Mulvaney et al. present a timescale for the Skytrain Ice Rise ice core which covers all ice older than 2 ka. The timescale to ~106 ka is continuous and based on methane matches using the continuous methane record supplemented by discreet measurements. They then identify an area of ice flow disturbance. Using discrete measurements of d18O of O2 and methane from the same depths, they confirm a flow disturbance, date a section below the disturbance to ~106-126 ka and suggest a continuous climate record during this interval. Below this, the ice is again disturbed and likely from the penultimate glacial period. Interestingly, both the onset of the Last Interglacial and the Penultimate Glacial Maximum are missing, which the authors suggest is due to flow disturbances caused by contrasts in ice fabric.

The paper is important, well written and should be published with minor revisions. This paper will be foundational for what I image are future high impact papers on the climate and ice sheet interpretation for which a timescale is necessary. The authors have made a wide range of measurements and performed a thorough analysis of the core. The timescale is well developed with a lot of care taken to explain the approach. I have some recommendations for making this even clearer, but I appreciate the effort the authors have taken. I have only two area to suggest significant changes. The first is the timescale from about 75 ka to 109 ka. The second is the uncertainty of the timescale.

I also want to specific note that I appreciate that the authors have made the data publicly available.

First, one initial thought on the introduction. The authors lead the introduction with a
statement about the “intense interest” in the stability of WAIS and the need for paleoclimate records to constrain potential ice sheet changes. Later they write "old ice might be available ... Berkner Island and Fletcher Promonotory, but there is no published age scale for these cores so far". The lead author of this paper was the project leader for both of those ice cores. I hope that this work on Skytrain inspires those cores to be revisited and published.

Discussion of timescale from ~75ka to 109ka, particularly 95ka to 109 ka

The timescale for this period seems more uncertain than the authors imply and could use more description. I realize much of the emphasis of this paper is on the LIG, but I think it is important to discuss where the end of the continuous climate record is reached.

The methane matches are not particularly robust given how different the shapes are, like the wider width of the peak centered on ~82 ka. The subpeak at 80 ka is also distinctly different. The nssMg does seem to help in this period.

The nssMg match is less robust in the period 95 ka to 109ka. At 95 ka, the methane rise at Skytrain looks substantially larger than the EPICA composite. Since there are folds in this area, I think more explanation should be given about why the methane features at ~95 ka and ~106ka are not a repeat of younger events.

I think a new section which discusses this interval would be help. With more description, I might agree that the timescale is continuous to 109 ka.

Uncertainty
The uncertainty is not discussed substantially in the manuscript. The uncertainties are given as part of the paleochrono output in the supplement, but I think these are likely too low. They assume a continuous climate record with well behaved ice-dynamics and confident tie points. I think this is likely only justified to about 75 ka. Given the meter to decameter scale folding, there is almost certainly smaller scale folding as well. Thus, the assumption of continuously increasing age even in sections that are primarily intact is not a given (hopefully the stratigraphy is being looked at for a future paper because it could be fascinating). And the confidence in the tie points seems to drop. The 82 ka methane peak is a good example. The uncertainty is given as <300 years but it looks like there is a 1000 year offset between the midpoints of the rise. I suggest two things:

- the uncertainty be manually adjusted to be greater for the older portions of the core. This can be a qualitative uncertainty. It would serve as a warning to users in a way that text in the manuscript would not because it would travel with the timescale data file
- Add a section and a figure which specifically discusses the uncertainty and how it changes through the core.

Suggestions for the presentation of the LIG timescale:

The figures and discussion of the timescale older than 106 ka can be revised to make it even easier to follow. Many of these figures should be integrated with subpanels because trying to find and compare the figures was challenging. At one point, I had a printed version open to three different pages and two electronic versions open on my screen. Here’s a couple of suggestions:

- Provide a plot of the methane and d18O measurements below 600m by depth. The methane variations are not visible in Figure 3 because it spans the full core. When the methane is already matched and put on the timescale (e.g. Figure 5), the record can be deceiving.
- The methane-d18O cross plots should be combined into fewer figures. I suggest combining Figures 8 and 9 so that is much easier to compare the reference records with the cross plot. The cross-plot should also be extended to start at ~60 ka, such that the two intervals at ~80ka and ~100 ka, which have similar d18O-O2 and ch4 values similar to the LIG, are shown. Figures 10 and 11 should be combined with subpanels and have the same length of time shown – i.e. both run from 100 to 130 ka so that the colors remain the same in the two cross plots.
L503 – Can you rule out ice from the Ellsworth mountains flowing to Skytrain ice rise at a time when Skytrain was lower in elevation (and not an ice rise)? Are the elevations Ellsworths and its glaciers not sufficient to flow onto the bedrock beneath Skytrain? Or are the water isotope values in the Ellsworth mountains too cold? You have demonstrated that there is a stratigraphic disturbance, but I think stating that the “only plausible” explanation is due to contrasting rheology is too strong – particularly since there are no ice fabric measurements presented in the manuscript.