Northeastern

Department of Civil and Environmental Engineering
Distinguished Seminar Series

Waves and Wave-Driven Flow over Reefs

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Monday, November 2nd, 2015
12pm-1pm
458 Richards Hall

Abstract

Using simple models and observations, I will discuss the fluid mechanics of wave driven flow over coral reefs. I will first present results of observations made on the north shore of Moorea that illustrate several important features of how these flow work: (1) Stokes drift, the net transport due to oscillatory motions of the waves, plays a significant role in the net flow over the forereef; (2) The radiation stress model used to analyze longshore flows on beaches works reasonably well for predicting the setup of the free surface that drives flow inshore of the surfzone; and (3) the waves themselves are quite nonlinear on the shallow forereef immediately offshore of the surf zone, although key quantities like radiation stress and Stokes drift can be predicted with reasonable accuracy using the free-surface variance (rather than simple wave height) without knowing the profile of the waves themselves. I will conclude by showing recent observations from Palmyra Atoll that demonstrate that the hydrodynamic roughness of a healthy, relatively pristine reef can be an order of magnitude larger than what is seen on reefs significantly affected by human actions.

Bio

Stephen Monismith received all his degrees (BS, MS, and PhD) from the department of Civil Engineering at UC Berkeley. Following completion of his thesis, he did a postdoc in Western Australia focusing on the fluid mechanics of stratified flows in lakes. He has been at Stanford University in the Dept of Civil and Environmental Engineering since 1987, and has been the department chair since 2009. He uses field, lab, and computational experiments to look at estuarine and lake physics as well as nearshore flows with waves and stratification, focusing on mixing and transport processes that are central to ecology, biogeochemistry and environmental management. Through his work on estuarine dynamics, he has been active in San Francisco Bay-Delta issues, including helping to develop the scientific underpinnings of freshwater flow regulations. In recent years, much of his efforts (and travel) have focused on the physics of coral reef flows, with field work and modeling carried out on reefs in the Red Sea, and in nearshore waters of Hawaii, Moorea, Palmyra Atoll, and Palau. He has parallel interests studying the inner shelf flows found near and inside the kelp forests of California. Through his coral reef work, he had the opportunity to serve as the project director for a unique NATO-supported collaboration between Israeli and Jordanian scientists studying the northern Gulf of Aqaba.

Stephen Monismith, PhD

Chair, Department of Civil & Environmental Engineering

STANFORD UNIVERSITY

Stanford | ENGINEERING
Civil & Environmental Engineering

Education

- **PhD, Civil Engineering, *UNIVERSITY OF CALIFORNIA, BERKELEY***
- **MS, Civil Mechanics, *UNIVERSITY OF CALIFORNIA, BERKELEY***
- **BS, Civil Engineering, *UNIVERSITY OF CALIFORNIA, BERKELEY***

Research Interests

- **Environmental & geophysical fluid dynamics**
- **Ecological impacts of flow processes**
- **Estuarine hydrodynamics**
- **Physical-biological interactions in phytoplankton and benthic systems**

Selected Service and Awards

- **Senior Fellow, Woods Institute of the Environment**
- **Director, Environmental Fluid Mechanics Laboratory**
- **Pritchard Award, Coastal & Estuarine Research Federation – 2012**
- **Borland Hydraulics Lecture, AGU – 2011**