

Interactive comment on “Ice island thinning: Rates and model calibration with in situ observations from Baffin Bay, Nunavut” by Anna J. Crawford et al.

Anonymous Referee #2

Received and published: 30 October 2019

This paper presents measured ablation rates of a tabular iceberg which calved from the Peterman Glacier, North Greenland, which are then used to calibrate a model for melt rates. The in-situ data set, which comprises repeated ice-penetrating radar surveys, surface mass balance measurements, as well as oceanographic data nearby is very unique, and a valuable contribution to the cryosphere community. Previously, studies on iceberg ablation rates were mostly based on modelling alone, or estimation of ablation rates from satellite altimetry, which is not straight forward because of the unknown surface processes and densification rates of a possible firn layer, which is especially important for the Antarctic icebergs. Thus, I would see it as an excellent contribution to The Cryosphere. I would like to rise a few points which might need

C1

addressing before publication:

1. At some point (section 3.2.2) it is stated that for the calibration of the model it is assumed that Δu is set equal to the ocean current velocity. As the iceberg is grounded during much of the time this might be a valid assumption. Nevertheless, as the iceberg can be easily tracked by remote sensing data, it would have been possible to look at real drift velocities, and how they compare to the ocean currents. Some studies have suggested (e.g. Lichey & Hellmer, 2001, Journal of Glaciology) that not only the ocean current is responsible for iceberg drift velocity and direction, but also the wind conditions. A comparison / discussion of these parameters would be an improvement.
2. In the introduction it is stated that this study is the first of its kind, for Arctic and Antarctic icebergs. However, to my knowledge there was a similar study set up for an Antarctic iceberg (Scambos et al., 2008, Journal of Glaciology) which might deserve a mentioning here.
3. In the discussion the big difference between the ration of basal and surface ablation rates from results of a former study is mentioned. When comparing these results it has to be considered the in case of the other study the Antarctic tabular iceberg started off with a firn column, while the Peterman iceberg did not have any snow cover, so in fact a blue-ice surface. If there is a firn column, surface melt water can percolate into the firn and refreeze, so the mass is not immediately lost. While on blue ice it is more likely to run off. The problem of refreezing melt water and firn densification is the biggest contribution to uncertainty for previous studies estimating ablation of tabular icebergs from altimeter data. For this setting it would be immensely helpful to have an in-situ data set like the one presented here. This might be added to the discussion.

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2019-125, 2019.

C2