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Vertical motions of passive margins of Greenland: influence of ice sheet, glacial erosion, and sediment transport

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The sub-ice topography of Greenland is characterized by a central depression below the sea level and by elevated (in some places significantly) margins. Whereas the central depression may be explained by significant load of the Greenland ice sheet, the origin of the peripheral relief remains unclear. We analyze the influence of formation of the ice sheet and carving by glacial erosion on the evolution of topography along the margins of Greenland. Our analysis shows that: (1) The heavy ice loading in the central part of Greenland and consecutive peripheral bulging has a negligible effect on amplitude of the uplifted Greenland margins. (2) First order estimates of uplift due to isostatic readjustment caused by glacial erosion and unloading in the fjord systems is up to 1.1 km. (3) The increase of accuracy of topographic data (comparing several data sets of resolution with grid size from 5 km to 50 m) results in increase of the isostatic response in the model. (4) The analysis of mass redistribution during erosion-sedimentation process and data on age of offshore sediments allows us to estimate the timing of erosion along the margins of Greenland. This ongoing analysis, however, requires careful account for the link between sources (localized glacial erosion) and sinks (offshore sedimentary basins around Greenland).