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A Simulated Comparison of Level-1b GRACE Analysis Techniques

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GRACE estimates of temporal mass anomalies have been obtained using a number of different approaches including; conventional spherical harmonic using a standard Gaussian smoothing filter and the mascon approach which applies a constraint matrix between mascon parameters that share geophysical similarities.

Temporal gravity fields are frequently produced by different groups and obtained using different codes and algorithms making it hard to directly compare any subsequent mass flux analysis. It is therefore important that an assessment of the different methodologies is undertaken to provide users with an understanding of the errors and to assess the ability of each technique to resolve basin-level mass changes at a variety of spatial scales. In this study we undertake a comparison of solutions generated through the estimation of mascon and spherical harmonic coefficients. Simulations provide an accurate assessment and quantify the capability of each technique to resolve basin-level mass changes at a variety of spatial scales while understanding how the methodologies handle the noise inherent at higher degree and order.

We will present results of our simulations and show how masses leak into their surrounding region through the GRACE KBRR residuals. Through a simulated recovery of a GLDAS anomaly with added noise in the form of ‘stripes’ we will show the advantage of the mascon solution over a spherical harmonic recovery. The study is subsequently extended to simulate the recovery of an Antarctic mass signal validating the use of the mascon methodology in Polar Regions. We will show how the addition of a constraint between mascon parameters that share geophysical similarities result in a reduction of the signal lost at all degrees and an improvement in the recovered signal.