

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

Anonymous Referee #1

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As the Authors point out there is still considerable uncertainty as to the actual impact of a range of possible processes which could contribute to the so-called Arctic Amplification of the temperature trends. This paper potentially clarifies a number of these issues. The investigation reveals many interesting aspects of relevant feedbacks and the timescales of these. Valuable also is their insightful analysis of the different regional responses and why, e.g., the relative importance of these processes in the Barents and Kara Seas differs significantly from that in the Beaufort Sea.

The paper could potentially make a valuable contribution in TC. However I have identified places where the explanations need to be more accessible and some additional relevant literature be incorporated into the discussion.

PAGE 2, LINE 5 - ‘Serreeze’ should be ‘Serreze’

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PAGE 3, LINES 24-25 – The use of CSEOF is very interesting in this study, and it would be worth presenting a few more words of justification and explanation. I would suggest explicitly referring here to Kim et al. (2015) as it presents possibly a more approachable explanation of CSEOF and illustrates this with useful examples.

PAGE 4, LINE 7 – ‘physically related’ is perhaps a more accurate expression than ‘physically consistent’

PAGE 5, LINE 15 - Do the authors mean ‘well separated statistically’ rather than ‘well separated statistically’? Also, we need a quantitative backup for this statement. What test was used to establish independence (eg the North test)?

PAGE 6, LINES 18-20 - Another important aspect of this issue (involving another subtle positive feedback) which should also be mentioned here is that due to warming more Arctic precipitation is now falling as rain and less as snow, with strong implications for surface albedo. Refer here to analysis of Screen et al., 2012: Declining summer snowfall in the Arctic: Causes, impacts and feedbacks. *Climate Dyn.*, 38, 2243-2256.

PAGE 9, LINES 7-12 - Also refer here to the recent new insights of Årthun, M., and T. Eldevik, 2016: On anomalous ocean heat transport toward the Arctic and associated climate predictability. *Journal of Climate*, 29, 689-704, doi: 10.1175/jcli-d-15-0448.1.

PAGE 12, LINE 15 – Perhaps the authors have not fully appreciated the interpretation of the results in Vladimir Alexeev’s paper. Central to their study is the presence of AA in an aquaplanet model without sea ice feedbacks. This key result pertaining to the origins of AA should be mentioned much earlier in the paper.

PAGE 12, LINES 19-21 – The authors are making an excellent point here in connection with the role of synoptic systems in the Arctic region and their relationship with trends. Very valuable here to also reference Simmonds et al. 2008: Arctic climate change as manifest in cyclone behavior. *J. Clim.*, 21, 5777-5796.

Need for correction in References ... PAGE 13 – Year of publication of Alexeev et al.

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paper is 2005, not 2015 PAGE 15 – Last reference. Please note correct spelling of author name Sorteberg, A., and Walsh, J. E.

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