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A Hamiltonian approach to nonlinear modulation of surface water waves in the presence of linear shear currents.

This is a study of the water wave problem in a two-dimensional domain in the presence of constant vorticity. The goal is to describe the effects of uniform shear flow on the modulation of weakly nonlinear quasi-monochromatic surface waves. Starting from the Hamiltonian formulation of this problem and using techniques of Hamiltonian transformation theory, we derive a Hamiltonian, high-order Nonlinear Schrödinger equation (often referred to as Dysthe equation) for the time evolution of the wave envelope. Consistent with previous studies, we observe that the uniform shear flow tends to enhance or weaken the modulational instability of Stokes waves depending on its direction and strength. This model is tested against direct numerical simulations of the full Euler equations and against a related Dysthe equation recently derived by Curtis, Carter and Kalisch (2018). This is a joint work with P. Guyenne and A. Kairzhan.