Numerical Study of the wave resistance of a two dimensional hydrofoil
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Abstract
Wave resistance is an important parameter in the design of high speed marine vessels such as hydrofoil boats, and can be estimated using numerical tools such as Reynolds Averaged Navier Stokes (RANS) solvers, which are much less expensive than towing tank experiments. Here we describe numerical experiments using a RANS solver (Openfoam) validated with experimental results by Duncan (1983), using a two dimensional NACA12 hydrofoil. The solver, based on volume fraction and finite volume formulation, has been modified to improve its stability and prediction of free surface. The wave drag on the hydrofoil is estimated from the total pressure drag and viscous drag. Numerical results in the subcritical Froude number range are compared with experimental data, with additional numerical studies carried out to extend results to the more relevant critical and supercritical Froude number range.

Structure of tilted vortices in baroclinic coastal flow
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Abstract
Oscillatory flow past abrupt coastal features, such as headlands and jetties, frequently leads to flow separation and the formation of coherent vortical structures. These vortices play a major role in coastal dynamics, and contribute to the stirring of nutrients, buoyant discharges and pollutants. In the regime where the water is deep and stratified, horizontal flow separation past a sloping headland can generate strongly tilted baroclinic vortices. Field observations and numerical simulations are used to explore the consequences of the strong tilt on the structure and evolution of these eddies. Results reveal that the background density field is altered in such a way as to maintain a pressure minimum in the tilted eddy core. This adjustment results in a wavenumber-one asymmetry of the density field. Isopycnals are deflected upwards on the shoreward side, and downwards on the opposite side of the eddy center. A simple analytical model suggests that this structure is obtained via a balance between the centrifugal force and the horizontal pressure gradient.