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LES of oscillating boundary layers under neutrally stratified and unstably stratified conditions[1] MARIO JUHA, JIE ZHANG, ANDRES TEJADA-MARTINEZ, University of South Florida — Results are presented from LES of open channel flow driven by an oscillating pressure gradient with zero surface shear stress. The flow is representative of an oscillating tidal boundary layer. Under neutrally stratified conditions, during certain phases of the oscillating pressure gradient, the flow develops large scale secondary structures, characterized by full-depth regions (or limbs) of negative and positive wall-normal velocity fluctuations. These structures are similar but less coherent than the classical Couette cells found in Couette flow driven by parallel no-slip plates moving in opposite direction. Unstable stratification will be imposed by a constant cooling flux at the surface and an adiabatic bottom wall. The effect of the surface cooling on the large scale secondary structures and the overall turbulence statistics will be investigated. The analysis will be performed in terms of the Rayleigh number (Ra), representative of the importance of surface buoyancy relative to shear, and the Rossby number (Ro), representative of the importance of the turbulence throughout the water column. For example, in unstratified conditions, if Ro is relatively small, turbulence stress is expected to be important only near the bottom of the boundary layer.

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