JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

Friday, September 27, 2019
3:00 PM, 132 Gilman Hall

"Self-Sustained Instability, Transition and Turbulence in the Separating Boundary Layer under an Internal Solitary Wave of Depression"

Presented by Prof. Pete J. Diamessis

Cornell University

School of Civil & Environmental Engineering

Hosted by Scott Wunsch (JHU-APL)

Internal solitary waves (ISWs) are highly nonlinear and dispersive waves which are frequently observed in the stratified ocean and lakes. The turbulence and particulate resuspension generated through interaction of ISWs with the ocean/lake bed carries important implications for larger-scale energetics, ecosystem equilibrium, water quality, acoustics and optics. This presentation will examine the development of the separated bottom boundary layer (BBL) in the footprint of a large-amplitude ISW of depression at laboratory scale generated by high-accuracy/resolution implicit Large Eddy Simulation. In particular, the talk will focus on a single relatively idealized case of a large-amplitude ISW propagating against an oncoming barotropic current with its own BBL. Following a short literature review, significant discussion will be dedicated to the non-trivial computational cost of setting up and conducting the above simulation, within long domains and over long-integration times, on US DoD-HPC systems. Results will focus on documenting the full downstream evolution of the structure of the separated BBL development. Particular emphasis will be placed on the existence of a three-dimensional global instability mode, at the core of the separation bubble where typically one might assume two-dimensional dynamics. The particular instability mode is spontaneously excited and is considered responsible for the self-sustained nature of the resulting near-bed turbulent wake in the lee of the ISW. Fundamental mean BBL flow metrics will then be presented along with a short discussion of associated turbulent energetics and the potential for particulate resuspension. The talk will close with a discussion of the relevance of the existing flow configuration to both the laboratory and ocean. Possible paths towards tackling the computational costs involved in a broader exploration of relevant parameter space will finally be offered.