

# ***Interactive comment on “A 1-D model study of Arctic sea-ice salinity” by P. J. Griewank and D. Notz***

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Final author response to review comment C642 on the TCD manuscript "A 1-D model study of Arctic sea-ice salinity"

We would like to thank the referee for taking the time to carefully read and criticize our manuscript and provide helpful feedback. The majority of the comments raised by the reviewer address confusing and imprecise text passages, in particular regarding description of the model and parametrization descriptions. We will address these comments by expanding and clarifying the text according to the referee's advice. The following list contains detailed responses to the more scientific and crucial comments of the referee.

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Regards, Philipp Griewank and Dirk Notz

1. We will greatly reduce the vague discussion on numerical efficiency, and will remove the conclusion which parametrization should be used. This will address the points raised on 1724, 1744, 1745, 1764, 1766, 1769.
2. We will change the title to "A 1-D modelling study of Arctic sea-ice salinity" on 1723.
3. We will replace the "we trust" as commented on 1734:9 and 1747:27 with a description why we choose the approaches.
4. 1737:19-1739:22: Thank you for drawing our attention to Polashenski et al 2012. The direct flushing through macroscopic holes was not neglected in our parametrization, they are one of the features we try to capture. What Polashenski et al refer to as macroscopic holes is a subset of what we refer to as flaws or cracks. We will make sure to cite Polashenski and expand on what we mean with crack or flaw.
5. 1743:5-10: While the main justification follows in the second half of the paragraph, we will expand it and explain that the idealized profile is a very crude approximation of measured multi-year ice salinities.
6. 1746:5-8: It is at the same time both a flaw and feature of the model. We will use a few sentences to address the issue.
7. We will keep the comments on pages 1745 to 1749 in mind when rewriting that section.
8. 1755:19-29: We don't expect to gain much from tracking a slush layer over time. Tracking slush as a separate layer would require more unverifiable model assumptions to differentiate slush from sea-ice and snow, as well as the transformation of slush to ice. The available data on slush is extremely scarce to begin with. We only use slush formation only as a process which transforms model snow to model sea ice.
9. 1755:25-29: The permeability does not decrease with decreasing salinity if there

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is not a heat sink available to extract the latent heat needed to turn the water into ice. Especially during surface melt where there is a positive atmospheric heat flux into the ice, the desalinating surface layer will not freeze solid.

10. 1756:23-24: Indeed the model could be wrong. This uncertainty is why we use "indicate" and "may be" to make clear that this is by no means a certain fact. We will add explicitly that the model might be wrong to avoid misunderstandings.

11. 1754:9-1756:26: We state at 1754:20-27 that the forcing used is from throughout the Arctic, as is used in the rest of the section, and why we consider this a valid comparison. We will expand this paragraph to explain why using barrow atmospheric forcing is not ideal. For example ice measured at barrow did not necessarily grow there. This is most obvious for the multi-year ice measured there, as Barrow is ice free in early fall.

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Interactive comment on The Cryosphere Discuss., 8, 1723, 2014.

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