

The Cryosphere Discuss., referee comment RC2
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Comment on tc-2021-273

Anonymous Referee #2

Referee comment on "A probabilistic seabed-ice keel interaction model" by Frédéric Dupont et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-273-RC2>, 2022

The manuscript describes extended version of grounding scheme by Lemieux et al., 2015. Authors provide theoretical description of the method, apply it for short term sea ice-ocean simulations and describe the results.

The paper is very well written, and enjoyable to read. Figures are also of a good quality. I have only several very small comments, and in my view, paper can be accepted after minor revision.

Minor comments:

Line 30. It would be nice to see a paragraph about other attempts to add fast ice in the Arctic Ocean simulations, like Lieser et al., 2004, Itkin et al., 2015 and Olason, 2016.

Lines 38-39: Please comment on computational efficiency as well.

Line 57. You probably mean then --> than.

Line 82. While it became obvious from the rest of the paper why you represent bathymetry as random variable, a simple additional sentence giving the motivation for it would be useful for ocean modelers like me, who often just take bathymetry as something that is well defined.

Line 118. ...here (see Section 3) --> in this section

Line 119. "The following SUBsections".

Line 163. You mean Subsection 3.3.1 here, I guess.

Line 242. Why so many EVP cycles? The standard value for CICE is around 120, if I am not mistaken?

Line 247. Please comment on what is the advantage of this forcing, which seem to be popular in regional ocean modelling, but is quite exotic for global modelling.

It would be good if you mention computational efficiency of the scheme in Section 3.4. Just if it decreases the model speed to a noticeable amount.

Line 325. "... a factor OF two".

Discussion

The resolution in the model setup is around 12.5 km in the Arctic. Please comment on how well, you think, this grounding scheme will be working in higher resolution setups (e.g. ORCA12 and higher).

Please add to the discussion comparison to other studies, that try to simulate fast ice.

References:

Lieser, J. (2004), A numerical model for short-term sea ice forecasting in the Arctic (Ein numerisches Modell zur Meereisvorhersage in der Arktis), Rep. Polar Mar. Res. (Berichte zur Polar Meeresforschung), vol. 485, 93 pp.

Einar Olason, A dynamical model of Kara Sea landfast ice, Journal of Geophysical Research: Oceans, 10.1002/2016JC011638, 121, 5, (3141-3158), (2016).

Itkin, P., Losch, M., and Gerdes, R. (2015), Landfast ice affects the stability of the Arctic

halocline: Evidence from a numerical model, *J. Geophys. Res. Oceans*, 120, 2622– 2635,
doi:10.1002/2014JC010353.