Empirical Estimates of Cloud Condensation Nuclei (CCN) from Field Observations

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The highest uncertainty associated with climate forcing comes from indirect forcing or clouds. How to parameterize the cloud spatial variance, lifetime, albedo precipitation and formation presents challenges to models and measurements. One such challenge is the characterization of aerosol activation into cloud droplets as a function of the percent water super saturation. Kohler theory of aerosol activation requires use of the size-dependent, aerosol composition to predict the CCN concentration. Several methods seek to simplify parameters within Kohler's equation to make the calculations feasible in large regional and global models.

This study presents an empirical method to predict the CCN concentration as a function of percent water super saturation. The aerosol optical properties of backscatter fraction and single scatter albedo function as proxies for the aerosol size and composition in a power law relationship to CCN. This method is tested at four sites with aged aerosol: SGP (Oklahoma, USA), FKB (Black Forest, Germany), HFE (Hefei, China) and GRW (Graciosa, Azores). Each site represents a different aerosol type and thus demonstrates the method robustness and limitations.

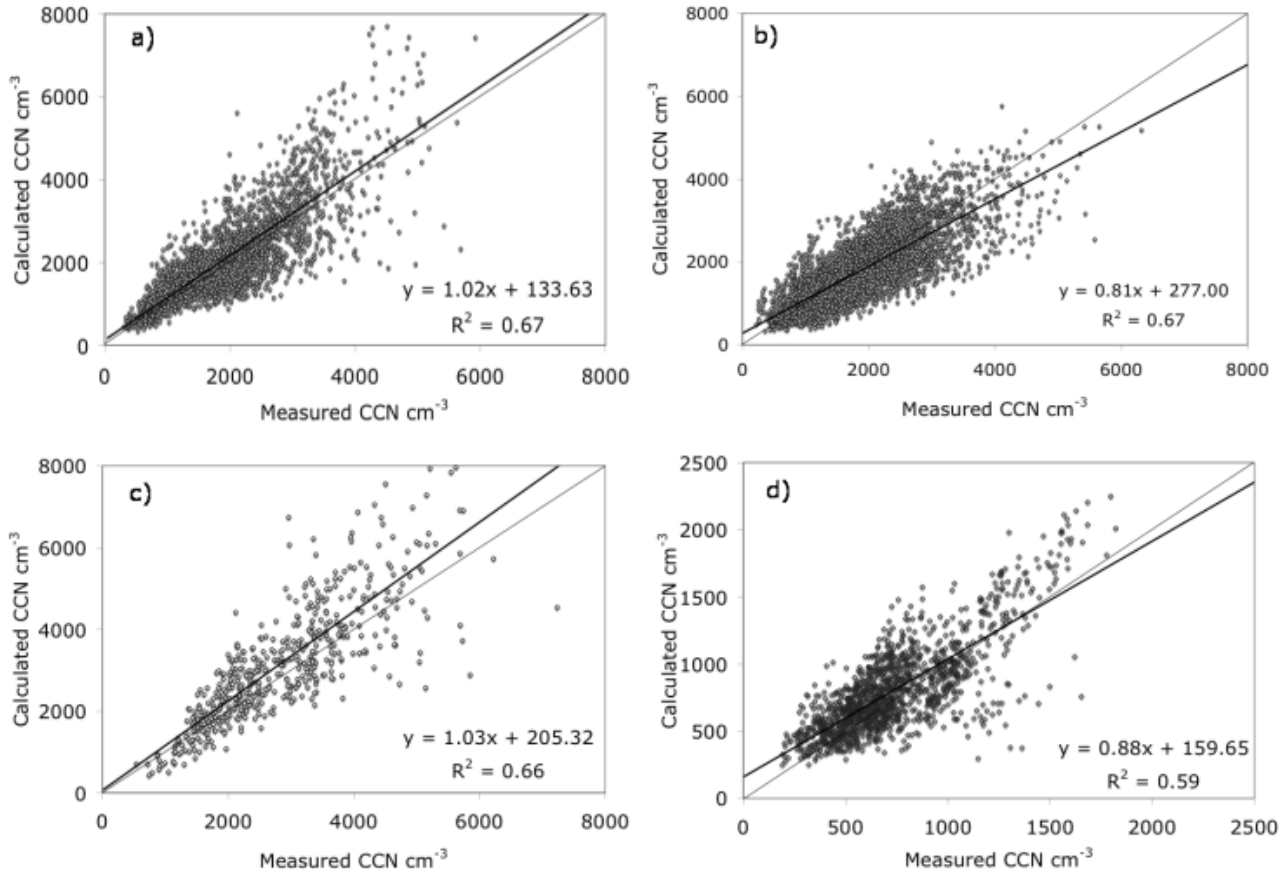

Figure 1. Correlations of calculated versus measured CCN from about 0.2 to 0.8 percent supersaturation for: a) Oklahoma, U.S. b) Black Forest, Germany c) Hefei, China, and d) Graciosa, Azore Islands. Least square fit and 1:1 lines are shown on each graph.