Observations of Chain Aggregates in Florida Cirrus Cloud Anvils during the CapeEx19 Field Campaign

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**ABSTRACT:** During the CapeEX19 field campaign in the summer of 2019 near Melbourne, Florida, the North Dakota Citation Research Aircraft observed chain-like aggregates of ice crystals in convection-induced cirrus anvils. Exactly where and how the chain aggregation process is occurring in the thunderstorm is still not well understood, which inhibits their representation in atmospheric cloud models. Cloud chamber experiments indicate that the cloud electric fields play an important role in the development in chain aggregates, as well as other microphysical parameters. CapeEx19 aircraft instruments included six Rotating-Vane Electric Field-Mills for in-situ electric field strengths, and the Particle Habit Imaging and Polar Scattering (PHIPS) probe for high resolution particle images and microphysical information of the particles. In addition to the electric field and PHIPS data, lightning data provided by the National Lightning Detection Network (NLDN) and the Kennedy Space Center Lightning Mapping Array (KSCLMA) enable documentation of thunderstorm electrical activity and charge structure. During the CapeEx19 field campaign, over 170,000 particle images from the PHIPS probe were taken where a large percentage of the particle images appear to be chain aggregates. In addition, some of the chain aggregates from the flights were comprised of pristine ice crystals from different temperature regimes with a lack of rimed ice. The observed chain aggregates from multiple flights were observed between 10 – 100 km from the storm cores within the cirrus anvil. Interestingly, the aircraft sampled electric field strengths greater than 10 kV/m in the cirrus anvils near the vicinity of convective storm cores during multiple flights. This implies that chain aggregation might be possible higher aloft in much colder temperatures within the thunderstorm. This sizable data set gathered during the CapeEx19 field campaign enables an investigation to answer the question do the microphysical properties/characteristics and amount of chain aggregates change with respect to the different storm environments with varying electrical activity. Moreover, the inquiry that chain aggregation is possible in the cirrus anvils near the vicinity of the convective storm cores is investigated.