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SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY

Department of Atmospheric Sciences Ph.D. Dissertation Defense Announcement

Ph.D. Dissertation Title:

Estimating volcanic sulfur dioxide to sulfate aerosol conversion rates in Hawai'i

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Date: **Monday, March 14, 2016**
Time: **1:00 PM**
Location: **IPRC Conference Room, POST 414**

Abstract:

Volcanic smog, known as vog, has been a persistent issue on the island of Hawaii since the eruption of Kilauea Volcano began in 1983. Vog, made up of sulfur dioxide (SO_2) and sulfate aerosols (collectively referred to as SO_4) pose a significant health risk to communities surrounding the volcano and on the leeward coast of Hawai'i. The Vog Measurement and Prediction Project (VMAP) was launched by the University of Hawai'i at Manoa (UHM) and United States Geologic Survey (USGS) in 2010 as a feasibility study to evaluate whether vog forecasts are achievable and usable. The UHM Vog Model has been operational since 2010 producing forecasts of sulfur dioxide and sulfate aerosols for the entire state of Hawai'i.

The UHM Vog Model is intended to help the public avoid high concentrations. More recently, the Hawaii Department of Health (HDOH) expressed interest in using model forecasts to issue air quality alerts when projected concentrations exceed certain thresholds. These alerts are meant to protect sensitive groups, which include the elderly, the young, and people with respiratory problems, especially asthma. Early evaluations of the model performance suggest that the model has trouble forecasting elevated levels of both SO_2 and SO_4, bringing the reliability of the model into question for issuing warnings. To address these shortcomings a number of improvements to the model are considered. The most promising improvement is including a more comprehensive sulfur chemistry scheme to the model to represent the conversion of SO_2 to SO_4.

A new sulfur chemistry scheme was constructed for inclusion into the UHM Vog Model. This scheme was based on kinematic theory and past research on sulfur chemistry. To provide a baseline for the new scheme a brief field campaign was conducted in the summer of 2015 to estimate the conversion rate of SO_2 to SO_4. The new sulfur chemistry scheme, along with other available schemes, was evaluated against observations of SO_2 and $PM_{2.5}$ around the island of Hawai'i during the November of 2015. The results of this evaluation suggest the new sulfur chemistry scheme improved forecasts for SO_2. Also, as forecasted time-windows extend from one hour to six hours the probability of detection for SO_2 exceedance events increases at certain sites from 10-30% to 50-70%.