UNIVERSITY of HAWAI'I MĀNOA

Department of Atmospheric Sciences Seminar Announcement

Department of Atmospheric Sciences, S.O.E.S.T., University of Hawai'i at Mānoa
2525 Correa Road, HIG 350; Honolulu, HI 96822 ☎956-8775

SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY

The relationship between tropical convection and the large-scale state of the atmosphere: implications for future thunderstorm intensity

Professor Martin Singh
School of Earth, Atmosphere & Environment
Monash University

Date: **Wednesday, April 24, 2019**
Refreshments: **3:00pm at MSB courtyard**
Cookies, Coffee & Tea Provided
Seminar Time: **3:30pm**
Location: **Marine Sciences Building, MSB 100**

Abstract:

According to the parcel view, thunderstorms occur as a response to conditional instability in the atmosphere. While this may be a reasonable model for an individual storm, on large scales, tropical precipitation has only a weak relationship to instability, and it is instead highly correlated with the environmental humidity. For instance, recent observational analyses have revealed that while the convective available potential energy (CAPE) peaks when the free troposphere is relatively dry, the highest daily precipitation rates are observed in regions where the free troposphere is close to saturation. In this talk, I will present a simple bulk-plume model for the thermodynamic structure of a region of the atmosphere under the influence of the large-scale flow, extending the results of Romps (2014) who considered the special case of radiative-convective equilibrium. The bulk-plume model reproduces the strong relationship between precipitation and environmental humidity found in observations, despite the fact that no direct sensitivity of convection to its environment is built in to the model. Furthermore, the bulk-plume model suggests that the atmosphere is most unstable under conditions where the tropospheric humidity is low, and specifically, where the saturation deficit of the environment is large. As the atmosphere warms due to climate change, this saturation deficit increases as a result of the Clausius Clapeyron relationship, implying increasing potential for intense thunderstorms under future global warming. Evidence for the importance of the saturation deficit for thunderstorm potential is presented from both observations and general circulation models.