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Interactive comment on "Diagnosing ice sheet grounding line stability from landform morphology" *by* Lauren M. Simkins et al.

Anonymous Referee #2

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General Comment

This is a well written, well illustrated and very interesting paper that investigates the morphology of grounding-line landforms in the western Ross Sea, Antarctica, and discusses their implications for grounding line retreat and controls thereon. The paper is very suitable for The Cryosphere and will be of particular interest to glacial geomorphologists and paleo-glaciologists but should also be of interest to glaciologists working on grounding-line dynamics and controls. Overall the paper is strong but there are a few points that the authors should address prior to publication (see below).

Specific Comments

1. There needs to be a greater discussion of these grounding line landforms as found in

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other glacimarine environments, particularly associated with tidewater glaciers in temperate glacimarine environments such as SE Alaska. This is important as the present paper argues that the specific type of grounding line landform (moraine or grounding zone wedge (GZW)) is independent of the type of glacier front (ice shelf vs grounded tidewater margin). Moraines similar to those described in the present paper have been documented in temperate glacimarine environments but have GZWs? If not then it might suggest that GZWs are preferentially associated with ice shelves?

2. P. 4 lines 26-29. You mention that GZWs are occasionally overprinted by glacial lineations but the latter are never associated with the moraines. Can you clarify exactly what you mean by "associated with"? Do you mean incised over the tops of the moraines or terminating against the proximal face of the ridge or. . .? It is interesting to consider the morphology of the moraine ridges if they were to be overridden. Presumably they would be smeared out and overprinted by lineations (to some degree at least). Would you be able to differentiate these overridden moraines from GZWs?

3. P. 4 lines 29-30. You infer the presence of crevasse squeeze ridges but say relatively little about them. Such features are commonly associated with surging glaciers in both terrestrial and marine settings and indeed are often regarded as a particularly diagnostic element of the surging glacier landsystem (e.g., Evans and Rea, 1999 Annals of Glaciology; Ottesen and Dowsdeswell, 2006, JGR). Are such features usually found in association with paleo-ice streams elsewhere and could their presence indicate some form of change to flow dynamics?

4. On p. 7 lines 30-32 you go on to say that the crevasse squeeze ridges are evidence for the "squeeze of subglacial sediment upward into the vacant space at the ice base. . .". I think the latter could be reworded a little clearer – e.g., ". . .into basal crevasses. . .".

5. The sentence on p. 6 "We question therefore whether water depth has an influence on landform-building processes" is rather sweeping. Surely it will do where the ice

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sheet retreats rapidly on a reverse bed slope and so precluding the formation of such landforms in the first place?

6. I think section 5 'Implications for grounding line stability' could be reduced in length without detriment to the paper. For example I think the introductory paragraph on p. 12 could either be cut or shortened.

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