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Lagrangian Coherent Structures in an Unstable Bottom Boundary Layer Under a Solitary Wave DANIEL NELSON, GUSTAAF JACOBS, San Diego State University, MAHMOUD SADEK, PETER DIAMESSIS, Cornell University — The role of Lagrangian Coherent Structures (LCS) in fluid mixing is investigated in the unstable bottom boundary layer (BBL) under a solitary surface wave mimicked by a soliton-like pressure gradient driven flow in an oscillating water tunnel. The finite-time Lyapunov exponent (FTLE) field, both backward in time and forward in time, is determined for a two-dimensional direct numerical simulation (DNS) of the unstable BBL from the development of the instability through the growth of the large scale transport structures. Attracting LCS are identified trailing the primary vortices that form moving separation surfaces which pick up material from the boundary and transport it into the primary vortices. Weaker, secondary separation surfaces form beneath smaller, secondary vortices. At a later time, the secondary vortices are absorbed by the primary vortices and the separation surfaces from the smaller vortices merge with the separation surfaces from the larger vortices. The primary vortices are the most significant sources of mixing between the near wall and outside the boundary layer, implying that the primary vortices are the physical mechanism for particle resuspension.

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