EGU21-3825
https://doi.org/10.5194/egusphere-egu21-3825
EGU General Assembly 2021

What is the heat uptake potential of Antarctic Bottom Water?

Jan Zika[1], Abhishek Savita[2], Ryan Holmes[1], and Taimoor Sohail[1]
[1]University of New South Wales, School of Mathematics and Statistics, Sydney, Australia (j.zika@unsw.edu.au)
[2]Institute for Marine and Antarctic Studies (IMAS), University of Tasmania, Hobart, Australia
(abhishek.abhisheksavita@utas.edu.au)

Antarctic Bottom Water (AABW) is a cold dense water mass which sinks around Antarctica keeping the abyssal ocean relatively cool. Recent observations have suggested a component of recent deep ocean warming is linked to AABW. Here we explore how much changes in AABW could affect changes in vertical ocean heat transport in a warming climate. If the AABW circulation were to be completely extinguished, for example due to increases in upper ocean thermal stratification, AABW would cease to cool the deep ocean and hence lead to an effective warming of the abyss. Therefore, we propose that long term mean vertical heat transport of the AABW circulation is an effective upper bound on the change in heat transport that can be affected by changes in AABW. We call this upper bound the 'heat uptake potential'. We analyse AABW circulations in an ensemble of numerical climate models. We find that the AABW circulation contributes between 0.05Wm^{-2} and 0.15Wm^{-2} to the global vertical heat balance in the model's pre-industrial states. Indeed, under abrupt CO_2 forcing changes, AABW heat transport systematically reduces (in some cases completely), with the largest reductions occurring in models with the largest pre-industrial mean heat transports. The AABW circulation vertical heat transport is found to be highly correlated with the minimum of the Meridional Overturning Circulation at 50^{o}S in the models, suggesting there may be observable constraints on the heat uptake potential of AABW.