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.

R: Thanks for the constructive comments from this referee. Please see reply as below.

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

R: Corrected.

Line 38: this sentence needs a source.

R: Added.

Text: *the Arctic has a faster warming trend than elsewhere on the planet, especially in the lower troposphere during the cold season (Cohen et al., 2014; Screen and Simmonds, 2010; Serreze et al., 2009).*

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.)

R: Agree. Atmospheric and oceanic heat transport, along with local positive feedbacks, may also contribute to Arctic Amplification.

Text: *This phenomenon, called Arctic Amplification, presumably results from reduced sea ice cover and enhanced oceanic energy release toward the atmosphere, atmospheric and oceanic heat transport from lower latitudes, and local positive feedbacks (Serreze et al., 2009; Cohen et al., 2014; Taylor et al., 2022).*

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

R: Added.

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

R: "the most persistent sea ice coverage" seems better and we adopt this suggestion.

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

R: Not much, but for the sake of statistics covering the whole research area in the Laptev Sea and East Siberian Sea, we adopt the method of alternative MO by SAT (example can be seen in Figure 2, Liang and Su (2021)). We also add this information in the Data and Methods.

Text: *Although the missing values are not quite a lot, the analysis here is more convenient if the whole research area in the Laptev Sea and East Siberian Sea is covered.*

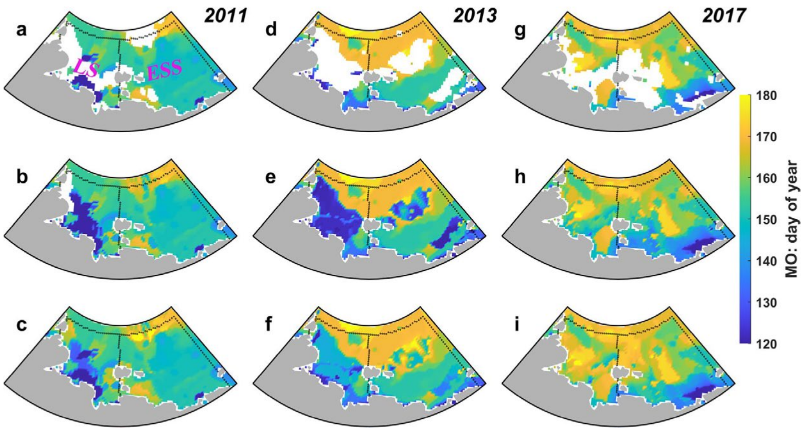

Figure 2, Liang and Su (2021)*: Comparison of the MO around the Laptev Sea (LS) and the East Siberian Sea (ESS), including the (a, d, and g) original results from the passive microwave (PMW) algorithm, (b, e, and h) the results filled with surface air temperature (SAT) based MO, and (c, f, and i) results filled with corrected SAT based MO. The three columns are for 2011, 2013, and 2017, respectively. Black dotted lines denote the boundaries of the LS and the ESS.*

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

R: Atmospheric reanalysis ERA5 to some extent incorporates the OSI SAF SIC dataset (Hersbach et al., 2020), which may keep the consistency between the atmospheric reanalysis and sea ice cover. Based on this comment, we also examine the results from the NASA team, which shows basically the same patterns in May as OSI SAF. We add this information in the text.

Text: *We also examine SIC dataset by the NASA Team algorithm (Cavalieri et al., 1996), which shows basically the same patterns in May as OSI SAF.*

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 possibly in May. The average MO is also date dependent.

R: Agree. The two metrics relate closely to each other. We suggest that we can retrieve the Melt Advance at the end of May, if we can get real-time satellite MO for the region, which may help improve timely seasonal prediction.

Text: *For the seasonal prediction of summer sea ice, this metric of Melt Advance is in essence similar to the average MO date, but may have advantages if we can get real-time satellite MO for the region. Then, at the end of May or other specific date, we can get the MA pattern which supports timely seasonal prediction.*

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

R: A good suggestion. We expect that reduced sea ice cover in the LS will enable more moisture to be released from the exposed ocean water. Actually, turbulent heat loss (latent heat and sensible heat loss) toward atmosphere weakens in the LS (Fig. S4 and S6). This suggests that warmer and moister atmosphere is mainly a result of air mass transport and in turn reduces turbulent heat loss from the surface.

Text: *We may expect that reduced sea ice cover in the LS enables more moisture to be released from the exposed ocean. However, latent heat loss as well as sensible heat loss toward atmosphere in the LS weakens (Fig. S4 and S6), which suggests that warmer and moister atmosphere is mainly a result of air mass transport and in turn reduces turbulent heat loss from the surface.*

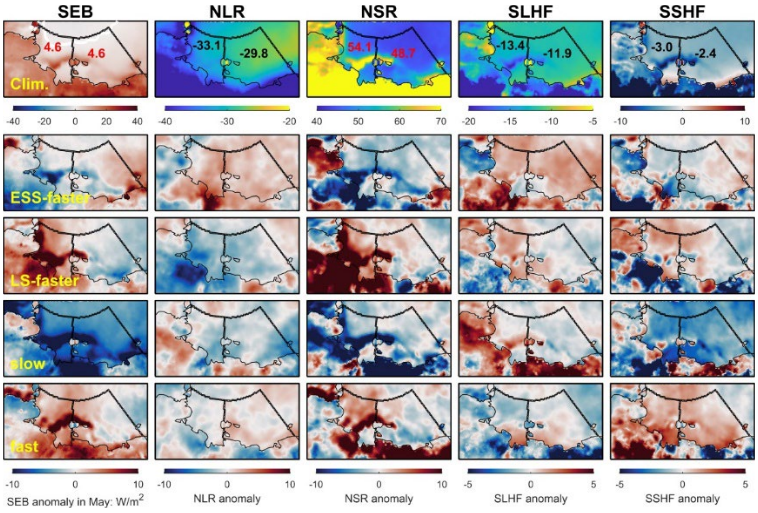

Fig. S4 *Climatological distribution of surface energy balance components in May (first row) and composite anomalies for the four scenarios (lower four rows). The relevant variables include SEB, NLR, NSR, SLHF, and SSHF in May, respectively. Numbers within the LS and ESS are the region-mean values for each sea.*

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?

R: We also look at downward shortwave radiation, which tends to be less when NSR is strong (Fig. S9). This is expected with increased water vapor. In this sense, surface solar radiation absorption is mainly related to the surface type and albedo. We examine clouds, but the results are not quite promising, which may be related to the cloud uncertainty in the data. Based on the ERA5 reanalysis, total cloud cover in this region reaches up to 90% in May and the interannual variability is relatively small. From the perspective of anomaly, water vapor rather than cloud cover has significant radiation effects in May.

We also examine the monthly snowfall under the four scenarios. For this region, snowfall dominates the total precipitation in May. Especially for the slow melt advance scenario, snowfall is abnormally high, which will also result in high surface albedo.

***Text:** While NSR is strong, downward shortwave radiation tends to be less (see Fig. S9), which is expected from more moisture in the atmosphere. However, cloud analysis based on ERA5 reanalysis doesn't suggest significant effects of clouds. Total cloud cover in this region generally is larger than 90% in May and interannual anomaly is relatively small (less than 5%, see Fig. S5). This indicates that from the perspective of anomaly, water vapor rather than cloud cover in spring has considerable radiation effects in the springtime. Given the large uncertainty of clouds in current datasets, this remains an open question.*

***Text:** We also examine the monthly snowfall under the four scenarios. For this region, snowfall dominates the total precipitation in May. Especially for the slow melt advance scenario, snowfall is abnormally high, which will also result in high surface albedo.*

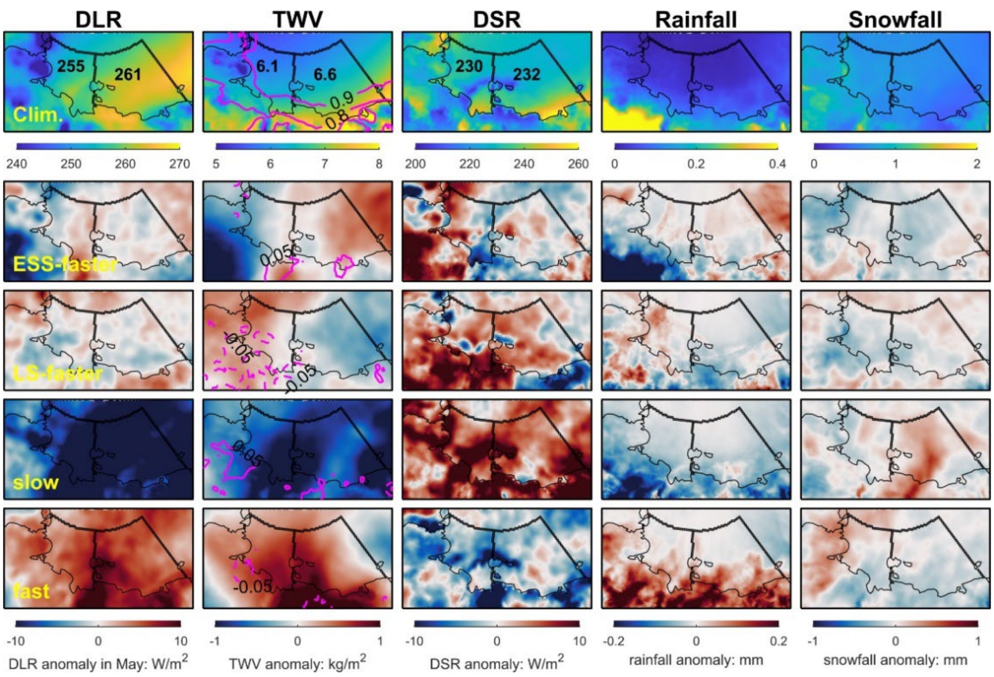

Fig. S5**. The same as Figure 4 except for downward longwave radiation (DLR), total-column water vapor (TWV), downward shortwave radiation (DSR), rainfall and snowfall.* ***Magenta contour lines superimposed upon TWV fields denote the corresponding total cloud cover in May*.*

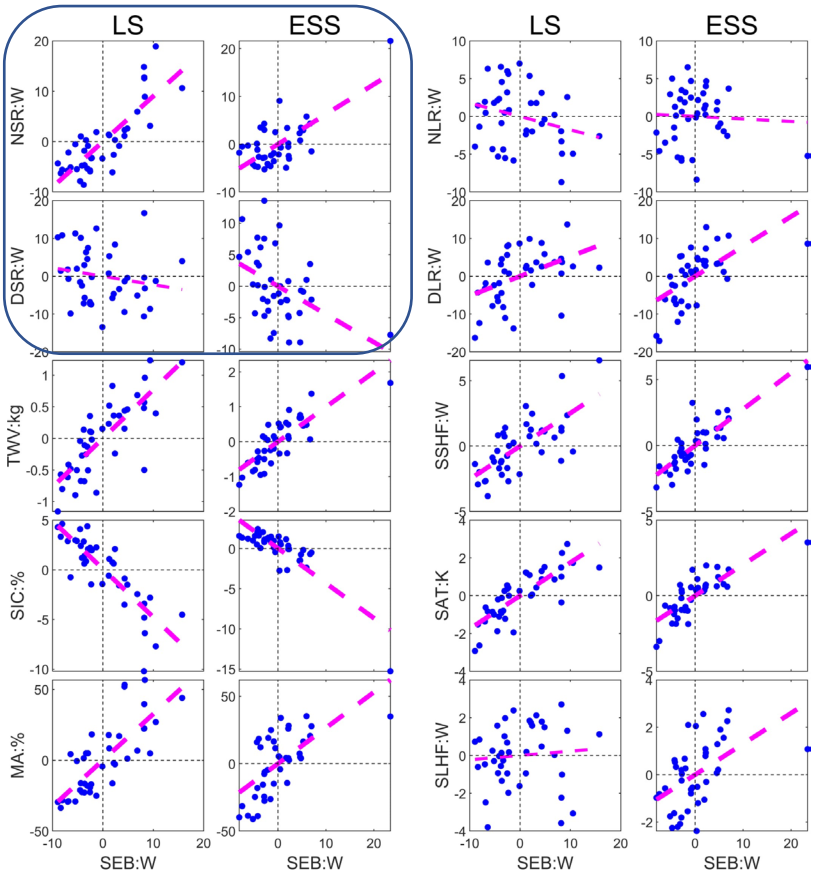

Fig. S9. *Scatter plots of region-mean anomalies of SEB and related factors in May in the LS and ESS, including NSR, DSR, TWV, SIC, MA, NLR, DLR, SSHF, SAT, and SLHF, respectively. Dashed magenta lines denote linear fits which are above the 95% confidence level when the lines are thick.*

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

R: Added.

Text: *Mortin et al. (2016) argued that on a synoptic scale, increased water vapor in the atmosphere favors stronger DLR, which promotes sea-ice surface melting.*

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.

R: Indeed, a warm and wet atmosphere is associated with decreased incoming shortwave radiation. Statistics here suggest that lower surface albedo seems to play a bigger role and results in higher absorbed solar radiation. This part may be a good point worth of further study.

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

R: Added.

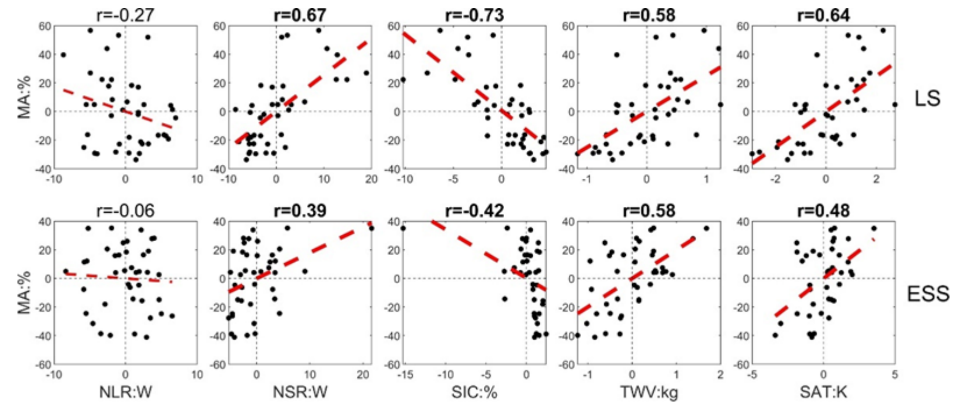

Fig. 5

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

R: They show positive surface energy balance (SEB) and Melt Advance pattern, respectively. We enrich the figure caption now.

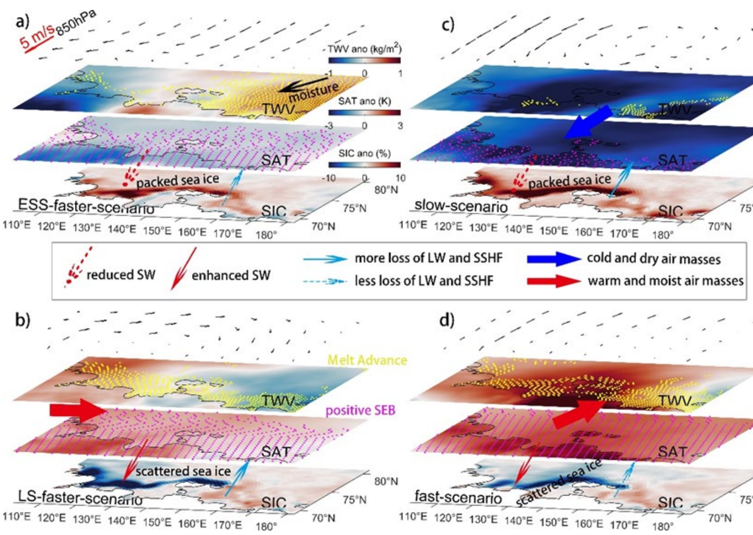

Fig. 7. *Schematic processes under the four scenarios of sea ice Melt Advance in the LS and ESS. a) ESS-faster-scenario; b) LS-faster-scenario; c) slow-scenario; d) fast-scenario. For each scenario, four layers represent composite anomalies of wind fields at 850 hPa, TWV, SAT, and SIC, respectively. Thin arrows denote shortwave radiation (red), and longwave radiation and sensible heat flux (cyan), while solid and dashed types suggest the fluxes enhanced or weakened. Bold blue arrow refers to transport of cold and dry air masses, while bold red arrow refers to warm and moist advection. Yellow dots superimposed upon TWV show Melt Advance by the end of May. Magenta dots upon SAT denote positive surface energy balance (SEB).*

Reference

Cavalieri, D., Parkinson, C., Gloersen, P., and Zwally, H.: Sea ice concentrations from Nimbus-7 SMMR and DMSP SSM/I passive microwave data, National Snow and Ice Data Center, Boulder, Colorado, USA, 10.5067/8GQ8LZQVL0VL, 1996.

Cohen, J., Screen, J. A., Furtado, J. C., Barlow, M., Whittleston, D., Coumou, D., Francis, J., Dethloff, K., Entekhabi, D., Overland, J., and Jones, J.: Recent Arctic amplification and extreme mid-latitude weather, Nature Geoscience, 7, 627-637, 10.1038/ngeo2234, 2014.

Hersbach, H., Bell, B., Berrisford, P., Hirahara, S., Horányi, A., Muñoz-Sabater, J., Nicolas, J., Peubey, C., Radu, R., Schepers, D., Simmons, A., Soci, C., Abdalla, S., Abellan, X., Balsamo, G., Bechtold, P., Biavati, G., Bidlot, J., Bonavita, M., Chiara, G., Dahlgren, P., Dee, D., Diamantakis, M., Dragani, R., Flemming, J., Forbes, R., Fuentes, M., Geer, A., Haimberger, L., Healy, S., Hogan, R. J., Hólm, E., Janisková, M., Keeley, S., Laloyaux, P., Lopez, P., Lupu, C., Radnoti, G., Rosnay, P., Rozum, I., Vamborg, F., Villaume, S., and Thépaut, J. N.: The ERA5 global reanalysis, Quarterly Journal of the Royal Meteorological Society, 146, 1999-2049, 10.1002/qj.3803, 2020.

Liang, H. and Su, J.: Variability in Sea Ice Melt Onset in the Arctic Northeast Passage: Seesaw of the Laptev Sea and the East Siberian Sea, Journal of Geophysical Research: Oceans, 126, e2020JC016985, 10.1029/2020JC016985, 2021.

Mortin, J., Svensson, G., Graversen, R. G., Kapsch, M.-L., Stroeve, J. C., and Boisvert, L. N.: Melt onset over Arctic sea ice controlled by atmospheric moisture transport, Geophysical Research Letters, 43, 6636-6642, 10.1002/2016GL069330, 2016.

Screen, J. A. and Simmonds, I.: The central role of diminishing sea ice in recent Arctic temperature amplification, Nature, 464, 1334-1337, 10.1038/nature09051, 2010.

Serreze, M. C., Barrett, A. P., Stroeve, J. C., Kindig, D. N., and Holland, M. M.: The emergence of surface-based Arctic amplification, The Cryosphere, 3, 11-19, 10.5194/tc-3-11-2009, 2009.

Summary:

The authors introduce a novel measure of the state of spring sea ice melt - Melt Advance (MA). Four scenarios of melt advance in the Laptev (LS) and East Siberian (ESS) seas are identified. For each scenario, a composite map and atmospheric parameters and sea ice concentration are derived. Based on the composite analysis authors conclude that "each scenario is driven by a distinct circulation of the low atmosphere in May". The identification of four scenarios of melt advance in the Laptev (LS) and East Siberian (ESS) seas is a valuable contribution. However, I find that the current results and their interpretation do not robustly support the conclusion drawn in the paper.

R: Thanks for all the insightful comments and suggestions from this referee. Please see reply as follows.

General comments:

The overall standard of result interpretation seems to be less than satisfactory.

1. The authors' interpretation of the influence of atmospheric circulation on Melt Advance (MA) appears speculative. While various atmospheric parameters are examined, the discussion lacks depth regarding atmospheric circulation. Descriptions such as "northeasterlies seem to bring slightly moist air masses" and "westerlies may contribute to positive anomalies in TWS and SAT" are somewhat vague.

R: Accepted. We have tried to improve the result interpretation according to these comments. Please see replies for specific comments.

2. The attribution of the slow Melt Advance in the 1980s to a cyclonic anomaly in the lower troposphere seems to me nonsensical. The association of a significant negative anomaly in surface air temperature with northerly winds appears contradictory to the well-established concept of Arctic warming and amplification. This inconsistency raises questions about the reliability of the study and concerns about the quality of interpreting the results.

R: Accepted. Some question is there regarding the attribution of the slow Melt Advance in the 1980s. It seems more reasonable to say of the decadal coolness in the Arctic in the 1980s. Please see replies for specific comments.

3. Region-specific sea-ice processes are not adequately addressed in the interpretation of the results.

R: Agree. According to the comments, we incorporate the polynya activity in this region and also note the coast-fast ice.

In general, the observed SIC anomalies in the Laptev Sea are related to the polynya activity. The northward sea ice drift results in the opening of polynya at the fast ice edge. Westerly winds would not typically result in reduced sea ice concentration in the region, as stated in the paper. The negative Sea Ice Concentration (SIC) anomaly in the Laptev Sea is resulted from polynya opening in response to northward wind and sea ice drift (e.g., Krumpen et al. 2011). In contrast, one would expect westerlies to close the polynya, leading to an increase in SIC. Please, also see Specific comment 6.

R: Accepted. Please see reply for specific comment 6.

In describing another Melt Advance (MA) scenario, the authors mention that due to wind action, sea ice consolidates against the coast, resulting in a positive sea ice anomaly. Unlike the authors describe, sea ice does not consolidate at the coast in May. The consolidated fast ice cover is formed by April (Selyuzhenok et al. (2014)). The subsequent SIC anomalies are related to the polynya activity in the region. Please, see Specific comment 4.

R: Yes, we should make it clear about fast ice and polynya activities. Please see reply for specific comment 4.

Specific comments:

1. As the paper aims "to demonstrate the springtime processes related to different MO scenarios'' presence of polynya might be considered:

From Fig. 2 and Fig. 4 it seems to me that polynya plays a curtail role in the MA scenarios. Of course, the presence of polynya is accounted for in SIC, but there is also another effect e.g., precondition state of sea ice before MO. Sea ice type and as a result surface albedo in the region depends on the polynya activity. It seems that if polynya is active in May, the MA develops under LS-faster or faster scenario.

R: Agree. We may account for the polynya implicitly by SIC, but polynya presence and activity are vital in this region.

Text: *[For the LS-faster-scenario] Such circulation has offshore wind component in the LS, which probably leads to more polynya opening and reduced SIC (Krumpen et al., 2011).*

2. Lines 23-30 (and elsewhere): As the authors showed, the slow scenario of MA was present only during the 1980s. Fig. 2, 3 show negative SEB, positive SIC anomaly, and negative SAT anomaly everywhere in the region. In my opinion, the slow scenario is purely related to the different states of sea ice and atmosphere in 1980s. The authors should make it clear that the slow scenario is not related to the "interannual flexibility of spring circulation in the low troposphere" (also addressed in General comment 2).

R: Agree. We should add this perspective in the conclusion. The interdecadal variability is not neglectable.

Text: *[For the slow-scenario] Note that all the three sample years are from the 1980s. So, the larger sea ice cover and cooler atmosphere mainly reflect the Arctic state in the 1980s, which is a decadal phenomenon rather than interannual characteristics.*

3. Lines 117-119: Please, explain what is meant by "date-dependent metric". It is not clear why MA potentially has an advantage over regional MO in predicting summer sea ice extent. Please, explain what is the advantage of MA over other September sea ice prediction methods based on MO (e.g. Petty et al. 2017). Fig.6 shows that MA performs slightly better than May SIC predicting in September SIC in the ESS. Is there any explanation for that?

R: The original demonstration of "date-dependent metric" may be confusing. In essence, the metric of Melt Advance is similar to the average MO date, except that by the end of May we can retrieve the Melt Advance if real-time satellite MO data is available. This may help timely seasonal prediction.

In the ESS, it seems that MA performs slightly better than May SIC predicting the September SIC. The main reason may be that May SIC in the ESS has small interannual variability, which is consistent with the lack of polynya activity in the ESS relative to the LS. We incorporate this in the interpretation of Fig. 6.

***Text:** For the seasonal prediction of summer sea ice, this metric of Melt Advance is in essence similar to the average MO date, but may have advantages if we can get real-time satellite MO for the region. Then, at the end of May or other specific date, we can get the MA pattern which supports timely seasonal prediction in a current year.*

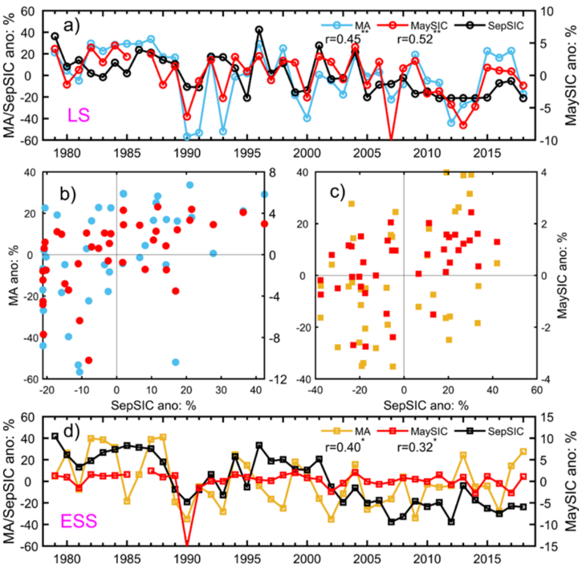

***Fig. 6.** Sea-ice surface Melt Advance, SIC in May and September sea ice cover in the Laptev Sea (subplot a and b) and East Siberian Sea (subplot c and d), 1979-2018. September sea ice cover is denoted by the areal percentage of sea ice cover relative to the whole sea. To facilitate viewing, Melt Advance is timed by -1. Correlation coefficients with double asterisks denote 99% confidence, while those with a single asterisk denote 90% confidence.*

4. Lines 207-210: The description is not accurate: "In the ESS-faster-scenario (see second row in Fig. 3 and blue bars in Fig. 4), prevailing northeasterlies in the lower troposphere push and consolidate the sea ice against the land, especially for the LS, which increases surface albedo and decreases solar radiation absorption." The shelf areas of the Laptev and East Siberian Seas are covered with extensive fast ice (up to 200 km wide). The fast ice cover can be seen as a near-zero SIC anomaly along the coast in Fig.3. In May sea ice does not consolidate against the land. The SIC

anomaly in Fig.3 is related to polynya occurrence.(e.g. Willmes et al. 2011). (also addressed in General comments)

R: Agree. The original description seems to indicate that more fast ice is formed in the ESS-faster-scenario, which probably is not the case. We change the description and also incorporate this useful information about fast ice in the Discussion section.

Text: *prevailing northeasterlies in the lower troposphere tend to increase SIC and reduce polynya area, especially for the LS, which increases surface albedo and decreases solar radiation absorption.*

Text: *[in the Discussion section] Regarding SIC anomaly in the LS and ESS, we should bear in mind that before melting the shelf areas of the LS and ESS are covered with extensive fast ice (up to 200 km wide), which is formed by April (Selyuzhenok et al., 2015). SIC in May can increase due to specific wind fields, but it probably does not consolidate against the land. Instead, the SIC anomaly is closely related to polynya development. As Fig. 3 shows, the largest SIC anomaly under the four scenarios usually occurs around the polynya region (Willmes et al., 2011).*

5. Lines 211-212: The TWV does not seem to be close to climatological. It has positive anomalies in the ESS and negative anomalies in the LS. This aligns with the later drawn conclusion that a moist atmosphere facilitates Melt Advance. Moreover, in lines 218-219 the authors explicitly say that TWV is increased in the ESS.

R: Some paradox in the original text. We agree that it has positive TWV anomalies in the ESS and negative anomalies in the LS, which supports the ESS-faster-scenario. We have removed this sentence in the text.

Deleted text: *"As a whole, the atmospheric state is close to climatology as shown by small SAT and TWV anomalies."*

6. Lines 220-223: It seems to be not logical that westerlies result in the reduced sea ice concentration over the Laptev Sea and increased concentration over the East Siberian Sea. Here again, the negative SIC anomaly in the LS reshapes polynya at the fast ice edge. The SIC in the region, which opens due to northward sea ice drift (e.g. Krumpen et. al. 2011)

R: It slightly looks that the westerlies have offshore wind component in the LS, which opens up polynya and reduces SIC, echoing the study of Krumpen et al. (2011). We add some explanation here.

Text: *Such circulation has offshore wind component in the LS, which probably leads to more polynya opening and reduced SIC (Krumpen et al., 2011).*

7. Lines 225-228: "The westerlies may also contribute to positive anomalies of TWV and SAT in the LS, which promotes faster MA." Do westerlies always bring moisture and warm air to the region? Please provide the background for this statement.

R: Our statement is somewhat speculative. We think that westerlies may bring air masses related to the North Atlantic part, which should be moist and warm.

Text: *The westerlies may also bring warm and wet air masses from the North Atlantic and* *contribute to positive anomalies of TWV and SAT in the LS*

8. Lines 317-319: "Composite analyses reveal that the dominant driver is circulation in the lower troposphere, which regulates sea ice dynamics as well as air mass advection." I do not agree with this conclusion. It seems to me that the authors described the results in the way that all four scenarios of MA are attributed to a mean wind direction. Their interpretation of the results contains logical errors and a disconnection from real processes. Please, see Specific comments 4-6.

R: We agree that this conclusion is oversimplified. We should mention that the slow-scenario mainly reflect the Arctic state in the 1980s when sea ice cover is more and atmosphere is cooler. In addition, polynya activity and initial sea ice condition are also not neglectable.

Text: *[Added statement in the Conclusion] Note that the slow-scenario mainly reflect the cool Arctic state in the 1980s. In addition, polynya activity in this region and initial sea ice condition are also not neglectable. LS-faster-scenario and fast-scenario seem to occur when polynya in the Laptev Sea opens.*

9. I would interpret Fig 3 as follows: ESS-faster scenario is associated with positive TWV anomaly and negative SAT anomaly over the ESS and negative TWV and positive SIC over the LS. LS-faster and fast scenarios seem to occur when polynya is observed in the Laptev Sea. Motrin et al. (2016) showed that moist and warm air trigger melt onset. The observed TWV anomaly repeats their finding (see Fig.2 in Mortin et al. (2016). I would be interested to see how much polynya contributes to MA in the region.

R: We incorporate this insight in the Conclusion. In addition, it seems a good topic to talk about the contribution of polynya on the MA, which merits a further study.

Text: *Composite analyses reveal that in these distinct scenarios of Melt Advance, atmospheric circulation, sea ice dynamics, air mass advection, and surface energy fluxes are related with each other. ESS-faster-scenario is associated with positive TWV anomaly over the ESS and negative TWV anomaly over the LS. LS-faster-scenario and fast-scenario seem to occur when polynya in the Laptev Sea opens. But the slow-scenario mainly reflect the cool Arctic state in the 1980s. In addition, polynya activity in this region and initial sea ice condition are also not neglectable.*

Technical comments:

Lines 67-68: ''heaviest ice block", please re-formulate

R: We use "the most persistent sea ice coverage" instead.

Lines 69-70: Do you mean MA scenarios?

R: Yes, it's corrected.

Lines 91-94: Please define SEB here. Is only data from May used? Please specify this in the Data and Methods section for all variables.

R: Yes, only data from May is used. We also define SEB here.

Text: *Note that the four components of the surface energy balance (SEB) include NLR, NSR, SLHF, and SSHF.*

Lines 104-111: This is general information that can be moved to the introduction.

R: Corrected.

Lines 112: "Interannually, MO is expected to change within one month (Fig. 1b)". The sentence is not clear to me. Please, consider reformulation.

R: Corrected.

Text: *The range for the interannual change of MO in a given place is expected to be around one month (Fig. 1b).*

Lines 116-117: The sentence seems to be not completed. " …as well as the spatial pattern" probably "of the melt advance" should be added.

R: Added.

Line 169: Please, define SEB in the Data and Method section.

R: Added.

Lines 215-216: Please, refer to Figure S4 in terms of SEB. Here authors state that the solar radiation absorption in the LS is higher than in the ESS. How can you support this conclusion?

R: Yes, we refer to Fig. S4 now. Here, we mean that negative anomaly of solar radiation absorption in the LS is greater than in the ESS.

Text: *Due to the greater reduction negative anomaly of solar radiation absorption in the LS, the net surface energy balance is a loss in the LS, but a gain in the ESS (Fig. S4 and S6).*

Lines 261-263: starting with "In addition.." Please, provide references.

R: Added.

Text: *Mortin et al. (2016) argued that on a synoptic scale, increased water vapor in the atmosphere favors stronger DLR, which promotes sea-ice surface melting.*

Lines 283-285: Please, elaborate. There is no information in this sentence. How are the modes of MO in the work in press related to the MA?

R: Corrected.

Text: *Liang and Zhou (2023) identified three modes of Melt Onset in the LS and ESS by EOF decomposition. The positive L-mode and E-mode correspond to LS-faster-scenario and ESS-faster-scenario, while the positive and negative LE-mode relate to fast-scenario and slow-scenario, respectively.*

Lines 286-299: This part presents a new analysis and resulting figure. Please, move it to the Results section.

R: Corrected.

Figures:

Fig.1. Caption “Four categories of sample years are marked”. Are there only 16 years out of 40 years long time-series that fall into one of four categories? Or these are only selected “sample” years?

R: We mean that only 16 years out of the long time-series fall into one of four categories. We reformulate this sentence accordingly.

Text: *Sample years (16 out of the long time-series) that fall into one of four categories are marked (see also Table 1).*

References:

Krumpen, T., et al. (2011), Sea ice production and water mass modification in the eastern Laptev Sea, J. Geophys. Res., 116, C05014, doi:10.1029/2010JC006545.

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