UNIVERSITY of HAWAI'I MĀNOA

Department of Atmospheric Sciences Special Seminar Announcement

Department of Atmospheric Sciences, **S.O.E.S.T.,** University of Hawai'i at Mānoa
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SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY

Tropical cyclones in vertical wind shear: Recent conceptual developments and "ventilation" pathways

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Date: Wednesday, September 14, 2016
Refreshments: 3:00pm at MSB courtyard
Free Cookies, Coffee & Tea Provided
(Please Bring Your Own Cup)
Seminar Time: 3:30pm
Location: Marine Sciences Building, MSB 100

Abstract:

Tropical cyclones (TCs) have severe, immediate impacts in tropical and subtropical regions. Significant, albeit more indirect impacts of TCs are found in the middle latitudes also. TCs provide a wealth of forecast challenges: TC intensity change is a particular prominent challenge. One roadblock to improved intensity forecasts is our incomplete understanding of the governing processes. Arguably, the most important environmental contribution to intensity change is vertical shear of the environmental winds. This presentation summarizes recent conceptual developments on TC–vertical-shear interaction based on idealized numerical experiments. Special attention will be given to the concept of ventilation, i.e. the systematic intrusion of environmental air into the inner-core convection.

The focus of many studies considering vertical shear has been on processes in the mid- to upper troposphere. Here, we will emphasize important modification of the TC's inflow layer. Vertical wind shear is prone to excite a persistent downdraft pattern tied to the tilt of the TC vortex. These downdrafts flush the inflow layer with low-entropy air diluting the TC's heat engine. Surface fluxes do not completely compensate for this entropy decrease and air within the inner-core updrafts rises with reduced entropy values. From the well-known Carnot cycle perspective, a decrease of storm intensity is then expected.

A simplified kinematic framework reveals that the downdraft region is fed by environmental, low-entropy air, arguably allowing for the persistence of the downdrafts. I will introduce a novel trajectory-based analysis that enables a succinct depiction of thermodynamic processes within the TC. This analysis supports the results from the simplified kinematic analysis and clearly demonstrates that a much-increased amount of low-entropy air from above the frictional inflow layer is drawn into TCs affected by vertical shear, as compared to TCs in quiescent environment. I will conclude with the identification of additional "ventilation" pathways and a discussion of their relative importance.