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Analysis of global climate variability from homogenously reprocessed ground-based GNSS measurements

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The tropospheric delay information obtained through long-term homogenous reprocessing of Global Navigation Satellite System (GNSS) observations can be used for climate change and variability analysis on a global scale. A reprocessed global dataset of GNSS-derived zenith total delay (ZTD) and position estimates, based on the network double differencing (DD) strategy and covering 1994-2012, has been recently produced at the University of Luxembourg using the Bernese GNSS Software 5.2 (BSW5.2) and the reprocessed products from the Centre for Orbit Determination in Europe (CODE). The network of ground-based GNSS stations processed to obtain this dataset consists of over 400 globally distributed stations. The GNSS-derived ZTD has been validated by comparing it to that derived from reanalysis data from the European Centre for Medium-Range Weather Forecasts (ECMWF). After validation and quality control, the ZTD dataset obtained using the DD strategy has been used to investigate the inter-annual, seasonal and diurnal climate variability and trends in the tropospheric delay on various regional to global spatial scales. Precise point positioning (PPP) is a processing strategy for GNSS observations which is based on observations from a single station rather than a network of baselines and is therefore computationally more efficient than the DD strategy. However, the two processing strategies, i.e. DD and PPP, have their own strengths and weaknesses and could affect the solutions differently at different geographical locations. In order to explore the use of PPP strategy for climate monitoring, another experimental dataset covering a shorter period has been produced using the PPP strategy and compared to the DD based ZTD dataset.