Energy cascade in internal wave attractors

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Abstract

One of the pivotal questions in the dynamics of the oceans is related to the cascade of mechanical energy in the abyss and its contribution to mixing. We propose internal wave attractors in the large amplitude regime as a unique experimental and numerical setup that models a cascade of triadic interactions transferring energy from large-scale monochromatic input to multi-scale internal wave motion. Experiments are conducted in a trapezoidal domain filled with uniformly stratified fluid. Fluid motion is measured with conventional PIV and Synthetic Schlieren technique. Numerical calculations are performed with the help of the spectral element method. We discuss the instability scenarios and their relation to the amplitude of the input perturbation and the position of the operating point of the system at zone of existence (Arnold tongue) of a wave attractor. We provide signatures of a discrete wave turbulence framework for internal waves and discuss the statistics of small-scale high-vorticity events, which induce mixing.

Publications:

1) Scolan H., Ermanyuk E.V., Dauxois T. (2012) Nonlinear fate of internal wave attractors. *PRL* **110**, 234501

2) Brouzet C., Ermanyuk E.V., Joubaud S., Sibgatullin I.N., Dauxois T. (2016) Energy cascade in internal wave attractors. *Europhysics Letters* (accepted)

3) Brouzet C., Sibgatullin I.N., Scolan H., Ermanyuk E.V., Dauxois T. (2016) Internal wave attractors: experiments and numerical simulations. *J. Fluid Mech.* (accepted)

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