Geophysical Research Abstracts
Vol. 13, EGU2011-3785, 2011
EGU General Assembly 2011

An investigation of ice crystal sizes and shapes in deep convective clouds using radiance and polarization measurements in conjunction with model simulations

Bastiaan van Diedenhoven (1,2), Ann Fridlind (2), Andrew Ackerman (2), and Brian Cairns (2)

(1) Columbia University, Center for Climate Systems Research, New York, United States (bvandiedenhoven@giss.nasa.gov), (2) NASA Goddard Institute for Space Studies, New York, United States

Deep convective clouds play an important role in the global climate system. In the tropics, the delicate balance between top-of-atmosphere longwave and shortwave radiative forcing by convectively generated ice clouds depends significantly on the sizes and shapes of the ice crystals. Important research questions are what sizes and shapes of ice crystals are produced in such deep convective events, and how they evolve with time. We contribute to addressing these questions using detailed model simulations in conjunction with a unique combination of aircraft remote sensing data obtained during the CRYSTAL-FACE campaign over Florida, including multi-spectral multi-directional total and polarized reflectances from the Research Scanning Polarimeter (RSP), and well-established retrievals from the MODIS Airborne Simulator (MAS). In a case study typical of CRYSTAL-FACE conditions, we show that ice crystal sizes and shapes vary significantly with cloud top temperature, and that these temperature dependencies in turn vary with the evolutionary stages of the observed storm system. Finally, we evaluate the ability of a cloud-resolving model with size-resolved microphysics to capture the fundamental observed micro- and macro-physical characteristics of the typical evolving storm system.