Leveraging equilibrium statistical mechanics to predict near-inertial wave statistics

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In the Ocean, Earth's rotation is responsible for quasi-inertial waves oscillating near the Coriolis frequency. Those waves account for a significant fraction of the Ocean's kinetic energy and they can induce turbulent mixing at depth [1]. The wave field is forced at large scale by atmospheric storms and develops smaller scales through advection and refraction by mesoscale eddies. Predicting the resulting statistics of the wave field in the equilibrated state is thus crucial to parametrize wave-induced mixing. Based on an idealized model [2], I will present an approach to quantitatively predict such statistics : spatial distribution of wave kinetic energy, spatial distribution of wave potential energy, Stokes drift induced by the waves, etc. The predictions are validated using numerical simulations.

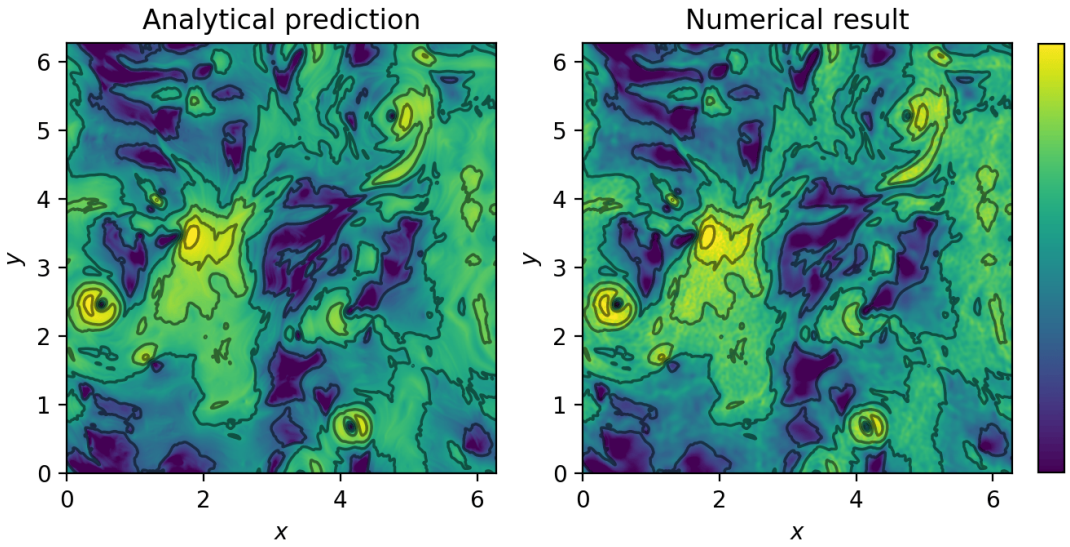

Figure 1. Comparison between analytical prediction (left) for the wave potential energy, and numerical observation (right). Light (resp. dark) colors correspond to high (resp. low) values of wave potential energy, gray contours are level sets of the prediction. Units will be given in my poster and show that the prediction is in very good quantitative agreement with the observations.

Références

1. M. H. Alford & J. A. MacKinnon & H. L. Simmons & J. D. Nash, Near-Inertial Internal Gravity Waves in the Ocean, *Annual Review of Marine Science*, **8**, 95-123 (2016).
2. W.R. Young & M. Ben Jelloul, Propagation of near-inertial oscillations through a geostrophic flow, *Journal of Marine Research*, **55** (1997).