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Turbulence during the generation of internal tides at obstacles

SUTANU SARKAR, University of California at San Diego

Three-dimensional simulations are performed to resolve turbulent processes in tidally-forced flow over different types of two-dimensional obstacles. Our objective is to explore the dependence of the spatial and temporal distribution of turbulence on the obstacle geometry. Fine-scale variability in the flow is associated with features such as critical slope boundary layers, upslope thermal bores, breaking lee waves, downslope jets, internal wave beams and wave-wave interactions. Turbulence in these flow features is maintained through both convective and shear instabilities, and the mixing efficiency depends on the type of instability that is operative. The spatio-temporal pattern of turbulent kinetic energy and dissipation depends strongly on local slope criticality, the overall aspect ratio of the obstacle, and the appropriately defined excursion number. Implications of the simulation results for simple parameterizations of the turbulent dissipation and mixing are discussed. The work presented here was done with Masoud Jalali.