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Expectation Maximisation based Kalman Filter parameter estimation of GRACE data

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GRACE gravity field solutions have proven to be a great device to measure Earth's water storage variations. Nevertheless, if one tries to project the available satellite space-time structure of the time varying fields onto a global time varying field, the well known problem of aliasing appears, as it is manifested in the stripes of the inverse solution. This phenomenon is largely enforced through the use of global spacial modeling functions like spherical harmonics.
One method to approach this problem is to apply the Kalman filter technique. This procedure requires knowledge of stochastic models of observations and process dynamics. However, Earth's gravity field is constantly changing in such a complex manner that it is impossible to accurately determine the correct process dynamic.
The Ornstein-Uhlenbeck process was applied as a viable process dynamic. This process contains free hyper parameters, that need to be estimated by an Expectation- Minimization(EM) algorithm, allowing it to take into account an a-priori space-time correlation pattern to improve Kalman Filter estimations.
The method was applied to unfiltered GRACE gaussian coefficients, using the intrinsic regularization abilities of the Kalman Filter itself. The result was a regularized potential field without additional hydrological information or other assumptions of the gravity field other than Kaula's Law.