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Versatile aerosol concentration enrichment factor system (VACES) operating as a Cloud Condensation Nuclei concentrator - Development and laboratory characterization

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The activation of atmospheric aerosol particles to cloud droplets is fundamental for cloud formation. Cloud condensation nuclei (CCN), a subset of the atmospheric aerosol, constitute one of the largest uncertainties in estimating global climate change. The ability of atmospheric aerosol particles to act as CCN depends on many factors, including particle size, chemical composition, and meteorological conditions. To enlarge the knowledge on CCN, it is essential to understand the factors leading to CCN activation. For this purpose a versatile aerosol concentrator enrichment factor system (VACES; Sioutas et al., 1997) has been modified to select CCN at different supersaturations. The redesigned VACES enriches CCN particles by first passing the intake flow to the saturator and then to the condenser. The activated particles are concentrated by an inertial virtual impactor, and then returned to their original size by diffusion drying. VACES enables to sample CCN particles without altering their chemical and physical properties. The modified system was characterized and calibrated using NaCl particles. Calibration results have shown that CCN concentrations can be enriched by a factor of approx. 16.