I appreciate the care with which Dr Leysinger Vieli has examined the manuscript. She makes a number of suggesting for improving the clarity of both text and figures which I am glad to respond to as follows.

General comments

Reviewer LV: I would like the author to make it clear in the paper that the reached hypothesis remains to be further tested

Author: *In the revised version of the manuscript I include a statement that the hypothesis remains to be further tested by, for example, ice-flow modelling.*

Specific comments

p.1223, l.3-5: Difficult to locate NW and SE on Figure 1, it is not clear where these geographic directions are. Improve Figure.

A north arrow has been added to the map and details of the map projection and grid markings added to the caption.

p.1224, l.5: It would be helpful to label 'J2925' on Figure 2a too.

The label that was present has been repositioned to make it more obvious.

p.1224, l.14-15: I found the change in flow direction from Figure 2a (out of the page) and 2b (into the page) quite confusing, especially that sometimes the Figure is described from left to right (Figure 2a) and then from right to left as in the main text and caption for Figure 2b starting with Fletcher Promontory first. I believe it would be easier to have them all showing the same ice flow direction and describing the location from left to right. If this is not possible it would help to label the radargram side in Figure 2b with the names of the ice rises, as in Figure 3.

Figure 2a has been reversed so that all profiles have ice flow into the page. Location labels have been added to Figure 2b.

p.1224, l.26-28: The resemblance in shorter-wavelength in section 12 to 17 km in Figure 3 is, to me, stronger with radargram J2925 at 22 to 24 km than with the northern margin of radargram J501.

Agreed, text amended.

To me the northern end (0 to 3 km) of radargram J501 resembles the layers along km 25 to 30 in radargram 145.

Agreed, I think that the similarity in form indicates similarity in function, i.e. both reflector patterns are produced by inflow into the Carlson Inlet trough from the adjacent high ground. Text amended to make this link clearer.

The margin in Figure 3 seems to be more towards 15 km (just where the layers move up again as in Figure 2a) for the deeper layers.

The margin markers on both Figure 3 and Figure 2a are placed according to the surface velocity data and correspond to the dashed yellow lines in Figure 1. The margin is not picked on the basis of an interpretation of the isochrone structure. Text and captions amended to make this clear.

Comparing in Figure 4b the Figure 4a superimposed on the MODIS surface I get the impression that the modern margin has moved towards the Fletcher Promontory compared to the Margin (line D) of the isochrone at 200 m depth. This is not discussed in the paper.

This in part arises from the difficulty in representing a 4-D problem on 2-D graphics. There is also the problem that these data are very 'rich', particularly the 3-D dataset of which line 145 is but one of 35 lines. I feel that the subtleties of regions such as the Talutis/Carlson convergence zone do deserve further examination but that they are not central to the thesis of this particular paper. The key point is that the radargram has the characteristic of a region where fast ice flows past near-stagnant ice and that this has been the case for most of the time period represented by the record I agree that the evolution of this margin in space (i.e.downstream from the convergence point) and in time (i.e. down the radargram) is fascinating but it doesn't add to the main story.

p.1225, l.18: The 3-D view in Figure 4 is fascinating. It would be good to add the sections A to E in Figure 3 too for easy comparison of the evolution of the different zones in the vertical direction.

Agreed, figure amended.

p.1225, l.26-27: In all Figures of Carlson Inlet (Figures 2a, 2b and 3) I can see a distinctive zone just below 400 m depth where the folding of the radar layers seems to be stronger. Is this just the effect of the layers flattening towards the surface (as this is always a horizontal line) or does this show a change in the past? This zone is also extended into Rutford Ice Stream. In the northern end of J501 it is below this zone where the narrower folds in the layers are found.

It is my interpretation that this is an effect of flattening toward the surface. The other reviewer has requested that topographically-corrected profiles should be presented and this will be done in the final version.

Looking at Figure 1 it seems that the catchment area of Carlson Inlet is rather small and the inflow is concentrated along the narrow region to the right of Kealy Ice Rise. Flowing into the main part of Carlson Inlet the ice has more space to take up and this might lead to lateral stretching (flattening) of the existing folds in the layers.

This is an illusion resulting from a 2D representation of a 3D surface. In order to clarify the flows, the catchment boundary has now been included in Figure 1. The area referred to by the reviewer is actually part of the Rutford Ice Stream catchment and the ice off the West side of Kealey Ice Rise flows to the West and into the Rutford margin.

p.1226, l.2-4: I am not sure what the effect of the ice flow from the steep ice rise is on the ice in Carlson Inlet. How fast would the ice come down from the ice rise? Is it faster than the ice in the Carlson Inlet?

Flow speeds in this area are low but higher than along Carlson Inlet because the slopes and hence driving stress are much higher orthogonal to the Fletcher/Carlson and Kealey/Carlson margins than along the axis of Carlson Inlet.

In Figure 3 on the Fletcher Promontory side - what do you mean by convergence flow? Is it the compression from ice flowing off the adjacent ice rise that you mean here? Please clarify.

Yes, by convergent flow I am seeking to get across the idea that flow off the adjacent ice rises causes compression in the main trunk of Carlson Inlet. This is an analogous situation to a steep side-valley glacier entering a larger main trunk with a lower down-flow surface slope.

p.1226, l.6-8: Here I think you should cite Martin, C., G.H. Gudmundsson, H.D. Pritchard, and O. Gagliardini (2009), JGR, 114, F04001, doi:10.1029/2008JF001204. In their paper about effects of anisotropy at ice divides they show that ice divides with concave shoulders, as seen on the satellite imagery (here in Figure 1 and Figure 4b), are divides of long-term stability. They calculate the characteristic timescale for Kealy Ice Rise and Fletcher Promontory as 1.25 and 1.36 kyr, respectively. Their modelling study suggests that concave shoulders are obtain at 4 times the characteristic timescale (5 and 5.44 kyr).

Agree, text amended.

p.1226, l.8-10: '... resultant driving stress induces a component of lateral compression at the margins of Carlson Inlet ...'. Looking at Figure 3 on the Fletcher Promontory side I do see that there seem to be several margins at different depths (at 800, 600 and 500 m), with the deepest at 25 km and others at 29 and 31 km along profile. Dating the top layers of these margins with Figure 5a (depth of the layers taken at 29 km where ice thickness is approximately 1700 m as used in age-depth calculation; depths of approximately 1100, 600 and 440) gives ages of 3600, 1200 and 800 years approximately.

I was wondering if this could be old flow margins between Rutford Ice Stream and Carlson Inlet at a time where Rutford Ice Stream was wider and the margin was nearer to Fletcher Promontory (see the lateral cuts on the right side of Fletcher Promontory). That these regions represent stages of the margin moving from Carlson Inlet towards Rutford Ice Stream and that what we see are bands of previously fast flowing ice next to the margin, which have been transported down Carlson Inlet along the margin of Fletcher Promontory. However, radargram J501 does not show signs of this feature, which means it would only work if for some time period in the past faster flow existed, allowing it to be advected past J501 by today. The chaotic pattern at the top of the right side of radargram 145 would be from the ice of the Fletcher Promontory flowing into the Carlson Inlet.

An indication of change in flow margin is seen in Figure 2a where below 400 m right of the 'Margin' (vertical dashed line) we see a fold pointing upward where the bed is sloping down. Maybe this was the old margin.

An alternative explanation could be that these margins show the ice from Fletcher Promontory flowing into the Carlson Inlet, where new ice pushes the old margins inwards, which are then subsequently covered by accumulation. However, it is not clear to me how for such a case the radar layer pattern is influenced.

The question remains how the feature in radargram J501 (northern end) is explained - what pulls the layers down? Is it faster flow? Is it possible that a narrow band of faster ice moved down along Kealey Ice Rise at the same time as the margin of Rutford Ice Stream changed?

These questions are fascinating but I don't think that we yet have the data available to write a complete description of the evolution of this region in these terms. For example the lateral cuts on the lower slopes of Fletcher Promontory may well provide some indication of successive high stands of Rutford Ice Stream ice, or they may be a manifestation of geological control by faulting on the margins of the Rutford graben. Some airborne radar lines exist over these features but no deep ground radar. The airborne data provide reasonable imaging of the bed but do not provide sufficient detail of the isochronal layering. However, I contend that the Carlson Inlet marginal zones are secondary to my core thesis which is that the central section of Carlson Inlet has been slow-flowing for between 3500 and 6800 years and that therefore Carlson Inlet has not been an ice stream during that period.

p.1230, l.7-10: The 3-D grids indeed are valuable methods to learn more about the past flow. Another valuable method is using numerical modelling of internal layers, where hypotheses such as made in this paper could be tested. I believe it would be good to mention somewhere in the text that the hypotheses made remain to be tested.

Agreed, text amended.

Technical Corrections

p.1223, l.9: Missing bracket here - I believe after 'Sounder'. *Agreed, amended.*

p.1233, Figure 1: State units of tick marks. *Agreed, amended.*

p.1237, Figure 4: Replace 'Fletcher Ice Rise' with ' Fletcher Promontory'. Tick labels on Figure 4b are not visible enough - larger Figure? *Agreed, amended.*