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MECHANICAL ENGINEERING COLLOQUIUM SERIES 2015-2016

Mechanical Engineering Lecture in Dynamics

From the Lab to the Ocean (and *vice versa*)

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On Friday, October 9th at 4:00pm in 3-370

The global oceans are a major influence on the Earth's weather and climate (as much heat stored in the upper three meters of the oceans as in our entire atmosphere), they lie at the heart of some of the most pressing environmental issues of our time (the evolution of great garbage patches is evidence that dilution is not a solution for pollution), and they are increasingly being exploited for their resources (the first deep-sea mining operations are soon to commence in the Bismarck Sea). In order to improve understanding of, and explore solutions for, issues of such pressing concern, research in the Environmental Dynamics Lab integrates fundamental modeling studies with field research programs. In this talk, we present the details of two current projects.

First, we consider the evolving state of the Arctic ocean, where increasingly ice-free summer months mean that the Arctic Ocean surface is increasingly exposed to surface forcing by storm activity; this, in turn, enables the enhanced injection of energy into the Arctic Ocean in the form of near-inertial internal waves, which can drive enhanced ocean mixing. Our recent theoretical and laboratory studies provide new understanding of how the complex density structures typically present in the Arctic Ocean scatter internal wave fields. This understanding is being used to support the interpretation of data from Ice Tethered Profilers currently monitoring the state of the Arctic Ocean, as well as data from the September 2015 NSF ArcticMix research expedition.

Thereafter, we will show how recent mathematical ideas regarding Lagrangian Coherent Structures (LCSs) provide a new means for understanding the organization of surface transport in the ocean. Effectively, LCS-based methods provide a new data reduction tool that reveals the otherwise hidden skeleton of flow transport; this, in turn, provides new fundamental understating as well as supporting better-informed decision making strategies. An application that we are pursuing is the elucidation of transport barriers within and around coral reef systems, with a view to understanding coral reef connectivity and the design of marine park boundaries.

Refreshments will be served before the seminar.
Please contact Tony Pulsone at pulsone@mit.edu with any questions.

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