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The Cryosphere Discussions

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

Anonymous Referee #2

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This study applies a novel technique (Cyclostationary empirical orthogonal function analysis) to ERA-interim reanalysis to examine physical processes behind Arctic sea ice reductions and Arctic amplification. While the study is unique and has the potential to yield insight on causal mechanisms, a number of issues should be addressed before publication.

1. The CSEOF technique requires a more broad-based description, including how the approach differs from standard EOF analysis, interpretation of the results in Table 1, how the spatial and temporal components of Figure 2 were derived, and the impact of mode 1 explaining only 15% of the total variability.

2. Throughout the manuscript, the term 'sea ice melting' is used to describe what are essentially negative winter (DJF) sea ice concentration anomalies in the Kara/Barents

sea with a maximum value of -10% (Figure 3). I'm not convinced this is the correct terminology to use. The negative ice concentration anomalies in this region are impacted in some combination by the timing of sea ice formation and temperature anomalies during the ice growth season (thermodynamics) and potential changes in ice motion and advection during the winter (dynamics). This may be semantics, but to refer to winter season negative ice concentration anomalies as 'ice melting' does not seem appropriate to me.

3. Related to the point above, all of the analysis is based on ERA-interim reanalysis, including sea ice concentration. This raises some questions: -how is ERA-interim sea ice concentration derived? Has it been validated? How does it compare to the more widely used passive microwave sea ice concentration data records? -how sensitive is this analysis to the choice of sea ice information? Do the results differ if sea ice information independent of the ERA-interim atmospheric fields is used?

4. What is the source of the sea surface temperature data?

5. I understand the general idea behind calculating the 'sea ice melting mechanism' (Figure 9) in terms of feedbacks associated with a given sea ice concentration change. A 1% sea ice concentration change, however, is not really physically relevant. This is well within the error of ice concentration datasets, and sea ice doesn't really change in this manner. This feedback totally discounts the role of ice dynamics – ice doesn't simply sit in one place and respond to temperature anomalies with an increase or decrease in ice concentration.

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