Investigating internal wave interactions with quasi-geostrophic turbulence

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Abstract

Two high resolution satellite altimeters are currently under development (SWOT, COMPIRA) with scheduled launches in about five years time. These instruments will provide sea-surface height data at very high spatial resolution and accuracy which will capture mesoscale/sub-mesoscale turbulence and the sea-surface signature of barotropic and baroclinic waves. Techniques for removing the barotropic signals are established, however removing the baroclinic signals is an outstanding problem largely due to phase incoherence with respect to the astronomical forcing. To better understand the source of the phase incoherence, we conduct numerical experiments where we propagate a coherent low-mode internal tide through a turbulent field produced by an unstable jet. We separate the model fields into a slow turbulent part and a fast wave part by an averaging/projection process, and also project onto vertical modes for per-mode analysis. The results show that the coherent wave field loses coherence following the interaction, and further show that a modest amount of energy (1-5%) is scattered to higher vertical wave modes. Lastly we employ an analytic approach to explore the physical mechanisms leading to the incoherence.

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