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Reassessment of the DDK-filter method with actual error covariance information

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The short wavelengths of global time variable gravity field models derived from the Gravity Recovery and Climate Experiment (GRACE) Mission are dominated by correlated noise. Therefore anisotropic filtering is required to separate signal and noise within this data. A widely used method is the decorrelation filter described in Kusche (2007), known as DDK filter, which is based on regularization using the error and signal covariance information. The standard DDK filter uses constant filter matrices derived from the error covariance of one monthly GRACE solution (August 2003). However, the error covariance strongly depends on the orbit geometry, and during the GRACE mission phase of more than 15 years its orbital altitude decreased and various short repeat periods were met. Thus, the decorrelation of GRACE and in future also GRACE-FO solutions can be improved by using actual time varying error covariance information instead of a constant one.
Our conclusions are based on both simulated and real gravity field model time series using the GFZ German Research Centre for Geosciences software EPOS-OC, which is also used to produce the official GFZ GRACE Level-2 products. We compare different setups of the decorrelation filter with other filter techniques and analyze different performance parameters in the spectral and spatial domain as well as mass variations integrated over river basins.

Reference: Kusche J (2007) Approximate decorrelation and non-isotropic smoothing of time-variable GRACE-type gravity field models, JGeod 81 (11), p 733-749, DOI 10.1007/s00190-007-0143-3