporal scales. Developments in GPS data processing have allowed the estimation of integrated water vapour (IWV) with a high degree of accuracy using continuously operating GPS networks. Comparisons with other independent techniques is performed to evaluate the quality of atmospheric parameter values directly measured or retrieved from the GPS system. We asses the accuracy of GPS atmospheric parameters namely Zenith Total Delay (ZTD) and IWV delivered in Near-Real Time from an European ground-based network of permanent GPS receivers,comparing them with respect to other GPS solutions, radiosonde profiles and HIRLAM NWP model derived ZTD. Inter-comparisons between results from different GPS analysis centers in the framework of TOUGH and E-GVAP show a good agreement. The station bias is between +/-6 mm, that is about 1 kg/m2 IWV, with a related standard deviation of about 7-8 mm. Results obtained considering 13 sites where radiosonde profiles are available nearby show that GPS ZTD is greater than radiosonde ZTD. The overall bias is about 7 mm with a standard deviations of 9 mm. The 7 mm bias detected between GPS and radiosonde will be compensated by applying absolute antenna phasecenter corrections in the GPS data processing. The residuals between HIRLAM versus GPS both ZTD and IWV have a seasonal signal with a standard deviation higher in summer than in winter. The monthly ZTD standard deviation increases from about 5 mm in winter to about 15 mm in summer for the ZTD and from 1 kg/m2 to 3 kg/m2 for the IWV. The study of the ZTD residual distribution between HIRLAM and NRT ZTD estimates coming from different TOUGH/E-GVAP analysis centers show an almost homogeneous behavior among them.