CGD SEMINAR

NCAR

DATE: Tuesday 5 November, 2019

TIME: 11 am – 12 pm

LOCATION: NCAR, 1850 Table Mesa Drive
Mesa Lab, Main Seminar Room

TITLE: Coral reef refugia at a smaller scale:
Diagnosing tidally-generated internal waves
and their impact on temperature variability

SPEAKER: Joanie Kleypas, NCAR
Scott Bachman, NCAR

Tidally-generated waves have the capacity to bring deeper, cooler, and nutrient-rich waters into reef environments. Although prevalent in stratified waters, the cooling effects of internal waves are often confined to the subsurface and at scales < 1 km. Thus, despite their potential importance to coral reefs, internal tides largely remain unseen or unresolved by remote sensing and oceanographic models. We test (1) whether tidally generated internal waves can be identified in high resolution models and (2) whether they drive temperature variations at depths occupied by reefs. To do this, we use a one-way series of nested regional ocean simulations to examine the roles of the barotropic tide and internal waves in driving high-frequency temperature variations in the Coral Triangle. The two finest resolutions of the series, with nominal grid resolutions of 1.5 km and 400 m, are sufficient to permit both types of waves. A filtering method using Lagrangian particles is applied to separate the wave component of the flow, which allows the diagnosis of the wave energy and its fluxes, and the identification of locations experiencing large, high-frequency temperature variability. Areas of large temperature variability are shown to possess three key characteristics: large variation of wave kinetic energy at the primary tidal frequencies, shallow depth, and a steep bathymetric gradient that provides access to cold, subthermocline water. In some locations the near-surface temperature consistently varies by over 5 degrees C on sub-daily timescales, even in the absence of atmospheric forcing. Temperature variations measured from INSTANT mooring data are of similar amplitude to those from the numerical simulations. These modeling methods provide a recipe for identifying where internal waves drive high temperature variability around the globe, which can be used for identifying refugia for coral reefs and other marine ecosystems under the threat of climate change.

Live webcast: https://www.ucar.edu/live

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