

Review of Liang and Zhou the cryosphere

This study focused on melt advance in the Laptev and East Siberian seas between 1979-2018 using the passive microwave melt onset dataset. They defined melt advance as the percentage of the area that had experienced melt onset by the end of May each year. They split up these advances based on four different scenarios: fast LS, fast ESS, slow and fast and analyzed the specific SEB and atmospheric terms associated with each. This was an interesting study and I enjoyed reading it, however I think some things could be improved upon. For one, I think clouds should be included in this study as they significantly affect the shortwave and longwave radiation and might help explain some of the contradicting statements, etc (see below). I like the concept of the melt advance metric that they made up, but I would not consider it a new dataset, as they are just taking the melt onset dataset and looking at the number of pixels that experienced melt by the end of May. It does not appear to increase the predictive skill of the September sea ice extent compared to melt onset or sea ice concentration. It would also be good to include the turbulent flux terms/figures in the main body of the text and go into this a bit more. I think this paper needs a series of revisions in order for it to be accepted for publication.

Line 28: 'over' should be 'cover'.

Line 38: this sentence needs a source.

Line 39: there are many factors which contribute to Arctic amplification, not just the exchange of energy from the ocean to the atmosphere.. please see Taylor et al., 2022 (Taylor, P. C., Boeke, R. C., Boisvert, L. N., Feldl, N., Henry, M., Huang, Y., ... & Tan, I. (2022). Process drivers, inter-model spread, and the path forward: A review of amplified Arctic warming. *Frontiers in Earth Science*, 9, 758361.)

Line 54: I would also include Markus et al., 2009 and Stroeve et al., 2014 in this list of citations.

Line 68: I wouldn't sure the term 'ice block' I would use 'the most persistent sea ice coverage...'

Line 80: Are there a lot of missing MO values in the Markus passive microwave melt onset dataset?

Line 84: Why use the OSI SAF SIC dataset? Why not the NASA team, etc?

Sentence on line 117: I think that the average MO date is also useful and will also be different every year, because it means that an earlier MO for more of the region, then this would be a similar metric to melt advance because a larger area would have melted In possibly May. The average MO is also date dependent.

Line 227: couldn't you see this with the latent heat flux anomalies? This might be useful to include or yo discuss more.

Paragraph beginning on Line 252: Can you say anything about the atmospheric state during the years with the strong NSR ? Are there significantly less clouds during those times which is also driving the increase in shortwave into the surface? I think this needs to be addressed as well. I assume in the years with increased water vapor and humidity that there are more clouds associated with this as well. I know you say the albedo increases due to the increase in sea ice concentration which makes sense, but also

during these slow melt advance years, are there any fresh snowfall events which would increase the albedo?

Line 263: Please cite these studies that have shown this.

Paragraph on line 258: I am confused by how a warm and wet atmospheric environment could also have higher solar radiation. Normally a wet atmospheric is accompanied by more clouds and increased downwelling longwave radiation, so even if the albedo is lowered it might not offset the decrease in incoming shortwave radiation due to increased clouds.

Figure 5: Perhaps adding in the correlation coefficient on each graph would be helpful.

Figure 7: what are the pink and yellow dots? A more descriptive figure caption is needed.