"The Distribution of Atmospheric Ice Particle Shapes and Their Observations"

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Models and observations currently use power-law relations and size distributions to connect ice particle geometry to integrated "bulk" properties like ice water content, snowfall rates, or radar reflectivity. While plenty of studies have explored the relationship between these geometric assumptions and their resulting bulk quantities, very few studies have explored the implications of these parameterizations on the distribution of ice particle geometry itself. Newer microphysics models are now directly predicting and evolving the power-law relationships that modulate ice particle geometry distributions. These new microphysics models therefore require innovative methodologies for appropriately comparing modeled particle shapes to observational estimates and techniques for incorporating multiple geometric measures into bulk calculations.

This seminar addresses two separate problems associated with estimating and modeling distributions of ice particle shape. First, I will present a methodology for transforming distributions of 3D spheroidal ice particle shapes to the distributions of 2D ellipse analogs that one could estimate from in situ cloud probe observations. I use this methodology to explore how various distribution parameters associated with particle size, shape, and orientation would affect the observed 2D ellipse fit distribution and how much these uncertainties obfuscate our current understanding of ice particle geometry. Second, I will show recent observations of snow aggregate geometry derived from the Multi-Angle Snowflake Camera (MASC) instrument. MASC derived tri-axial ellipsoids exhibit a near "universal" distribution form that Monte Carlo simulations of aggregates can also amazingly produce. These Monte Carlo simulations are used to explore how aggregate shapes and densities evolve throughout aggregation. The results from these simulations counter many of the prevailing and often cited claims about aggregate shapes. Finally, I show that the use of a bivariate ellipsoid distribution in model calculations allows for realistic and observationally consistent estimates of both mass and fall speed distributions. The use of such an ellipsoid distribution in model calculations reduces number-weighted fall speed by about ½ but increases size sorting anywhere from 8% to 20%.

Thursday, 30 May 2019, 3:30pm

Refreshments 3:15pm

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

This seminar will be webcast live at:
http://ucarconnect.ucar.edu/live

Recorded seminar link can be viewed here:
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