EGU22-2813, updated on 11 Aug 2022
https://doi.org/10.5194/egusphere-egu22-2813
EGU General Assembly 2022

Wave-eddy interactions in the Gulf of Lion: Bridging ocean general circulation models and process ocean simulations

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Near-inertial waves (NIWs) are of major relevance to the global ocean circulation as they inject wind energy from the surface to the ocean interior and represent a primary source of energy to the internal wave continuum. Eddies and fronts play a significant role in the downward penetration of NIW energy (from generation to propagation) and subsurface dissipation. Much of our understanding of NIW interactions with submeso- and mesoscale flows comes from limited observations as well as idealized theoretical and numerical processes, but these do not typically consider the presence of temporally evolving larger-scale flows. On the other hand, more realistic and time-evolving eddy fields from submesoscale-resolving Ocean General Circulation Models (OGCMs) forced with winds show truncated spectra at the subsurface due to the lack of vertical resolution -the subgrid vertical scale is 1-2 orders of magnitude larger than the scale at which dissipation occurs. Since OGCMs are indeed very attractive tools to quantify global-regional impacts of small-scale phenomena, we propose to gain understanding of their biases in terms of wave-eddy interactions by using a novel approach.

This approach consists of nesting a non-hydrostatic Boussinesq model (Flow_Solve) into an OGCM configuration (NEMO-GLAZUR64) for the Gulf of Lion with O(1 km) horizontal and O(30 m) vertical resolution. Preliminary analysis of NEMO-GLAZUR64 output reveals a highly energetic NIW field with intriguing distribution patterns relative to the eddies. We zoom into these patterns by following eddies with our nesting approach. The Boussinesq model provides a magnifying glass into dynamical processes that are either parameterized or fully unresolved in the OGCM. Wave energy budgets inferred from high-resolution process studies with Flow_Solve and NEMO-GLAZUR64 are then compared in order to better constrain model uncertainty in OGCMs due to NIW dynamics.