

# MMM SEMINAR SERIES



## *Multiscale perspectives on aerosol-cloud-turbulence interactions from laboratory experiments, theory, and numerical simulations*

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Clouds are a crucial component of the climate system, affecting radiative forcing and the hydrological cycle. Of particular importance, clouds and associated microphysical processes significantly impact climate sensitivity. Turbulence is woven into cloud microphysical interactions at various scales and thus is challenging to represent in atmospheric models with limited resolution capability. Macro-scale cloud properties intimately depend on small-scale properties such as cloud particle size and concentration, which are directly coupled to the turbulent environment and aerosol properties. This talk will cover aerosol-cloud-dynamics interactions at laboratory scales to the mesoscale, focusing on microphysical details. Aspects of this complex problem are investigated using three different approaches -- laboratory experiments, theory, and numerical modeling. Experiments in the Michigan Tech Pi Cloud Chamber show turbulence-induced broadening of droplet size distributions, and the aerosol concentration modulates this broadening process. The theoretical droplet size distribution shapes in turbulent clouds and their comparison with experiments will be discussed. The numerical modeling part of the talk will cover investigations of this multiscale problem using large-eddy simulations of a stratocumulus cloud field and cumulus congestus clouds. A state-of-the-art Lagrangian particle-based microphysics scheme ("super-particle method") is used for these numerical simulations that is significantly advanced compared to traditional Eulerian bin and bulk schemes. The talk will end with a broader discussion of how these process-level investigations of aerosol-cloud-turbulence interactions could improve the bulk representation of clouds in weather and climate models.

**Thursday, 11 January, 2024, 2:00PM**

**Refreshments 1:45PM**

**Please also join colleagues for refreshments and informal discussion after the seminar until 3:30pm**

NCAR-Foothills Laboratory, 3450 Mitchell Lane  
FL2-1022, Large Auditorium

**Seminar will also be live webcast**

<https://operations.ucar.edu/live-mmm>

Participants may ask questions during the seminar via Slido.