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Instabilities, inertia-gravity waves and ocean mixing in the western equatorial Pacific

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Microstructure profiles and high-resolution velocity measurements conducted in the western equatorial Pacific over a number of years show high correlation between interita-gravity wave (IGW) activity and kinetic energy dissipation rates. To understand the connection between the IGW activity and enhanced dissipation at the process level, we perform a series of numerical experiments using a basin scale wind-forced ocean model with a very high resolution in both horizontal and vertical directions. The basin scale is necessary to capture the propagation of NIWs from the sites of their generation to the sites of their dissipation, whereas high resolution is necessary to capture the transfer of energy between IGWs and the background flow, other IGWs, and turbulence. We determine the necessary conditions on the characteristics of forcing and oceanic background under which IGWs can substantially enhance mixing in the ocean interior (i.e. well below the base of the mixed layer) and apply these results to interpret the measurements from the western equatorial Pacific, where strong modulation of the levels of mixing by the ENSO cycle allows one to study two very different regimes.