

Interactive comment on “Mechanism of Seasonal Arctic Sea Ice Evolution and Arctic Amplification” by K.-Y. Kim et al.

Anonymous Referee #3

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The authors have examined the mechanisms by which declining sea ice in the Arctic is contributing to Arctic amplification of climate change. They focused on the differential changes in the Barents-Kara, Laptev and Chukchi seas and identified a unique pattern of change in the Barents and Kara seas associated with turbulent transport of heat from open water in the winter. The authors make a useful contribution to our understanding of the surface energy budget under conditions of reduced sea ice in the Arctic.

I have a few general recommendations and some specific edits recommended:

General comments

1. The authors often talk about sea ice “melt” when they are referring to the trend toward reduced sea ice concentration. In some cases, “melt” may be the appropriate term, but in most cases it would be better to refer to reduced sea ice concentration

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and/or extent. 2. The authors discuss the increase in 850hPa temperatures over the Barents and Kara seas of less than 0.1K, which they indicate leads to a ~ 1 W/m² in downwelling longwave, which leads to two questions (see p. 8, l. 25-34). a. How can the authors be certain that the change in 850hPa temperature is due to the reduced sea ice concentration? b. I did some back of the envelope calculations, and it appears the magnitude of the downwelling longwave change is too large to be fully explained by the 850hPa temperature increase. Perhaps increased atmospheric moisture is playing a role in the increased downwelling longwave? The authors briefly discuss (p. 9, l. 20-23) and cite the recent Park et al. paper (p. 12, l. 21-23), but perhaps this issue should be further explored/discussed. 3. I appreciated that the authors added a schematic to explain the processes involved in the Barents and Kara seas (Fig. 9). Unfortunately, I was still left somewhat confused by the figure. For example, the “Increase T 0.07K” does not indicate at what level. The arrows leave me wondering if this is all happening concurrently or if there is a time associated with each process. I think this schematic is a good idea but could benefit from some additional thought.

Minor comments

1. p. 1, l. 10: “Arctic” misspelled, article missing 2. p. 1, l. 14: remove “to be” 3. p. 2, l. 4: “Serreze” misspelled 4. p. 2, l. 7: “in the earlier period” please be specific 5. p. 2, l. 29: “remains to be melted” is awkward 6. p. 2, l. 32: “While summer sea ice melting is clearly seen...” Does this mean decreased summer sea ice concentrations? 7. p. 3, l. 2: “winter sea ice melting” Is sea ice really melting during the winter? Please see general comment #1 above. 8. p. 3, l. 12-13: “each term in the feedback” is repeated 9. p. 3, l. 22: add “and” before “2 m temperature” 10. p. 5, l. 4: “extract physically meaningful consistent evolutions from these variables” I was confused by this statement, perhaps because of the use of the word “evolutions” 11. p. 5, l. 9: “volatile” is not the word choice I would have expected 12. p. 6, l. 2: should be “increases” (agr) 13. p. 7, l. 21-22: “It is noted that” and “It is also worthy of remark that” are not necessary 14. p. 8, l. 2: “is maintaining sea ice stay melted” is confusing 15. p. 9, l. 21: “trapping” is not

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a good description of this process 15. Figure 3 (and others): Some of the contours are difficult to follow, particularly on the JJA panel. If you chose not to label some of the contours, you may want to indicate the contour interval in the captions.

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