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Assessing Greenland ice mass loss by means of point-mass modelling: a viable methodology

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Greenland ice mass loss is one of the most serious phenomena of present-day global climate change. In this context, both the quantification of overall deglaciation rates and its spatial localization are highly significant. We have thoroughly investigated the technique of point-mass modelling in order to derive mass-balance patterns from GRACE (Gravity Recovery And Climate Experiment) gravimetry. The method infers mass variations on the Earth's surface from gravitational signals at satellite altitude. In order to solve for point-mass changes, we applied least-squares adjustment. Due to downward continuation, numerical stabilization of the inversion process gains particular significance. We stabilized the ill-posed problem by Tikhonov regularization. Our simulation and real data experiments show that point-mass modelling provides both rational deglaciation rates and high-resolution spatial mass variation patterns. Apart from least-squares adjustment, we present and discuss results using genetic algorithms (GA) for point-mass modelling. In this framework, we particularly shed light on GA-based regularization parameter estimation in the context of ill-posed problems.