

Interactive comment on “The instability of diffusive convection and its implication for the thermohaline staircases in the deep Arctic Ocean” by S.-Q. Zhou et al.

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This manuscript presents the application of classical theory of double diffusive convection to oceans and lakes. It beautifully demonstrates over 8 orders of magnitude of parameter space that, with the use of some measured parameters, the classical theory can describe a scaling relation between interface thickness and temperature difference for the convection layers in thermohaline staircases. It also predicts the depth of the bottom layer, and the evolution time of the bottom layer in the deep Arctic ocean. It demonstrates that salinity gradients are primarily responsible for stratification in most tested cases. Because of the success of this model for a number of thermohaline

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convection systems, I strongly recommend it for publication in the Journal for Physical Oceanography. I just have one minor comments below.

In the calculation of the bottom layer thickness, why is Ra_{Ti} used instead of Ra_{Δ} , which was used in the previous calculations? Is there a theoretical reason that this is the more relevant choice? While Ra_{Ti} seems to produce a more accurate value, it is not clear that this level of accuracy can be expected of the model – it is still accurate within a factor of 2 using Ra_{Δ} , which is comparable to the level of accuracy in Fig. 5a.

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