Benefiting from the continuously improved IGS products, precise point positioning (PPP) turns out to be a powerful technique with a promising future in the course of GNSS evolution. In order to exploit the full accuracy potential of PPP, numerous studies have been conducted to improve the functional model formulating the mathematical relationship between observations and unknown parameters, while less attention has been paid to the stochastic model describing the statistical properties of GNSS measurements. A sophisticated consideration of the stochastic aspect is a key issue in quality assessment and integrity monitoring.

Analysing representative time series of PPP residuals, this paper employs autoregressive moving average (ARMA) processes to model temporal correlations of GNSS observations which are commonly neglected in the stochastic model. The residual systematic errors (e.g., multipath effects) are reduced by performing Vondrák filtering and sidereal stacking prior to the correlation analysis. Additionally, appropriate statistical tests are applied for evaluating the assumption of (weak) stationarity and assessing the significance of temporal correlations.

The detected correlation lengths ranging between 3 and 15 minutes are considerably affected by satellite geometry and site quality with respect to multipath effects. Increased multipath impact leads to higher parameter values of ARMA orders. The test results validate the appropriateness and effectiveness of ARMA processes in characterising the temporal correlation behaviour of GNSS observations. Finally, the extended variance-covariance matrix accounting for the temporal correlations derived from the identified ARMA models is exemplarily presented and discussed.