UNIVERSITY of HAWAI'I MĀNOA

Department of Atmospheric Sciences
Special Seminar Announcement

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SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY

A Modeling Study on Coupling between Westerly Wind Events and ENSO

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Date: Wednesday, September 21, 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:

The El Niño-Southern Oscillation (ENSO) phenomenon is the interannual variability of the coupled atmosphere-ocean system at the equatorial Pacific. Westerly wind events (WWEs), defined as strong surface wind anomalies persisting for a few days to weeks over the western-central equatorial Pacific, are observed frequently during El Niño. Despite the frequency gap, the interaction between WWEs and ENSO has been suggested. However, the role of WWEs for the spatio-temporal diversity of ENSO is not fully understood yet. The purpose of this study is to clarify important processes of coupling between WWEs and ENSO on the diverse behavior of ENSO. In Chapter 2, the response to WWEs was examined by ensemble experiments using a coupled atmosphere-ocean general circulation model (CGCM) with an ideal WWE forcing in several timings and locations. The response to WWEs depended on the timing of an imposed WWE through the interaction with the annual cycle of atmosphere and ocean. Asymmetric response to WWEs between El Niño and La Niña was also shown. Chapter 3 shows the characteristics of WWEs and easterly wind events (EWEs) and their state dependence and asymmetry by analyzing observational data. Both types of events appear over the warm pool, where SST is sufficiently high for active deep convection, favorably occur with increasing the SST at the Niño4 region. However, the frequency of occurrence of EWEs is less than that of WWEs due to the asymmetry in their development processes. In Chapter 4, the coupled system between WWEs and ENSO was investigated using a coupled atmosphere-ocean model with intermediate complexity by parameterizing the state-dependent atmospheric noise based on Chapter 3. When additive noise are given over the western Pacific (AD), oscillations become irregular but the increase of its variance depends on the thermocline feedback strength, γ. When the state-dependent noise is adopted (SD), the solution is also irregular besides its variance and asymmetry increase irrespective γ. Both the additive and state-dependent noises produced the eastern-Pacific (EP) and central-Pacific (CP) El Niños. CP El Niño is favored by the state-dependent stochastic noise, which enhances the zonal advection to warm the central Pacific, and in turn the warmer Niño4 SST increases the probability of occurrence of the noise. Thus, the state dependence of the noise may play a crucial role on the asymmetry and diversity of ENSO in nature. Therefore, the reproducibility of the background annual cycle, high-frequency atmospheric disturbances related with WWEs, and their interaction in numerical models may influence the El Niño prediction and future projection of ENSO.