EGU2020-22177
https://doi.org/10.5194/egusphere-egu2020-22177
EGU General Assembly 2020

The impact of a parameterisation of submesoscale mixed layer eddies on mixed layer depths in the NEMO ocean model

Daley Calvert[1], George Nurser[2], **Mike Bell**[1], and Baylor Fox-Kemper[3]
[1]Met Office, Exeter, UK
[2]National Oceanography Centre, Southampton, UK
[3]Department of Earth, Environmental and Planetary Sciences, Brown University, Providence, Rhode Island, USA

A parameterisation scheme for restratification of the mixed layer by submesoscale mixed layer eddies is implemented in the NEMO ocean model. Its impact on the mixed layer depth (MLD) is examined in 30-year integrations of "uncoupled" ocean-ice and "coupled" atmosphere-ocean-ice-land global climate configurations used by the Met Office Hadley Centre. The specification of the mixed-layer Rossby radius in the scheme is shown to affect its impact on the MLD in the 1/4 degree uncoupled configuration by up to a factor of 2 in subtropical and mid-latitudes. This factor has been limited in the extent to which small mixed-layer Rossby radii are utilised to guard against CFL-type instabilities in the scheme, but such a limit was not found to be necessary for this implementation. An alternative form of the scheme is described that approximates the mixed-layer Rossby radius as a function only of latitude. This form is shown to yield similar results to the original formulation for an appropriate choice of parameters. The global mean impact of the scheme on the MLD is found to be almost twice as large in the 1 degree and 2 degree uncoupled configurations as it is in the 1/4 degree configuration, although the parameterised vertical buoyancy fluxes have closer agreement. This is shown to be the result of the scheme overcompensating for the decay in strength of resolved mixed layer density fronts in this model with decreasing horizontal grid resolution. The MLD criterion defining the depth scale of the scheme is shown to affect its global mean impact on the MLD by nearly a factor of 3 in the 1/4 degree uncoupled and coupled configurations, depending on whether the criterion is chosen to capture the actively mixing layer or well-mixed layer. Climatological MLD biases are improved overall in both cases, substantively reducing deep winter biases whilst slightly increasing shallow summer biases.

How to cite: Calvert, D., Nurser, G., Bell, M., and Fox-Kemper, B.: The impact of a parameterisation of submesoscale mixed layer eddies on mixed layer depths in the NEMO ocean model, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-22177, https://doi.org/10.5194/egusphere-egu2020-22177, 2020