EVALAUTING THE RESPONSE OF AN ARCTIC OCEAN MODEL TO AN OBSERVATIONALLY-INFORMED AND SPATIALLY-VARIED DISTRIBUTION OF VERTICAL MIXING

by

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Abstract

Numerical models are integral to our understanding of the rapidly changing and difficult to observe Arctic Ocean. In most models, vertical mixing in the interior of the Arctic Ocean is parametrized by a user-defined background vertical diffusivity. For this, a single background vertical diffusivity value is typically applied uniformly throughout the model domain. However, this practice does not reflect the spatio-temporal variability of vertical mixing rates that have been observed in the Arctic Ocean, which span more than three orders of magnitude. Many aspects of ocean state are modulated by vertical mixing, and this practice could theoretically affect model performance in a number of ways. Motivated by this, we here generate a large number of observational vertical diffusivity estimates for the Arctic Ocean using a spatially diverse set of data. We then use these estimates to construct a background vertical diffusivity distribution that is both observationally-informed and spatially-varied. In this thesis, we evaluate the response of an Arctic Ocean model to this mixing distribution. Specifically, we evaluate the response of temperature and salinity distributions, circulation, and sea ice conditions. We discover that certain aspects of the Arctic Ocean model appear to be sensitive to the vertical mixing in specific geographical regions. Furthermore, we find that the observationally-informed distribution improves the similarity between the model and observed climatology. Our findings require refinement, however, they show promise for improving model performance and generating understanding of the role played by vertical mixing in the real Arctic Ocean.