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Cenozoic reshaping of the Barents Shelf: Influence of erosion, sedimentation, and glaciation

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Morphology evolution of the Barents Shelf is a key question in understanding how erosion and glaciation reshape the face of the Earth. The Cenozoic history is a subject of a longstanding debate in the Barents realm, in part, due to decades of petroleum exploration in the region. We address here the whole-region study of the influence of a set of mechanisms and factors on the erosion and sedimentation estimations. Several local studies along the edges of the Barents shelf enlighten the relation between sediments accumulated off-shelf and amount of erosion in the adjacent areas. There are only few studies of the entire Barents region but precision of these studies is limited due to uneven distribution of measurements and uncertainties in paleo-conditions. We compare the masses of sediments accumulated along the edges of the Barents shelf with erosion predicted in Henriksen et al. (2011) and estimate that erosion is significantly overestimated. Local corrections to this erosional model do not bring balance close. The major part of the erosional estimate is based on seismic methods and well logs reflecting sedimentary rock's compaction changes caused by (now partly removed) load from above. This load, however, may be caused not by eroded material alone, but also by ice cap during the glacial cycles. Reduction of erosional estimates by accounting for ice load bring balance between existing erosional model and accumulated sediments close. We also model the glacial erosion using the numerical approach erosion backward in time (Medvedev et al., 2018). The method was modified for this study to account for difference in the lateral length scale of on- and off-shore erosion and flexural isostasy. We compare this erosional model with estimated masses of glacial-induced sediments off-shelf the Barents Sea. The results performed for a range of controlling parameters show that the Barents shelf was mainly submarine at the beginning of glaciation.

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