



Long time series of VLBI tropospheric parameters for climate studies

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The Very Long Baseline Interferometry (VLBI) started its observations of extragalactic radio sources at the end of the seventies and has steadily extended its operations until today. Its signals at X- and S-band radio wavelengths are retarded and bended within the Earth's atmosphere. While most of the electrical distortion happens in the ionosphere, different refraction indices of the denser troposphere, the lowest part of the atmosphere, lead to unnegligible delays of the observed signals. This influence has to be considered when solving for the final geodetic parameters in the least-squares fit. Models of the troposphere using in situ air pressure data are introduced in the analysis assuming hydrostatic conditions. They cover about 90% of the total delay mapped into zenith direction by mapping functions dependent on elevation and azimuth. The residual signal delay in zenith direction still holds about 0 to 40cm and arises from non-hydrostatic water vapor variability. Due to its unpredictable fluctuations this quantity is considered unknown but can be determined by the parameter estimation. Thus, unlike other modern space geodetic techniques VLBI with an observational history of 25 years at some stations provides rather stable, consistent and reliable time series of tropospheric parameters. For the determination of these long time series the homogeneity of in situ meteorological data plays a crucial role among the following other important factors: choice of the TRF and its treatment during the parameter estimation, choice of time intervals for the estimation of parameters, choice of mapping function and cutoff elevation angle. To ensure consistency of the in situ meteorological observations outlier detection and standard normal homogeneity tests (SNHT) have been performed revealing several inhomogeneities, which have to be straightened for further analysis. The finally obtained long time series of tropospheric parameters have been compared with those from other IVS Analysis Centers.