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Technical Note: Characterization of a static thermal-gradient CCN counter

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Abstract. The static (parallel-plate thermal-gradient) diffusion chamber (SDC) was one of the first instruments designed to measure cloud condensation nuclei (CCN) concentrations as a function of supersaturation. It has probably also been the most widely used type of CCN counter. This paper describes the detailed experimental characterization of a SDC CCN counter, including calibration with respect to supersaturation and particle number concentration. In addition, we investigated the proposed effect of lowered supersaturation because of water vapor depletion with increasing particle concentration. The results obtained give a better understanding why and in which way it is necessary to calibrate the SDC CCN counter. The calibration method is described in detail and can, in parts, be used for calibrations also for other types of CCN counters.

We conclude the following: 1) it is important to experimentally calibrate SDC CCN counters with respect to supersaturation, and not only base the supersaturation on the theoretical description of the instrument; 2) the number concentration calibration needs to be performed as a function of supersaturation, also for SDC CCN counter using the photographic technique; and 3) we observed no evidence that water vapor depletion lowered the supersaturation.

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