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LES of a Stratified Boundary Layer under an Oscillating Current
BISHAKHDATTA GAYEN, SUTANU SARKAR, UC San Diego, JOHN TAYLOR, MIT — A numerical study based on large-eddy simulation (LES) is performed in the case of an oscillating tidal flow with a uniform ambient stratification. Here, the Reynolds number $Re_\delta = U_0\delta_s/\nu = 1790$ (U_0 = maximum amplitude of the outer flow, $\delta_s = \sqrt{2\nu/\omega}$ is the Stokes layer thickness, ν is the kinematic viscosity of the fluid and ω the angular frequency of the oscillatory current), and $N_\infty^2/\omega^2 = 500$ where N_∞ is the buoyancy frequency of the overlying stratified layer. Turbulence appears at a tidal phase of approximately $\pi/4$ and is sustained throughout the deceleration phase ($\pi/2 < \omega t_d < \pi$, $3\pi/2 < \omega t_d < 2\pi$). Production of turbulence is confined to the the wall region and, for stratified flow, in the mixed layer between the wall and the thermocline. For both the stratified and unstratified cases, there is a log layer over a significant extent of the tidal cycle. Our unstratified flow results are verified against the numerical simulations of Salon *et al* (2007) and experimental data of Jensen *et al*. (1987). In the presence of stratification, the boundary layer height decreases substantially and the wall shear stress increases slightly with respect to the unstratified case. Stratification effects on boundary layer turbulence and on the thermal field including the formation and collapse of the thermocline will be discussed.

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