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ARMA modeling of GPS time series

G. Kocak (1) and B. Heck (2)

(1) Dokuz Eylul University, Izmir, Turkey (mgkxyz@yahoo.de), (2) Geodetic Institute, Universität Karlsruhe (TH), Karlsruhe, Germany (heck@gik.uni-karlsruhe.de)

The GPS sampling rate depends on the type of application. Seismological applications and monitoring high buildings require 10-50 Hz data acquisition. 1 s sampling rate is sufficient for real time applications where cm accuracy is aimed. 30-120 s sampling interval is chosen for mm-accuracy applications depending on baseline length where the satellite-station network reaches an appropriate configuration. Tectonic studies on the other hand require daily coordinate values for long-term monitoring. In all these applications raw phase and coordinate values are sequenced and sequential elements show correlation due to unmodeled physical effects such as atmospheric impacts. This time correlation affects the stochastic model of observations. In this study we modeled the time series for two selected case studies by ARMA processes and derived the stochastic model by ARMA coefficients. In the first case, we used doubly-differenced (DD) GPS phase observations of 30 s sampling interval on a short baseline. Our second investigation focused on the daily coordinate time series of a continuously operating reference station. We used least squares stationary residuals for obtaining suitable ARMA coefficients and these coefficients, in turn, are employed for obtaining the covariance matrix of observations. The modeled weighted (transformed) residuals have thus white noise characteristics. We modeled GPS daily coordinate values simpler than GPS DD phase residuals because DD residuals show more fluctuations. Our study revealed that ARMA linear models can be used for describing the stochastic model.