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Interactions between near-inertial waves and mean flow in the ocean

Wind forcing of the ocean generates a spectrum of inertia-gravity waves that is sharply peaked near the local inertial (or Coriolis) frequency. The corresponding near-inertial waves (NIWs) are highly energetic and play a significant role in the slow dynamics of the ocean at large and mesoscales. In order to examine this role, we use generalised-Lagrangian-mean theory to derive a new model that captures the two-way interaction between NIWs and mesoscale motion. This model couples the Young & Ben Jelloul (1997) model of NIWs with a quasi-geotrophic model in which the wave effect arises through a modification of the potential-vorticity-inversion relation. Simple arguments based on the new model's conservation laws and confirmed by numerical simulations suggest that NIWs provide a significant energy sink for the mesoscale flow. (Joint with Jin-Han Xie.)