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Observing and Modelling Upper Ocean Mixing by Near-Inertial Oscillations

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Near-inertial oscillations (NIOs) have been observed to drive substantial ocean mixing during the passage of atmospheric storms. This mixing is poorly resolved in climate models due to coarse spatial and temporal resolution of the atmospheric forcing and missing ocean physics. A new parameterisation is developed in the Norwegian Earth System Model (NorESM) to account for enhancement of both mixed layer turbulent kinetic energy and interior diapycnal diffusivity by locally forced NIOs. This parameterisation is based on the inclusion of a simple slab model in the NorESM coupler, receiving high frequency wind forcing and generating near-inertial current distributions consistent with available observations from surface drifters. Our results suggest that NIOs are unimportant for mixing at depth, but act to deepen the ocean mixed layer and significantly impact air-sea buoyancy fluxes, contributing to the reduction of large model biases in tropical SST. Additional analysis of mooring data from the PIRATA observational array reveals that a large fraction of the near-inertial energy injected at the surface is realised through a few extreme storms rather than a continuum of events. Further improvements to the ocean mixing parameterisation may thus require the resolution dependence of the simulated storm activity to be explored in more detail.