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# Modelling eddies in global eddy-permitting simulations: Impacts of an ocean kinetic energy backscatter parametrization

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The potential of a kinetic energy backscatter scheme is demonstrated in an eddy-permitting global ocean simulation. Ocean models commonly employ (bi-)harmonic eddy viscosities which excessively dissipate kinetic energy in eddy-permitting simulations. Over-dissipation not only affects the smallest resolved scales, but also the generation of eddies through baroclinic instabilities, impacting the entire wavenumber spectrum. The backscatter scheme returns part of this over-dissipated energy back into the resolved flow.

Backscatter is employed in the FESOM2 multiresolution ocean model with a quasi-uniform 1/4° mesh. In multidecadal ocean simulations, backscatter increases eddy activity by a factor 2 or more, moving the simulation closer to observational estimates of sea surface height variability. Moreover, mean sea surface height, temperature, and salinity biases are reduced. This amounts to a globally averaged bias reduction of around 10\% for each field, which is even larger in the Antarctic Circumpolar Current.
However, in some regions such as the coastal Kuroshio, backscatter leads to a slight over-energizing of the flow, and in the Antarctic to an unrealistic reduction of sea ice. Some of the bias increases can be reduced by model tuning and related adjustments to the backscatter scheme. Nevertheless, the substantial observed improvements from the backscatter scheme already outweigh increases in bias or costs.

## Do you need an official invitation letter?

No

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