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Comparison of Variance Component Estimators in Geodetics Science through Noise Analysis

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In this article, we tried to examine and compare the existing Variance Components Estimation Methods in Geodetic science. For this purpose, first, definitions of statistical and functional models were used and then effects of errors on these (co) variance models were assessed. Finally we achieve five (co) variance models for estimation in geodetic problems, namely, Helmert method, Best Invariant Quadratic Unbiased Estimator (BIQUE), Minimum Norm Quadratic Unbiased Estimator (MINQUE), Least Squares (LS) and Restricted Maximum likelihood (REML). These models involve different statistical and functional models; the first three models are similar and the last two models are similar, too. However, in examining statistical models we found that BIQUE and REML models were dependent on distribution function and so we had to consider observation distribution for them. But, to examine more, we required a numerical analysis for estimation of (co)variance. Therefore, noise assessment of GPS time series was selected and results of five (co) variance estimation methods were compared. Results showed that if observations had normal distribution, all the five methods had same results. However, the main difference was after (co)variances estimation. For example, if we had negative variance (which is anomalous with statistics science), only the LS method has solution and enough flexibility for such problems. Also, compared with other models, LS and REML methods provide better precision in some components. It can be concluded that for noise assessment of GPS time series, use of LSVCE and REMLVCE methods are preferred.