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Title: Analysis of Cloud Condensation Nuclei Measurements Conducted during the Polarimetric Cloud Analysis and Seeding Test Projects

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Abstract: Cloud Condensation Nuclei (CCN) activation produces cloud droplets that can develop into rain. CCN number concentration is determined using a counter that pulls an air sample into a supersaturated environment and counts the number of droplets that form. Researchers have operated CCN counters at the surface and on aircraft. When using CCN measurements to study hygroscopic cloud seeding, cloud base is the most desirable sampling location; however, the expense and difficulty of aircraft measurements limits their availability. Hence, it is important to determine under what meteorological conditions surface based CCN measurements can be used to infer cloud base CCN concentrations. Understanding when surface measurements accurately predict cloud base CCN concentrations would allow long term, continuous, surface-based measurements to be used to determine on which days hygroscopic seeding is most effective. During the summer of 2010 and 2012, sixteen aircraft flights that measured cloud base CCN concentrations with concurrent surface base CCN measurements were conducted near Grand Forks, North Dakota. Flight profiles show a well mixed CCN concentration layer between the surface and cloud base for almost all cases. Hence, typically surface measurements can be used to infer cloud base properties. Statistical summaries indicate that day-to-day changes in CCN concentrations are much larger than regional variations. Since CCN concentration is predicted to affect the effectiveness of hygroscopic seeding, knowing the daily CCN concentration is important and surface measurements can be used to obtain cloud base CCN concentrations for summer time convective clouds in North Dakota.