Energizing Turbulence Closures in Ocean Models

Laure Zanna, James Anstey, Alistair Adcroft, Scott Bachman, Luca Mana, Joakim Kjellsson

The role of turbulent mesoscale (10-100km) eddies is crucial for the ocean circulation and its energy budget. The sub-grid scale eddy variability needs to be parametrized in ocean models, even at so-called eddy permitting resolutions. I will present some recent advances made in representing turbulent eddy fluxes using a non-Newtonian stress. The non-Newtonian stress depends on the partially resolved scales and their variability and is shown to be a good parametrization of ocean turbulence by enhancing the kinetic energy inverse cascade. The parametrization possesses attractive features for implementation in global models: little computational cost, flow- and scale-awareness, and a dependence on the life cycle of mesoscale turbulence. I will show new results where the parametrization is implemented 1) in a Eulerian model together with a kinetic eddy energy equation in a primitive equation model, and 2) in a Lagrangian trajectory model. In both cases, I will discuss impact on energy transfer and then on mixing rates.