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Troposphere mapping functions for GPS and VLBI from ECMWF data

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Hydrostatic and wet troposphere mapping functions are used to map down the hydrostatic zenith delays onto certain elevation angles, and they serve as partial derivatives for the estimation of wet zenith delays, respectively. To account for the curvature of the Earth and the atmosphere, they are based on continued fraction forms which comprise three coefficients a, b, c. An exact mapping of the zenith delays is indispensable for the determination of geodetic parameters with highest accuracy. Numerical weather models have been applied to determine troposphere mapping functions that are used in VLBI or GPS analysis for the last couple of years. E.g., the Vienna Mapping Functions VMF, which are time series of the coefficients a of the continued fraction form, rely on the best b and c coefficients available (from IMF and NMF). Based on ERA40 data from the ECMWF (European Centre for Medium-Range Weather Forecasts), the b and c coefficients for the hydrostatic mapping functions have been re-determined. This updated VMF with the improved b and c coefficients yields better baseline length repeatabilities and station height changes as large as 3 mm at the equator and at the poles compared to the former VMF. Additionally, an azimuth-dependent version of the Vienna Mapping Function (VMF-2) has been determined for the continuous VLBI campaign CONT02. It does not only comprise the coefficients a once per station every six hours but also every 30 degrees in azimuth. Whereas the hydrostatic variation in azimuth corresponds to a tilting of the mapping function, the wet variation is much more irregular and cannot be described by a simple model. Consequently, the application of VMF-2 for the VLBI analysis of CONT02 yields a further improvement of the baseline length repeatabilities.