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A new for parameterization of heterogeneous ocean convection

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We propose a new framework for parameterization of ocean convection processes. The new framework is termed patchy convection. Our aim is to represent the heterogeneity of mixing processes that take place within the horizontal scope of a grid cell. This new scheme is to represent the effect of preconditioning for deep convection by sub-grid scale eddy variability. The new parameterization separates the grid-cell into two regions of different stratification, applies convective mixing separately to each region, and then recombines the density profile to produce the grid-cell mean density profile. The scheme depends on two parameters: the areal fraction of the vertically-mixed region within the horizontal grid cell, and the density difference between the mean and the unstratified profiles at the surface. We parameterize this density difference in terms of an unresolved eddy kinetic energy. We illustrate the patchy parameterization using a 1D idealized convection case before evaluating the scheme in two different global ocean-ice simulations with prescribed atmospheric forcing; i) diagnosed eddy velocity field applied only in the Labrador Sea ii) diagnosed global eddy velocity field. The global simulation results indicate that the patchy convection scheme improves the warm biases in the deep Atlantic Ocean and Southern Ocean.