Comment on gmd-2021-28

Anatoly Sinitsyn (Referee)

Referee comment on "ArcticBeach v1.0: A physics-based parameterization of pan-Arctic coastline erosion" by Rebecca Rolph et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-28-RC3, 2021

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Review of the article "ArcticBeach v1.0: A physics-based parametrization of pan-Arctic coastal erosion" by Rolph et al. (2021)

The article presents a model for estimation of coastal dynamics at permafrost, ice-rich coastlines. More specifically, erosion rates at coastal bluff and beach are handled by the model. The model utilizes 1-D coastline erosion model of Kobayashi et al. (1999), bathystrophic storm surge model of Freeman et al. (1957), and empirical equations of Kriebel and Dean (1985) for estimating cross-shore sediment transport. The model is forced by historic hydrometeorological data (wind speed and sea ice concentration), and initialized by existing bathymetry of the case study locations. The model is validated by observed water level data. Sensitivity of the modelled retreat rates is accessed with the Monte Carlo approach. Modelled retreat rates are compared with observed rates for evaluation of the model performance. It was found that the water level plays critical role in defining retreat rates. The results demonstrate that the model is capable to reproduce retreat rates withing the same order of magnitude as the observed retreat rates. This is promising result justifying the model performance, and possibilities of application for crude assessments of coastal dynamics in relevant coastal settings.

The model developed by the authors looks definitely useful for the field of arctic coastal dynamics, and shall be considered as a very good step forward.

I have several, largely suggestive comments, which are presented in the attached file. Intension of these comments is to clarify some points in the text of the article and make it more suitable for engineering community, who is not necessary dealing with permafrost coastlines on a daily basis.

Main point of my comments are the following:

- Despite the title, the model is aiming to handle some, but not all, of the morphologies comprising pan-Arctic coastlines, i.e. ice-rich coastal bluffs/coasts. This limitation could be mentioned in the text otherwise the article might provide to a reader a hope on a generic model applicable to all Arctic coastlines, or a vision that the Arctic coasts are all ice-rich.
- As continuation of the previous comment, it looks natural, if such modelling attempt would aim to model or refer to a well-described coastal process such as thermal abrasion or thermal denudation, and to model a core component of such processes. If fact model do model components of such processes. This would help to compare the model results with direct field observations. One may object that it is just a sense of usage of a certain terminology, as the article is efficiently deals with the processes called thermal abrasion and thermal denudation. Still, due to the aforementioned points, the article looks somewhat detached from the body of literature describing the processes on the Artic coastlines.
- In motivation for the article, the authors refer to the challenges ice-rich coastlines cause to the infrastructure. It is known from the practice, that it is normal to avoid ice-rich coasts when designing new infrastructural projects. Yet, sometimes handling such coastal type cannot be avoided. Hence, in general terms, relevance of models handling ice-rich sediments for the infrastructure developments might be somewhat limited. Yet, applicability of such models can take place in certain cases with relevant coastal conditions.
- As continuation of the previous comment, in my opinion, such model and its further development may consider the needs biogeochemistry on equal footing as the needs of infrastructure.

Sincerely yours,

Anatoly Sinitsyn

Please also note the supplement to this comment:
https://gmd.copernicus.org/preprints/gmd-2021-28/gmd-2021-28-RC3-supplement.pdf