

Chain Aggregates Observations during Recent Field Campaigns

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Cloud aggregation is a fundamental process involved in the chain of events that produces precipitation. Ice crystal aggregation occurs due to the continuous influence of aerodynamic, inertial, and gravitational forces in clouds that result in collisions. Many recent field projects have observed elongated, chains of individual crystals that form an aggregate, which are called “chain aggregates”. Electrical forces have been the main explanation for how similarly sized crystals can form long, linear aggregates. Laboratory experiments show that chain aggregates form with strong electric fields (greater than 60 kV m⁻¹) due to enhanced aggregation efficiency likely caused by an induced dipole on the crystals which promotes collisions. Understanding the context of where and when chain aggregates are observed in terms of the time evolution of cloud systems provides important information about possible formation processes. Machine Learning methods are a critical tool for identifying the millions of aggregate images obtained during a single research flight. Additionally, aggregate observations need to be put into context with other measurements and related to the storm’s life cycle. The observations of high concentrations of chain aggregates during recent field projects show that a better understanding of them is needed to understand their effects on the aerodynamics of vehicle flights, interpretation of remotely sensed data (radar, lidar), cloud radiative effects, and electrification processes.

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