

ATS/CIRA Colloquium

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**Exploring environmental and microphysical
controls on orographic precipitation**

Hosted by Russ Schumacher

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via Microsoft Teams

Orographic precipitation provides a substantial source of freshwater to communities worldwide, while also posing hydrometeorological and socioeconomic risks. Understanding where, how much, and what type of precipitation will occur remains a forecasting challenge. The environmental conditions upstream of a topographical barrier can bring the ingredients necessary for precipitation, but once clouds form over mountain slopes, the details become more complex as hydrometeors form and interact with each other and their environment. To understand better the environmental and microphysical controls on orographic precipitation, novel sensitivity analysis (SA) methods are applied to idealized simulations of moist neutral flow over a bell-shaped mountain using a high-resolution cloud model (CM1) and testing various environmental conditions (e.g., horizontal wind speed) and microphysical parameters (e.g., snow fallspeed coefficient). These SA methods include 1) the Morris-one-at-a-time (MOAT) method exploring interactions between a large set of parameters through multivariate perturbations, providing a subset of the most important or sensitive parameters; and 2) a Markov chain Monte Carlo (MCMC) algorithm to explore a large parameter space efficiently, gaining insight into environmental and microphysical parameter interactions and relationships. This presentation will introduce these SA methods and their application to the study of orographic precipitation, present results and major conclusions from two recent studies, and discuss open questions and broader impacts of this work.

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