

Interactive comment on “Modeling intensive ocean–cryosphere interactions in Lützow-Holm Bay, East Antarctica” by Kazuya Kusahara et al.

Anonymous Referee #1

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Kusahara and co-authors use an ocean-sea ice-ice shelf model to describe oceanographic and cryospheric processes in Lützow-Holm Bay, East Antarctica. Consistent with observations, the model shows warm intrusions onto the continental shelf and consequent rapid melting of the Shirase Glacier Tongue. The model also describes the impact of winds and fast ice on warm water delivery to the ice shelf. This study is an important advance to our understanding of the Antarctic system and therefore appropriate for The Cryosphere. However, I believe that some further explanation/analyses are required before the manuscript can be published, as described below.

Major Comments – A recent study by Hirano et al (2020) shows new observations from Lützow-Holm Bay. This new study by Kusahara et al represents an important advance compared to that previous study. However, in the text it is not fully clear what

C1

is new here. I would try to strengthen what is new here (e.g. cross shelf exchange) and put less emphasis on what both model and observations show. – The simulation with fast ice shows warm water (CDW?) all over the water column in the trough. This is not observed anywhere around Antarctica. It seems to me that the no-fast-ice simulation produces more realistic results. A discussion about this is required, including whether the authors think the fast-ice simulation is realistic. – Figure 18: I like the schematic. However, how the water intrudes into the canyon is not analysed here. In particular, an eastward undercurrent requires cross-isobath flow (and potentially upwelling) to access the canyon on the eastern side. There is a wide literature describing this. The way this is depicted in the schematic is a bit misleading. I would closely look at the circulation pattern at the mouth of the canyon to see what happens.

Minor Comments

– Line 17: It is not well known if there is a gyre in East Antarctica, and specifically close to the Totten region. I would be more cautious with this inference. I would rather say that the ACC is closer to the coast in Amundsen/Bellingshausen seas and Totten region than elsewhere. – Line 49-54: see above. – Line 58: fastest melting? – Line 109: Concentration? What do you mean? – Line 186: “trough”. – Line 189-190: change the wording to be more clear. – Figure 10: specify in the caption what the black lines are. – Line 290-291: “The observed estimate from the single location includes the entire SGT variability and regional variability.” What do you mean? Please clarify. I would put in a map the location of the ApRES. I would also compare model basal melt in a grid point located near the ApRES location. – Line 330: “attached to the bottom”. – Line 371: explained ->balanced. – Figure 17: specify in the caption the location of these data.

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C2