Response to first referee comments

We thank the reviewer for their positive and constructive comments on our manuscript. Our answers to the comments are provided below.

I see the authors made revisions of the original manuscript and addressed my comments. The new version of the manuscript shows significant improvement. However, it would be best for the authors to carefully review the figures once again, as some of them could still benefit from enhanced aesthetics to improve readability.

We agree with this comment, and have made further efforts to improve the readability and presentation of the figures. Specifically we have moved the legend to the right side of ceratin figures to decrease cluttered elements. Figure 5., 6., 8. and 9. in the manuscript as well as Figure S3., S4 and S5. in the supplement have been updated to reflect this change.

Response to second referee comments

We would like to thank the reviewer for their positive comments and useful feedback on our manuscript. In our response we answer the comments made and highlight changes made in our manuscript.

A deep learning system is introduced to predict regional sea-ice charts. Starting from the last available ice chart, and forced by atmospheric fields from AROME Arctic, it is predicted how the sea-ice concentration contours move within the next three days. Outperforming baseline models and physical forecasting systems for short-term forecasts, the added value of this system is clearly presented.

All previous reviewer comments were taken into account, and compared to the first version, even a new baseline (free-drift model) has been implemented. However, the description of this new baseline is lacking some important details. For example, what is the numerical integration scheme to advect the particles? Looking into the code, it seems like the implementation is based on advecting the position with a forward Eulerian integration. The concentration is then interpolated with nearest neighbours from the advected positions. Yet, such an integration scheme can lead to diffusion (cf., Fig. 10 in Germann and Zawadzki, 2002). Hence, my suggestion would be to add two or three sentences detailing the implementation and its potential weaknesses, such that the reader can better understand the baseline model, while leaving the results as they are. Beside this, the manuscript is publishable as it is.

We wish to thank the reviewer for this insightful comment on the description of the free-drift baseline, and we agree that further detailing the free-drift implementation improves manuscript readability.

We have modified Section 3.5 in the manuscript with a detailing of which integration scheme we have used and how it is applied, as well as addressing the weaknesses as they are described in Germann and Isztar (2002). Additions to the manuscript are highlighted in blue.

The wind-driven free-drift baseline-forecast is implemented following the description in Zhang et al. (2024). Hence sea ice motion is estimated to be 2% of the surface wind speed 20 degrees to the right (clockwise) of the surface wind direction. New positions are calculated by advecting each grid cell with it's corresponding wind-speed using a first order *forward Euler integration scheme. Since the free-drift forecast individually advects sea ice parcels based on limited area wind-forcing, the free-drift forecast is not guaranteed to be spatially consistent as some grid cells might not be covered by sea ice after advection while they are clearly in the sea ice pack. Thus we perform nearest neighbor interpolation after advecting the sea ice to ensure that the free-drift forecasts are spatially consistent. Additionally, it is described in Germann and Isztar (2002) that simple advection schemes tend to introduce numerical diffusion resulting in a loss of smaller scale features. Finally, in order to be consistent with the deep learning models, input SIC is advected with the same AROME Arctic mean surface wind fields also supplied as predictors to the deep learning model.*

References

Germann, U. and Isztar, Z.: Scale-Dependence of the Predictability of Precipitation from Continental Radar Images. Part I: Description of the Methodology, Monthly Weather Review, 130, 2859–2873, https://doi.org/10.1175/1520-0493(2002)130⟨2859:sdotpo⟩2.0.co;2, 2002.