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Instability map and transition characteristics of the bottom boundary layer under solitary wave MAHMOUD SADEK, Cornell University, LUIS PARRAS, University of Malaga, PETER DIAMESSIS, PHILIP LIU, Cornell University — Transition prediction in the bottom boundary layer (BBL) flow driven by a soliton-like pressure gradient in an oscillating water tunnel (an approximation for the BBL under solitary waves) is investigated using hydrodynamic linear stability theory. The study of transition in such a flow is divided into two approaches. The first approach is associated with the classical transition resulting from the exponential growth of TS waves. The findings for this approach can be summarized in a map for the temporal instability of the base flow (BF). In this map, the connections between experimental observations, classical stability analysis and fully non-linear 2D numerical simulations have been established. The second approach deals with an alternative transition scenario for this BF due to the algebraic growth of the disturbance leading to the formation of turbulent spots (TS) as reported in laboratory experiments. In this regard, the stability analysis is reformulated in the non-modal framework for the purpose of finding the optimum disturbance characteristics leading to the formation of the observed TS waves. The results of the non-modal analysis are used as an input for 3D DNS of the BBL which aims to mimic the experimental observations and understand the different possible transition scenarios within the BBL under solitary waves.

Mahmoud Sadek
Cornell University

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