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High-resolution GRACE Monthly Gravity Field Solutions Expressed as Geopotential Coefficients

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The commonly used filters (e.g. Gaussian smoothing, decorrelation and DDK filtering) applied to GRACE spherical harmonic gravity field solutions generally lead to reduced resolution, signal damping and leakage. This work is dedicated to improving spatial resolution and reducing signal damping by developing a regularization method with spectral constraints to spherical harmonics. Before constructing the spectral constraints, we create spatial constraints over global grids (covering lands, oceans and the boundaries between lands and oceans) from the a priori information of GRACE spherical harmonic models. Since we are solving geopotential coefficients rather than mascon grids, we further transfer the spatial constraints into the spectral domain according to the law of variance-covariance propagation, leading to spectral constraints regarding geopotential coefficients. In our work, the regularization method with spectral constraints was demonstrated to have comparable ability as mascon modelling method to enhance the spatial resolution and signal power besides reducing signal leakage. Applying the presented method with spatial constraints, we produced the first time series of high-resolution gravity field solutions expressed as geopotential coefficients complete to degree and order 180. Our analyses over the global and regional areas show that our high-resolution solutions are in good agreement with CSR and JPL mascon solutions.