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Integrated water vapor from IGS ground-based GPS observations: Initial results from a global 5-minute data set

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Ground based GPS zenith path delay (ZPD) measurements are well established as a powerful tool for integrated water vapor (IWV) observation. The International GNSS Service (IGS) provides ZPD data of currently more than 300 globally distributed GPS stations. To derive IWV from these data, meteorological information (ground pressure and mean temperature above the station) are needed. Only a limited number of IGS stations is equipped with meteorological ground sensors up to now. Thus, meteorological data for IWV conversion are usually derived from nearby ground meteorological observations (ground pressure) and meteorological analyses (mean temperature). In this paper we demonstrate the applicability of ground pressure data from ECMWF meteorological analysis fields in this context. Beside simplified data handling (no single station data and quality control) this approach allows for IWV derivation if nearby meteorological stations are not available. Using ECMWF ground pressure and mean temperature data the new IGS 5-minute ZPD data set has been converted to IWV for the first time. We present initial results from selected stations with ground meteorological sensors including pressure and temperature comparisons between ECMWF and local measurements. The GPS IWV is generally validated by comparison with ECMWF IWV. For selected stations IWV comparisons with sun photometer and GPS radio occultation measurements are presented. The ECMWF derived station meteorological data are validated with local measurements at all accordingly equipped stations. Based on this comparison, the mean error (in terms of standard deviation) introduced by time interpolation of the 6-hourly ECMWF data is estimated below 0.1 mm IWV.