

Interactive comment on “Tidal influences on a future evolution of the Filchner-Ronne Ice Shelf cavity in the Weddell Sea, Antarctica” by Rachael D. Mueller

K. Makinson (Referee)

kmak@bas.ac.uk

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Review Journal: TC Title: Tidal influences on a future evolution of the Filchner-Ronne Ice Shelf cavity in the Weddell Sea, Antarctica Author(s): Rachael D. Mueller et al. MS No.: tc-2017-110

The authors present a modelling study of how tides influence the basal melting and freezing beneath Filchner Ronne Ice Shelf, the circulation of melt water within the cavity, and subsequent evolution of the cavity shape. Multiple simulations are presented with and without tidal forcing, at two different ocean temperatures, and with a modified cavity geometry that is generated from enhanced melting in the warmer scenario. The

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paper has a logical structure and the good use of tables and multi pane figures assists the reader through the various simulations. The results clearly highlight that modelling ocean tides in this region is critically important as they impact on the magnitude of basal melting (and freezing) which in turn influences the buoyancy driven circulation within the cavity. This result supports the general conclusions of other modelling studies looking at FRIS, but by considering warmer ocean scenarios and a melt/freeze modified cavity geometry, this study provides insight into how tidal currents and circulation patterns will change and feed back into modifying the ice shelf and ice sheet. While present day geometries and ocean temperatures are used for forcing, the simple uniform ocean salinity north of FRIS ignores the present day east to west increase in density. As a consequence, the overall modelled circulation within the cavity is reversed from the present day conditions. The circulation scenarios presented here are therefore more representative of the Hellmer et al warm phase and having the label of ‘present day’ is misleading when talking about the circulation. It would be useful to clarify this point early in the paper for readers who are less familiar with this region.

Overall this is a useful contribution to the suite of modelling efforts focused on this region and recommend publication in TC.

Suggested minor revisions:

L39 remove ‘the’

L58 change to ‘over the observational record.’

L60 change ‘the’ to ‘on’

L69 remove both ‘the’

L71 Modified Warm Deep Water (MWDW)?

L73 MWDW also seen at Ronne Ice Front (Mooring R2 and CTD’s Foldvik et al 2001 doi:10.1029/2000JC000217)

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L90 change to 'pattern and magnitude of'

L118 Are these temperatures and salinities restored throughout the model runs?

L122 It would be worth mentioning the lack of an east to west density gradient and hence the reverse circulation in the cavity.

L195-196 it would be useful to define what these numbers (Haney number and Beckmann and Haidvogel number), are if you are going to mention them.

L203 extreme stratification profile – a little more explanation maybe?

L212 Mention that this is a known problem/limitation with this type of model.

L216 1914 m. correct?

L233 .03 is this correct? Remove 'below'

L234 remove 'above freezing'

L236 consider removing ,. Given. ...bathymetry.'

L239-40 consider changing to 'conditions and ran with and without ...'

L243 change to 'tide-resolving with at temporal resolution of 2 hours and'

L270 change 'over' to 'after'

L286 section label needed

L298 change to 'maximum tidal currents along'

Para L327-330 consider adding a value or percentage for the 'increased melt rates' and 'slightly modifies'

L336 it should be noted that there is very limited freezing north of Henry ice rise. L415 'southern' rather than 'innermost'

L441 'these' to 'the'

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L466 sources

L510 Fig. 10e

L543 'is' to 'are'

L706 Ronne Ice Front

L759 Any bathymetry data from beneath ice shelves is useful as it will help better define the cavity geometry which you have demonstrated to be important for the whole system (tides and circulation).

Fig 1. Add W and S labels for lon and lat.

L1010 remove 'than the standard geometry'

L1012 change to 'barotropic tidal transport'

L1017 change to 'continuous dye release'

Fig8 and 9. Mention in caption that this is after 2 years.

Fig12. Holland et al 2008 show similar melt figures over an extended range. doi:10.1175/2007jcli1909.1

Also Holland et al 2007 doi:10.1029/2006JC003915 show similar results to your dye tracer experiments.

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