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Study on individual stochastic model of GNSS observations for precise kinematic applications

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The proper definition of mathematical positioning model, which is defined by functional and stochastic models, is a prerequisite to obtain the optimal estimation of unknown parameters. Especially important in this definition is realistic modelling of stochastic properties of observations, which are more receiver-dependent and time-varying than deterministic relationships. This is particularly true with respect to precise kinematic applications which are characterized by weakening model strength. In this case, incorrect or simplified definition of stochastic model causes that the performance of ambiguity resolution and accuracy of position estimation can be limited.
In this study we investigate the methods of describing the measurement noise of GNSS observations and its impact to derive precise kinematic positioning model. In particular stochastic modelling of individual components of the variance-covariance matrix of observation noise performed using observations from a very short baseline and laboratory GNSS signal generator, is analyzed. Experimental test results indicate that the utilizing the individual stochastic model of observations including elevation dependency and cross-correlation instead of assumption that raw measurements are independent with the same variance improves the performance of ambiguity resolution as well as rover positioning accuracy. This shows that the proposed stochastic assessment method could be a important part in complex calibration procedure of GNSS equipment.