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Parameterization of subgrid stirring in eddy resolving ocean models.

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Horizontal stirring by time-varying mesoscale flows contributes to forming submesoscale tracer filaments. Here, we propose a parameterization of the transport associated with the formation of submesoscale tracer filaments by mesoscale flows for use in O(10km) resolution ocean models. Theoretical motivations are provided for modelling subgrid stirring by the resolved mesoscale flows with an anisotropic generalization of Smagorinsky operator. For level coordinate models, an isoneutral formulaton of the proposed subgrid operator is provided. The proposed subgrid operator is diagnosed with DRAKKAR global 1/4° eddy-resolving model output. In the Southern Ocean, the parameterization is shown to provide diffusivities peaking at about $400\mathrm{m}^2\mathrm{s}^{-1}$. If applied prognostically, the proposed subgrid operator could drive meridional heat transports of about .5PW at 45°S. This suggests that a significant fraction of the transport by mesoscale flows could be associated with tracer features of scale smaller than our model grid size (∼20km at 45°S). A large contribution to this transport is associated with differential advection by the time-mean flow at the subgrid scale. Preliminary prognostic tests indicating that the parameterization is both stable and accurate will be discussed.