

Interactive comment on “Past Ice-Sheet Behaviour: Retreat Scenarios and Changing Controls in the Ross Sea, Antarctica” by A. R. Halberstadt et al.

J. P. Klages (Referee)

johann.klages@awi.de

Received and published: 9 March 2016

Halberstadt et al. combined new multibeam swath-bathymetric data with already existing bathymetric and seismic datasets to present an extensive and comprehensive view of ice sheet extent and retreat in the Ross Sea Embayment (RSE), Antarctica. On the basis of this new compilation the authors were able to reconstruct flow pathways and retreat dynamics during and subsequent to the Last Glacial Maximum across the entire RSE, which led to some new conclusions about the ice sheet history in that region. The paper is well written, easy to grasp, but sometimes slightly lengthy and repetitive. The figures support the text sufficiently, however some figures could be easily combined with others in order to provide more clarity, and to save space. Generally and after

C1

consideration of the edits suggested below, I would like to see this manuscript published as it provides a new and valuable combination of datasets that allow a detailed insight into the Ross Sea Embayment glacial history.

As the editor already pointed out, I would like to see a more detailed implementation of this work with previous work from the area, especially in the introduction. In particular, more recent papers such as Bart and Owolana (2012), QSR and McKay et al. (2016), GEOLOGY need to be considered in this regard. Extensive work has been performed in the RSE and the authors should point out more clearly what is known so far, how their new results fit into these previous results, and how their newly presented results complement and maybe change them. I further encourage the authors to incorporate the results of previous modelling efforts in more detail (e.g. recent studies by Gollledge et al.) in order to define synergies. This would reveal the progress already achieved, but would also highlight the need for necessary future work. Building onto that it should be emphasized how empirical future work in the area could focus in order to reduce existing data-model mismatches. The authors should further point out that sediments and reliable radiocarbon dates for min. GL retreat are urgently needed in order to verify their hypotheses. Since their interpretations are exclusively based on geophysical data, they should phrase much more carefully in many parts of the manuscript. The lack of age control should be the strongest motivation for future work in the area. Lastly, the introduction should emphasize the significance of the RSE for Antarctic ice sheet stability in more detail, maybe also in regard to other large embayments such as the Weddell and Amundsen Sea Embayment. Therefore, the significant contributions by The RAISED Consortium (2014) should be incorporated. And – but this is just my personal opinion – I would suggest to slightly change the title of the manuscript to “Past Ice-Sheet Behaviour in the Ross Sea Embayment, Antarctica: Retreat Scenarios and Changing Controls”.

If the aforementioned issues and the minor edits and suggestions in the supplementary file will be met sufficiently, I fully support the publication of this manuscript in

C2

"The Cryosphere". Technical corrections, suggestions for improving the readability, and some concerns from my side are listed in a supplementary file by page and line number.

Interactive comment on The Cryosphere Discuss., doi:10.5194/tc-2016-33, 2016.

C3

P1, line 8: Replace "on" with "for" (*for numerical ice-sheet models*)
P1, line 12: Delete "in contact with the bed".
P1, line 22: Change to "The Ross Sea Embayment (RSE) drains ~25% of the AIS into the Ross Sea and thus is the largest drainage basin in Antarctica, fed by multiple ice streams...".
P2, line 11: Change to "Multibeam swath bathymetry provides a record of bed conditions beneath the former ice sheet, ...".
P2, line 12: Change to "These landforms record flow behaviour and past thermal regimes of formerly grounded ice."
P2, lines 15-16: Change to "This unique and integrated dataset ... much higher resolution, thereby revealing the palaeo-ice sheet bed with a much higher resolution compared to their modern counterparts."
P2, lines 17-19: Change to "...this dataset to define glacial geomorphic features that characterize past flow and retreat dynamics, thus reconstruct ice-sheet paleodrainage across the Ross Sea Embayment during and subsequent to the LGM."
P2, line 21-22: "Change to "..., which preferentially eroded along pre-existing tectonic lineaments (you may give a reference here)."
P3, line 5: Write "Austral summer".
P3, line 16: Replace "cannibalized" with "eroded" or "obliterated".
P3, line 24: Replace "post-LGM" with "postglacial", since some features may be covered by sediments that started to deposit prior to the LGM.
P3, lines 24-25: Replace "(post-)LGM" with "glacial" since some of the subglacial features in the RSE do not necessarily record LGM ice cover.
Results section:
I suggest renaming section to "Results and interpretation". Descriptions of features and references to similar, already described features elsewhere are largely missing - at least for the new dataset. Which landforms did you detect, how would you describe them, do they resemble already published features, and how do you interpret them on that basis (Description - Reference - Interpretation - Significance).
P3, lines 28-29: Change to "Subglacial landforms form beneath permanently grounded ice that exerts the offset buoyant forces by the ocean."
P4, line 27: Replace "equivocal" with "controversial" and give reference(s) for this statement.
P5, lines 4-5: Rephrase to "Ice-marginal features form within the grounding zone, the transition from permanently grounded ice to ice that decoupled from its bed to become a floating ice shelf."
P5, line 5: Either mark listed features as examples (e.g. GZWs, marginal moraines, ...) or list all of them.
P5, lines 11-12: Not exclusively - large GZWs may also indicate higher sediment flux.

Fig. 1.

C4