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Perspectives on Internal Wave Shoaling: What Can We Simulate, Where are the Gaps, and What Remains a Mystery?

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Thursday, April 17, 2025
11:10 am - 12:00 Noon
Building 53, Room 215
Pizza will be served!

Abstract: Internal waves are observed ubiquitously in natural waters. While linear theories give some useful facts about such waves, their fundamental aspects require nonlinearity. A well-known location which accentuates wave nonlinearity is the shelf, over which incident internal waves grow in amplitude, change shape and possibly break. This has implications for ocean mixing and the exchange of material between the deep and coastal oceans, with implications for fisheries and ocean biology in general. Internal wave shoaling has been studied using laboratory, numerical and field observation techniques. In this talk I will focus on the realism, and lack thereof, of numerical simulations. I will point to a gap between typical experimentally motivated set ups and field scales; namely the small slopes typically observed in the ocean and will discuss the details of process study simulations that attempt to faithfully treat realistic slopes. I will then discuss extensions of existing set ups, showing preliminary results for each. I will conclude with a few challenges for coastal ocean models.

Bio: Marek Stastna is a Professor in the Department of Applied Mathematics at the University of Waterloo. His interests cover a broad range of environmental flows, including nonlinear internal waves, hydrodynamic instabilities, gravity currents and natural convection. He received his PhD in 2001 from the University of Waterloo for work on internal solitary waves under Kevin Lamb, and did postdoctoral work at the University of Toronto with Dick Peltier from 2001 to 2004, returning to Waterloo as an Assistant Professor in 2004. He served as the President of the Canadian Meteorological and Oceanographic Society in 2020-2021.