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Extracting high spatial resolution local gravity field from GRACE data

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GRACE spherical harmonic coefficients are typically limited to degree and order 50 or 60. This means that the spatial resolution of geophysical estimates from GRACE gravity field are limited by truncation errors and leakage of signals from, for example, oceans to continents or from one glacier to another. This results in estimates of local mass balance of glaciers or hydrological catchments being inaccurate. In this paper, we use least squares to estimate discrete mass changes of small regions that sum to the integrated signal as seen by GRACE. The goal is to find the highest spatial resolution that can be estimated from GRACE. We find that the spatial resolution is dependent on the latitude of the region, with greater resolution in high latitude regions where the groundtracks are denser. We show results of two regions: estimating mass changes in Australian continent (mid-latitude) to study hydrology of drainage basins, and estimating mass balance in Greenland (high latitude) to study changes of the ice sheet. We find that high negative correlation between neighbouring regions restrict the spatial resolution that can be achieved.