Response to the reviews of egusphere-2026-362 "Conservation of Heat in the Coupled Arctic Prediction System (CAPS v1.1): Comprehensive model evaluation based on the MOSAiC observations" by Chao-Yuan Yang, Fengguan Gu, Jiping Liu, Annette Rinke, Hu Yang, and Xiaoxu Shi

Responses to comments by Reviewer #2

General comments

I would like to thank the authors for making great improvements to the manuscript over the first submission. The revised manuscript demonstrates a comprehensive response to all the issues raised by the reviewers. The story line, methods, results, and implications are clearly formulated in its current form.

This manuscript presents an updated version of the Coupled Arctic Prediction System (CAPS v1.1), in which the atmosphere–ice–ocean coupling strategy has been modified to ensure a physically consistent treatment of surface heat fluxes across the component interfaces. The authors identify an inconsistency in the original CAPS arising from parallel calculations of related surface turbulent heat fluxes in WRF and ROMS/CICE, and revise the coupling strategy so that the relevant interface fluxes are calculated by a single designated component and then exchanged consistently.

The revised coupling substantially reduces the diagnosed interfacial heat-flux residuals and leads to a markedly different evolution of simulated sea ice relative to the original coupling configuration. In particular, the comparison between Exp_FREE_OLD and Exp_FREE provides a useful and relatively clean assessment of the effect of the revised coupling. The manuscript further evaluates CAPS against a comprehensive suite of MOSAiC observations and appropriately distinguishes the effects of the revised coupling from those associated with spectral nudging. The additional nudging sensitivity experiments are particularly useful in demonstrating that the improved agreement in Exp_NUD should not be interpreted as an improvement resulting solely from the revised coupling or model physics.

Overall, the manuscript provides a useful and well-documented model development, and the coupling modification is relevant for future applications of CAPS on longer timescales. The manuscript is also generally comprehensive in its model evaluation and provides code, processed evaluation datasets, and simulation outputs to support reproducibility.

I recommend publication in Geoscientific Model Development after minor revisions. My comments below are mainly intended to improve the precision of the terminology, interpretation, and presentation.

Minor and technical comments

1. Line 232 Please carefully check subject–verb agreement and singular/plural usage throughout the manuscript. For example, “the model domains of WRF, ROMS, and CICE is” should be “are.”

2. A number of expressions could be improved grammatically, for example:

“may prone to drift” should be “may be prone to drifting”;-- Lin236

“more thicker SIT” should be “thicker SIT”; -- Lin398

“the comparable areal coverage” may need revision depending on the intended meaning; -- Lin383

“can reduced errors” should be “can reduce errors.” --Lin793

3. The manuscript is generally well organized but quite long. Some of the detailed evaluation results could potentially be streamlined or moved to the Supplement, particularly where multiple figures provide similar information. This is not essential for publication, but some condensation could improve readability.

Response: We thank the reviewer for the constructive suggestions. We have carefully proofread the manuscript and corrected grammatical errors, particularly those related to subject–verb agreement, singular/plural usage, verb tense, and the expressions highlighted by the reviewer. Specifically, we have made the following corrections:

- **Original L232: The subject-verb agreement has been corrected. Now it reads “In this study, the model domains of WRF, ROMS, and CICE are the same as the previous pan-Arctic configurations of CAPS…”**
- **Original L362: The sentence has been revised to read “…may be prone to drifting to a state with extensive sea-ice coverage as the model integrates for a longer period.”**
- **Original L398: The sentence now reads “However, all experiments show more areas of thicker sea ice in the Western Arctic Ocean, especially along the coastal areas of Alaska and eastern Siberia.”**
- **Original L383: To clarify the intended comparison, the sentence has been revised to read “the areal coverage of overestimated local SIE along the coasts of Alaska, central Siberia, and eastern Siberia was comparable to that of underestimated local SIE near Fram Strait and the Canadian Archipelago. These opposing biases partially offset each other, resulting in a smaller difference in total SIE between Exp_FREE and the observations (Figs. 3a, 4f).”**
- **Original L793: The grammatical error has been corrected as suggested.**

We have also made minor language revisions throughout the manuscript to improve clarity and readability while preserving its overall structure and scientific content.