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Mixing and Energy Produced by Explicit Internal Tides In The Indonesian Seas Using Realistic OGCM

Dwiyoga Nugroho (1), Ariane Koch-larrouy (1), Benoit Tranchant (2), Guillaume Reffray (3), Phillipe Gaspar (2), and Gurvan Madec (4)

(1) IRD/LEGOS, Toulouse, France, (2) CLS, Ramonville Saint-Agne, France, (3) Mercator Ocean, Ramonville Saint-Agne, France, (4) LOCEAN,Paris, France

As a semi-enclosed basin with complex bottom topography, Indonesia archipelago is a region of strong internal tides generation that produce large water mass transformation, leading to a homohaline stratification at the exit passage. This intense mixing has been proved to play an important role in the above atmospheric convection, and thus on entire tropical climate and its variability. We have conducted a series of numerical experiments using a regional general circulation model (NEMO) with a 1/12 degree resolution forced at the boundaries by a global assimilated simulation to study the characteristics of internal tides and its impact on circulation and mixing. The model shows good agreement with the observations, where strong water mass transformation has been previously diagnosed. Barotropic tides are well validated with observed surface tides. Internal tides generation compares well with previous estimates in the region. Comparisons with a simulation without tidal forcing and another including previous physically based parameterisation are done. The results show that explicit baroclinic tides and internal tides parameterisation produce nearly same mixing in the thermocline. However, in the surface, the barotropic tides create larger mixing on the shelves, than on the region of internal tides generation. Different tracer advection schemes have been tested that differ in particular for their diffusive part. A energy budget of the dissipation in the model has been calculated for all the simulations. Spurious mixing from the most diffusive advection scheme combined with the high frequency forcing of the tides produce a similar water mass transformation as the dedicated physical parameterisation. However, this mixing is numerical mixing and varies from different advection scheme to another in intensity and localisation. Altogether, our results demonstrate the sensitivity of mixing to advection schemes and suggest caution when introducing explicit tidal forcing to obtain realistic simulations of the internal mixing and circulation in the Indonesian Seas.