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Comparison of total column water vapour estimates from ground-based GPS and sun photometer observations

S. Heise (1), G. Dick (1), G. Gendt (1), J. Wickert (1), U. Leiterer (2), H. Dier (2), B. Vogel (3)

(1) GeoForschungsZentrum Potsdam (GFZ), Telegrafenberg, Potsdam, Germany, (2) German Weather Service (DWD), Richard-Aßmann-Observatorium Lindenberg, Germany, (3) IMK, Karlsruhe Research Centre, Germany, (Stefan.Heise@gfz-potsdam.de, Phone/Fax: ++49 331 288 1757/1732)

Water vapour plays a key role in the Earth's atmosphere system. E.g., it is the basic prerequisite for precipitation, transports large amounts of latent heat energy and represents an important greenhouse gas. Thus, precise knowledge of spatial and temporal water vapour distribution is important in meteorology for both, numerical weather prediction and climatological studies. Considering the high variability of water vapour in comparison to other meteorological quantities (e.g., pressure or temperature), conventional observations (e.g., radiosondes or meteorological satellites) are rather sparse and additional water vapour data from new observation techniques are highly desirable to achieve an adequate coverage. Exploiting the water vapour induced part of atmospheric refraction, ground-based observations of the Global Positioning System (GPS) provide a valuable source of integrated humidity information. Since May 2000, GFZ is processing the data from a dense German GPS network in near real-time to derive total column water vapour. In this study we compare water vapour results from GPS and sun photometer observations (all available data 2000-2005) at the five German sites Lindenberg, Karlsruhe, Hamburg, Helgoland and Leipzig. The latter four stations are part of the AErosol RObotic NETwork (AERONET). Sun photometry exploits water vapour absorption, provided that no clouds or only thin cirrus are between the radiometer and the sun. To prove whether local GPS and photometer data provide significant additional water vapour information we also intercompare with analyses from the European Centre for Medium-Range Weather Forecasts (ECMWF).