ATS/CIRA Colloquium

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Hosted by Chris Kummerow

3 p.m. Thursday, January 18
ATS 101 and Zoom

Revisiting Remote Sensing of Cloud Microphysical Properties: A Physics Perspective

The global climate is in part regulated by complex radiative interactions with clouds on various spatial scales in the atmosphere. Satellite remote sensing observations can provide global distributions of cloud properties, while airborne remote sensing observations can characterize local-scale cloud properties. The common essence in both remote sensing observation types is how to interpret radiometric signals and derive cloud properties based on physical principles. Since the satellite era, numerous efforts relying on standalone spaceborne remote sensing have been made to improve the characterizations of cloud properties on a global scale. Nevertheless, accurate cloud remote sensing is still challenging partly due to insufficient observational information and inappropriate assumptions made in the remote sensing algorithms. This obstacle becomes more unambiguous, given a recent significant demand for spaceborne datasets for physical process-oriented cloud microphysics studies. In this talk, I will introduce a couple of potential pathways to overcoming the obstacle. The first part of this presentation will focus on the characterization of marine water cloud properties based on the synergistic use of MODIS shortwave observations and CloudSat radar observations. Vertically inhomogeneous droplet profiles are considered in the MODIS-CloudSat remote sensing algorithm, and therefore the retrieved cloud properties are useful for the physical process studies of marine water clouds. The second part of this presentation will focus on the maximum use of lidar and other observations for a better characterization of cloud properties involving ice crystals. The effort began with a solid understanding of the backscattering properties of a single ice crystal. Coherent backscattering (CB) in single-scattering is found to be an essential mechanism for robust backscattering property simulations of an ice crystal and is incorporated into the backscattering simulations, enabling physics-based interpretation of lidar signals into the ice crystal properties. In addition, future research plans on the characterization of mixed-phase clouds using the University of Wyoming King Air (UWKA) remote sensing observations will be discussed.

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