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Effects of model resolution on ice shelf-ocean boundary layer

Alena Malyarenko[1,2], **Stefan Jendersie**[3], Mike Williams[2], Natalie Robinson[2], and Pat Langhorne[1]
[1]University of Otago, Dunedin, New Zealand
[2]National Institute of Water and Atmospheric Research, Wellington, New Zealand
[3]Antarctic Research Centre, Victoria University of Wellington, New Zealand

Boundary layer mixing at the ice-ocean thermodynamic interface is represented by turbulent transfer coefficients, Γ_T and Γ_S. Commonly used expressions for these are based on observations at the sea ice-ocean and ice shelf-ocean boundaries, and result in values ranging over 5 orders of magnitude ($10^{-7} < \Gamma_T < 10^{-2}$). To demonstrate the potential effect of the choice of turbulent transfer parameterisation we applied all of the available transfer coefficient values (12) to an idealised ice shelf-ocean cavity model experiment using the ISOMIP domain with ROMS. The mean ablation rate in warm cavity scenarios varies between 2.1 and 4.7 m/year, and in cold cavity scenarios between 0.03 and 0.17 m/year.

Γ_T and Γ_S not only directly determine the ablation rate, but have effects on fresh water distribution in the ocean boundary layer. High Γ values develop deep mixed layers, while low Γ values stratify the top ocean grid cells. Thus the ocean boundary layer structure directly depends on vertical resolution in the ocean model and how well the mixing scheme can handle the stratification effects. The experiment results we are presenting here include comprehensively tested and quantified effects of tidal forcing, mixing schemes, vertical flux distribution and ocean model resolution on the ablation rates and the ocean boundary layer structure.