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Study of integrated water vapour trends and variability using ground-based GPS data and climate models

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A high-quality, consistent, global, long-term dataset of zenith tropospheric delay (ZTD) and integrated water vapour (IWV) was produced from Global Positioning System (GPS) measurements at more than 400 sites over the globe among which 120 sites have more than 15 years of data over the period from 1995 to 2010. The GPS ZTD data were screened for outliers and compared systematically with coincident ECMWF reanalysis (ERA-Interim) data. Good consistency is found between the GPS and ERA-Interim ZTD data with small biases and shifts in the GPS data which potentially result from instrument changes. The GPS ZTD data were converted to IWV using surface pressure and weighted mean temperature from ERA-Interim. Integrated water vapour trends and variability (diurnal cycle, seasonal cycle and inter-annual variability) from GPS, ERA-Interim, regional climate model simulations over the Mediterranean Sea (Med-CORDEX, at 50 and 12 km resolution forced with ERA-Interim) and global climate model simulations (CMIP5, with a focus on West Africa and the tropics) are investigated and compared.