

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-289

Anonymous Referee #1

Referee comment on "Estimating a mean transport velocity in the marginal ice zone using ice–ocean prediction systems" by Graig Sutherland et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-289-RC1>, 2021

This is an interesting paper on the adjustment necessary for the applied use of drift forecasts from short-range forecasting systems. However it is not possible to make a meaningful, statistically significant conclusion on its validity based on an extremely limited sample dataset of 4 drifter buoys, operating for a maximum of 2 weeks during Fall 2018. Given the authors are employed by the forecasting centers producing the model outputs it is possible to do a much more comprehensive analysis with the addition of drifter data from open sources such as International Arctic Buoy Programme (IABP). This will allow further testing to ensure that the results are valid both seasonally, and for varying compactness of the MIZ.

The abstract identifies that knowledge of drift transport in the MIZ is critical for applications including offshore operations and emergency response. It then states that the proposed approach can be used "for operational purposes in the MIZ". There is insufficient evidence presented in this paper to warrant this statement, and there is no attempt to explain or justify this in presenting the results or conclusions. It is also odd that in including this statement, that there is no attempt to verify this applicability through the operational monitoring sections of the Norwegian Meteorological Institute or Environment and Climate Change Canada with their Norwegian or Canadian Ice Services. The abstract attempts to link the approach to operational monitoring, however the term "operational" is used throughout in the limited definition of the research community in meaning only the routine production of data, not the quality assurance and support also included in operational monitoring services.

The recommendation is therefore for major revision, including a more thorough analysis with additional data sources.

As the transport model is dependent on sea ice concentration (SIC), it is heavily reliant on the accuracy of the source of this data and it's spatial resolution. The 80% threshold for assuming ice is or is not in free drift is based on observations, which cover much smaller

areas than the typical 100 square kilometers of passive microwave (PMW) SIC products and 12.5 kilometer resolution of TOPAZ.

P7 Figure 2 and L153: What is shown here is that both CAPS and TOPAZ fail to properly reproduce the MIZ in their SIC values, as a result proposing a drift correction weighted by SIC runs into an issue. This is due to assimilation of PMW SIC into both models that fails to properly represent the MIZ and ice edge, except if it is extremely compact. It would be interesting to see these 2 models compared against the openly available U.S. Naval Research Laboratory GOF3.1 forecasts, where assimilation of SIC in the MIZ is augmented with use of the Multisensor Analyzed Sea Ice Extent – Northern Hemisphere (MASIE) product. Although CAPS gets its sea ice state from RIOPS/GIOPS, and it also assimilates ECCC Canadian Ice Service ice chart data which would provide better information on MIZ ice conditions, those ice charts only cover the Canadian Arctic area and not north of Svalbard, so the SIC data coming from CAPS in this study also originated in PMW SIC products. A more thorough analysis should be performed also including MIZ in the Canadian sector of the Arctic, e.g. Beaufort and Labrador Seas.

P5 L123 “various ice floes”. Given ice type is important for understanding the drag coefficients and differences in drift behaviour, why is the stage of development of these floes and whether there was any deformation (ridging) present not recorded?

P5 L144 “The horizontal resolution is about 12 km in the Arctic.” No, it is exactly 12.5 km on the Polar Stereographic grid projection used.

P6 Figure 1: “Contours of ice concentration”. A contour is a line feature, what is shown is shaded discretized sea ice concentration.

P15 Section 5 Conclusions. The proposed general leeway model needs a more comprehensive evaluation to warrant the conclusions here such as P16 L277 “It is clear from the available data that the inclusion of an ice leeway improves short-term predictions in the MIZ”.

The text includes a few typographical and stylistic errors:

P2 L23, P2 L35, P2 L50, P3 L70: Replace “arctic” with “Arctic”, as capitalization is used when referring to the geographic region.

P2 L27: Repetitive “typically”.

P2 L40, P4 L109: Replace "don't" with "do not".

P2 L45: Replace "it's" with "it has"