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A better GRACE solution for improving the regional Greenland mass balance

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In most GRACE based researches, a variety of smoothing methods is employed to remove alternating bands of positive and negative stripes stretching in the north-south direction. Many studies have suggested to smooth the GRACE maps, on which mass variations are represented as equivalent water height (EWH). Such maps are capable of exposing the redistribution of earth surface mass over time. In Greenland the shrinking of the ice cap becomes significant in the last decade. Our present study confirms that the dominating melting trends are in the east and southeast coastal zones, however, the smoothed signals along the coastline in these areas do not represent the original but averaged measurements from GRACE satellites which means the signal strength indicating that negative mass variations are mixed with some positive signals that are very close to this area. An exact identification of the topographic edge is not possible and visually the EWH maps appear to be blurred. To improve this, we firstly used spherical harmonic coefficients of GRACE level-2 data from CSR-RL04 and produced a smoothed EWH map. Empirical Orthogonal Functions(EOF)/Principal Component Analysis(PCA) have been introduced as well, in order to extract the melting information associated with the recent warming climate. Next, the Greenland area is redefined by 16 basins and the corresponding melting zones are quantified respectively. Least Squares methods are invoked to interpolate the mass distribution function on each basin. In this way we are able to estimate more accurately regional ice melting rate and we sharpen the EWH map. After comparing our results with a hydrological model the combination SMB – D is established which contains the surface mass balance (SMB) and ice-discharge (D). A general agreement can be reached and it turns out this method is capable to enhance our understanding of the shrinking global cryosphere