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Department of Atmospheric Sciences Seminar Announcement

A Comparison of Simulated Seasonal and Diurnal Leeside Circulations between the Island of Hawaii and Oahu

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Abstract:

Most of the areas in Hawaii have winter wet/summer dry weather patterns. The Kona lee side area of the largest island in the Hawaiian Island chain, the Island of Hawaii, is the only area in the State of Hawaii that exhibits a summer rainfall maximum during the annual cycle. In this study, the historically daily real-time experimental forecasts using the MM5 model during 2004-2009 for major Hawaiian Islands were used to analyze the island scale climate during the seasonal and diurnal cycles. Our results show that the summer rainfall in the Kona area is a combined result of orographic blocking and land-sea thermal contrast. During the summer months, the diurnal heating cycle over the island of Hawaii is more pronounced than any other time of the year. In addition to orographic precipitation on the lower slopes due to the development of afternoon upslope flow, the Kona leeside has a nocturnal rainfall regime along the coast due the convergence between offshore flow and the westerly moist reversed flow off the lee side coast. During the summer months, trades (6-8 m s^{-1}) are the strongest and most persistent. The westerly moist reversed flow off the Kona coast is strongest in summer with significant coastal convergence after sunset.

In contrast to the Island of Hawaii, the western lee side of the Island of Oahu is dry and warm with very little rainfall in summer. For the mountain ranges of Oahu, the Froude number (Fr) is about 1. Thus, it is unlikely for the flow splitting on the windward side with a dynamically driven westerly return flow on the lee side to occur under normal NE trade wind flow. Despite its relatively small size the diurnal driven circulations are pronounced throughout the year. The western lee side coast of Oahu is dominated by the thermally driven afternoon sea-breeze circulation and is most significant during the summer months. However, with the depletion of moisture by orographic showers over the Koʻolau and Waianae mountain ranges and descending airflow aloft, the western lee side of Oahu is relatively dry with much lower precipitation as compared to the Kona lee side of the Big Island.

Inter-Comparison of CMIP5 Model Representations and Satellite Observations of Cloud-Aerosol Interactions

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Abstract:

Aerosols are a critical component of the Earth's atmosphere and can affect the climate of the Earth at a variety of spatial and temporal scales through their interactions with solar radiation and clouds. They can both directly and indirectly affect the planet. These indirect effects can alter the structure of a cloud, through reduction of the average size of droplets present in the cloud (first indirect effect) or by reducing the amount of precipitation formed in a cloud (second indirect effect). Because clouds can affect the radiation budget by both warming and cooling the Earth, it is necessary for these direct and indirect effects to be studied further in order to better understand climate change. Recent breakthroughs in global climate modeling efforts have improved our understanding of cloud-aerosol interactions, but many uncertainties and dissimilarities between the models and observed satellite data remain.

In order to identify areas where climate models may poorly represent cloud-aerosol interactions, model data is compared with satellite observations. Here we use cloud and aerosol properties available from the MOderate Resolution Imaging Spectroradiometer (MODIS) satellite (i.e. aerosol optical depth and cloud fraction), and then analyze analogous cloud and aerosol properties from CMIP5 models that explicitly include aerosol-cloud interactions. These models include the GFDL, CAM5, MRICGCM3, NorESM1M, and MIROC5. Similarities and differences between the MODIS and model data are then identified and visualized by calculating the differences between the two data sets to identify regions of the Earth where the models over- or under-predict aerosol or cloud amount. Through the use of map visualizations, regions and seasons of interest are identified to focus on different aerosols, such as biomass burning smoke, dust, or industrial pollution. Once regions and seasons of interest are identified, the analysis of both the microphysical and radiative effects of aerosols with respect to clouds will be completed by calculating CF vs. AOD curves for both the model and satellite data sets. Thus, it will be possible to assess the ability of the CMIP5 models that explicitly include aerosol-cloud interactions to accurately represent satellite observations of aerosols and clouds and their observed relationships.

Date: Wednesday, April 29, 2015
Refreshments: 3:00pm – 3:30pm at MSB Lanai
Free Cookies, Coffee & Tea Provided
Seminar Time: 3:30pm
Location: Marine Sciences Building, MSB 100