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A multidecadal model estimate of pan-Arctic coastal erosion rates and associated nutrient fluxes

Stefanie Rynders and Yevgeny Aksenov
National Oceanography Centre, Marine Systems Modelling, Southampton, United Kingdom (s.rynders@noc.ac.uk)

Arctic coastal erosion is an environmental hazard expected to increase under climate change, due to decreasing sea ice protection along with increasing wave heights. In addition to the impact on land, this affects the marine environment, as coastal erosion is a source of organic matter, carbon and nutrients for the coastal waters and shelf seas in the Arctic. Following Barnhart et al., we adapted the White model for iceberg melt to calculate pan-coastal erosion rates. The approach combines ice, ocean and wave model output with permafrost model output and geological characteristics from observations. The calculated erosion rates show large spatial variability, similar to observations, as well as a large seasonal cycle. Additionally, it brings to light the increasing trend between the 1980s and 2010s, with a lengthening of the erosion season, plus inter-annual variability. Using observed nutrient ratios, the erosion rates are converted to biogeochemical sources, which can be used for marine ecosystem models. The approach could be used on-line in earth system models, providing both projections of future erosion rates as well as improved biogeochemistry projections. We acknowledge financial support from Advective Pathways of nutrients and key Ecological substances in the Arctic (APEAR) project (NE/R012865/1, NE/R012865/2, #03V01461), as part of the Changing Arctic Ocean programme, jointly funded by the UKRI Natural Environment Research Council (NERC) and the German Federal Ministry of Education and Research (BMBF), and from the European Union's Horizon 2020 research and innovation programme under project COMFORT (grant agreement no. 820989), for which the work reflects only the authors' view; the European Commission and their executive agency are not responsible for any use that may be made of the information the work contains.