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Analytical error analysis for satellite gravity field determination

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The time-wise and space-wise approaches are generally applied to data processing and error analysis for satellite gravimetry missions. But both the approaches, which are based on least-squares method, address the whole effect of measurement errors and estimate the resolution of gravity field models mainly from a numerical point of view. Moreover, quirement for higher accuracy and resolution gravity field models could make the computation more difficult, and serious numerical instabilities arise. A direct analytical expression between power spectral density of the satellite gravimetry measurements and spherical harmonic coefficients of the Earth's gravity model is derived based on two-dimensional Fourier description. This method provides a physical insight into the relation between mission parameters, instrument parameters and gravity field parameters. In contrast, the least-squares method is mainly based on a mathematical viewpoint. By taking advantage of the analytical expression, it is efficient and distinct for parameter estimation and error analysis of missions. It is easy to obtain from the analytical relationship that the low-frequency noise affects the gravity field recovery in all degrees for the instance of satellite gradiometer recovery mission, which agrees with the work before by the numerical error analysis methods.