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Colored noise and frequency-dependent data weighting

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In many practical applications, data to be processed are contaminated by colored (i.e. frequency-dependent) noise. Then, a proper weighting of such data in the frequency domain may significantly improve the quality of data processing results. The following aspects of Frequency-Dependent Data Weighting (FDDW) are addressed: (1) a quantitative description of colored noise (power spectrum and power spectrum density); (2) how to assess data noise as a function of frequency in practice; (3) FDDW versus filtering; (4) how to build a numerically efficient FDDW procedure on the basis of filtering and pre-conditioned conjugate-gradient method; (5) filtering in the time domain (ARMA-filtering) versus filtering in the Fourier domain; (6) is it possible to apply FDDW for non-stationary data noise?

Global gravity field modeling on the basis of satellite data is considered in order to illustrate the problem. It is shown that a proper FDDW not only improves the gravity field models obtained, but also makes them insensitive to particular distortions, e.g. to the influence of non-gravitational forces. Thanks to that, explicit measurements of non-gravitational forces using accelerometers may even be not needed in certain situations.