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Mass Transport Due to Partially Reflected Waves in a Two-Layer Viscous System

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Based on Lagrangian coordinates, a perturbation analysis is conducted to find the mean drifts due to partially reflected surface waves in a two-layer system, where the lower fluid is assumed to be much more viscous than the upper one. A single analytical expression is obtained for the mass transport velocity in each layer, incorporating the cases where the wave can be progressive, standing or partially standing, and the domain can be closed or open at its far field. It is shown that the patterns of mean flow in the two layers are materially affected by the lower-fluid viscosity. It is possible that the mass transport in the core region of the upper layer is completely quiescent despite the existence of some strong drifts in the lower layer. The wave reflection may also have different effects on the mean flow structures when the system is closed or open.

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