Overall comments

As noted by reviewer Eleri Evans and in the comment by Brad Lipovsky, this study produces a very useful new Antarctic ice-margin dataset and mapping of frontal change which is a valuable addition to the literature. It also provides a useful and interesting look at patterns of change in some of the major ocean and climate parameters around Antarctica over the ERA5 period/last ~two decades, on a large scale and in a manner that is consistent and compelling. As the core results of this study, these are strong contributions (I suggest some minor improvements/clarifications below).

The correlation analysis between the frontal changes and climate/ocean parameters is more challenging because the response of ice shelves and glacier fronts to forcing is so markedly non-linear. Thresholds in the response to forcing are common, as are instabilities in which, by definition, the shelf/glacier behaviour becomes divorced from external forcing. These issues are alluded to in parts of the discussion, but need to be addressed.

The behaviour of ice fronts could be seen as the combined result of:

i) Externally-forced trends like ice-shelf thinning due to increased basal melting (as in the Amundsen Sea Embayment), or the loss of the surface firn cover due to warmer summers (as on Larsen A and B). The forcing of these trends could potentially be diagnosed through correlation, if the right parameters can be measured for long enough (e.g., ocean temperature at depth, or positive summer surface air temperatures). Note though that the response to these forcings is not necessarily linear due to feedback. For example a reduction of albedo as a shelf surface melts acts as a positive feedback, enhancing the sensitivity of melt to shortwave radiation.

ii) Externally-forced shocks superimposed on these trends, like an exceptionally warm summer (as on Larsen B). These would not be readily captured by decadal climate means and would not necessarily have the same effect on all shelves/fronts, so would be difficult to correlate to frontal change.

Threshold behaviour could be very important for i) and ii) – e.g., the difference between a summer surface temperature staying just below freezing or just above is profound, with the latter producing meltwater and rapidly densifying the firn. Rapid retreat or full shelf collapse could be triggered a slightly larger than normal retreat of a shelf front that happens to take it back behind a compressive arch of forces (e.g., Larsen A).

iii) Internal ice dynamics like the calving cycle, with a long, slow advance followed by an abrupt calving event, controlled by the evolving stress field and existing damage to the ice. This is largely unrelated to external forcing. For some shelves with long cycles, these may not be well sampled even by decades-long observations. Calving-cycle events can be large, dominating the statistics of frontal change.

iv) Unstable dynamic response to trends and shocks. Once initiated, thinning, acceleration, damage and retreat of shelves like PIG and Thwaites may run indefinitely, strongly controlled by evolving ice stress and damage, and only somewhat modulated by the sort of environmental parameters studied here. A marine ice sheet instability (MISI) could, for example, be triggered after several decades of ocean-driven shelf thinning and perhaps some shelf retreat, but once initiated could even drive an ice shelf readvance as ice dynamics took over, regardless of the external forcing. Similarly, a marine ice cliff instability

(MICI) could be triggered by an initial external forcing but then progress into a runaway retreat regardless of what happens to that forcing.

I'd expect that these non-linearities, thresholds and instabilities mean that ice front changes are not likely to correlate well with external forcing....and yet...there are some signals there in the correlation results. And it does seem reasonable that a sustained forcing, like decreased sea ice cover, acting over a large area could drive a coherent signal of change at multiple independent ice fronts, particularly where their calving is dominated by frequent production of multiple small bergs rather than rare, large tabular bergs. The forcings are important because they drive the trends and provide the shocks, but they might be difficult to untangle when looking at all of the ice fronts.

General suggestions

Given the above, I suggest that instead of seeking to explain ALL ice-front changes through correlations with external forcing, the discussion section is re-oriented towards addressing the questions:

i) are ANY of these ice-front changes externally forced? (i.e., which ones can be distinguished with confidence from noise, internal dynamics and dynamic instabilities?)
ii) then for these fronts where forcing is detectable, which forcings have mattered most?

To do this, perhaps choose subsets of the coast with numerous relatively small, independent ice fronts that are not experiencing major dynamic thinning, are not dominated by rare, major calving events at one or two shelves, and are not still responding to shelf collapses from several decades ago (like Wordie and various other AP coasts probably were). Look for correlations that are spatially coherent on the same scale as the forcing patterns, i.e., affect multiple neighbouring shelves/fronts simultaneously. Consider extracting statistics on decadally-extreme forcing events rather than just decadal means. Consider focussing on beyond-threshold parameters like summer-air-temperatures-above-freezing (or positive degree days) rather than all temperatures. Consider calculating these temperatures only at very low altitude (e.g., <200 m or as appropriate) to focus on the shelves and ice fronts themselves - the 100 km landward buffer currently used will inevitably bias the shelf/front temperatures low, and this could be important. The bias will be particularly big for small, fringing shelves with relatively steep ice sheet inland.

While this involves some extra analysis, I think that you already have the datasets to focus in on these questions.

Specific suggestions/questions

Section 3.1 on coastline detection – physically what aspects of the HH/HV signal distinguish the 'ocean' and 'land' classes? i.e., why is it desirable to have HV as well as HH? A contrast in volume-scatter from the land ice and sea ice?

What decisions did you make in defining messy fronts like the collapsing Thwaites Glacier/Iceberg tongue?

Line 142: why use winter scenes rather than summer when open water is more likely?

Section 3.1: can you give more detail on the uncertainty assessment? The total uncertainties of ±29 and ±144 sq km given in the abstract seem exceptionally small.

Line 167: how did you define the 30 'stable' areas used for quality control?

Line 172: do these uncertainties have a sign or are they ±? Is there a tendency towards biasing the fronts too far seaward, because sea ice/melange is sometimes present on the seaward side, and sometimes mistaken for 'land ice' (but not the other way around)?

Line 192: what do these '% of total area' mean? i.e., the 'total area' of what? Do you mean 'total coastline length' instead of area?

Figure 2: I'm confused by the pie chart sizes. What does the size of the pie charts indicate when they include both positive and negative area changes as segments of the pie? e.g., for the Ronne pie in the top panel, what was the advance rate from 1997-2018? Is the size the net area change, which can either be positive or negative?
Ross East label is missing.

Line 231: Do you mean "by 1°C" rather than "of 1°C"?

Figure 6: Larsen B is showing up as having a big increase in snowmelt, but in fact it had by then collapsed.

Line 299: what does "the percentage of retreat/advance within each glacier/ice shelf basin" mean?

Line 376: in contrast, Larsen C has not broken up. It did have a big calving event though.