Physics Colloquium
Michigan Technological University

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Room 139, Fisher Hall

Evidence for Giant Aerosol Particles as a Source of Supercooled Large Drops in Wintertime Stratiform Clouds

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Supercooled large drops (SLD) can pose a significant hazard for aviation because they tend to accumulate behind the leading edge of the wings where deicing mechanisms are lacking. Even when present in small amounts, SLD can cause significant ice buildup that degrades aircraft performance through decreased lift and increased drag. Multiple studies have demonstrated that warm rain processes are prevalent, or even dominant, in mixed-phase stratiform clouds containing SLD, but the formation mechanism for SLD has not been suitably demonstrated. Here, the possibility that SLD form upon giant (diameter > 2 μm) aerosol particles is investigated, using observations collected with the National Center for Atmospheric Research's (NCAR) C130 aircraft during the second Alliance Icing Research Study (AIRSII). The observations are used to quantify and compare SLD in the clouds and giant aerosol particles in the clear air. Four of the six flights investigated have comparable numbers of SLD and giant aerosol particles; the other two flights have SLD concentrations several orders of magnitude less than the observed number of giant aerosol particles. No difference in the atmospheric or cloud conditions is found to explain the disparity in the results, but chemical analysis of collected giant aerosol particles reveals significant daily variability in their chemical composition. Surprisingly, the majority of giant aerosol particles collected on some flights were composed of salt. Backward air trajectories computed from the observation sites using numerical weather prediction model data suggest a local source of these giant salt particles rather than long-range transport from the oceans.