1 Clean bag transfer

For a clean bag transfer, both chambers are cleaned according to the respective cleaning procedures. Then a transfer is performed by refiling MICC from the MAC bag. Aerosol numbers larger than the numbers in the chambers before transfer are thus a result of introduction from leakages in the system. These background aerosol need to be taken into account for any experiment performed on specified aerosol 'cooked' in the aerosol chamber. That means, in case of ice formation in very low numbers, nucleation of ice on these contaminant aerosol cannot be ruled out.
Aerosol concentrations in the aerosol and cloud chamber were both below 1 cm^{-3} prior to transfer. After the transfer 10.1 cm^{-3} aerosol particles were observed by the CPC in the cloud chamber.

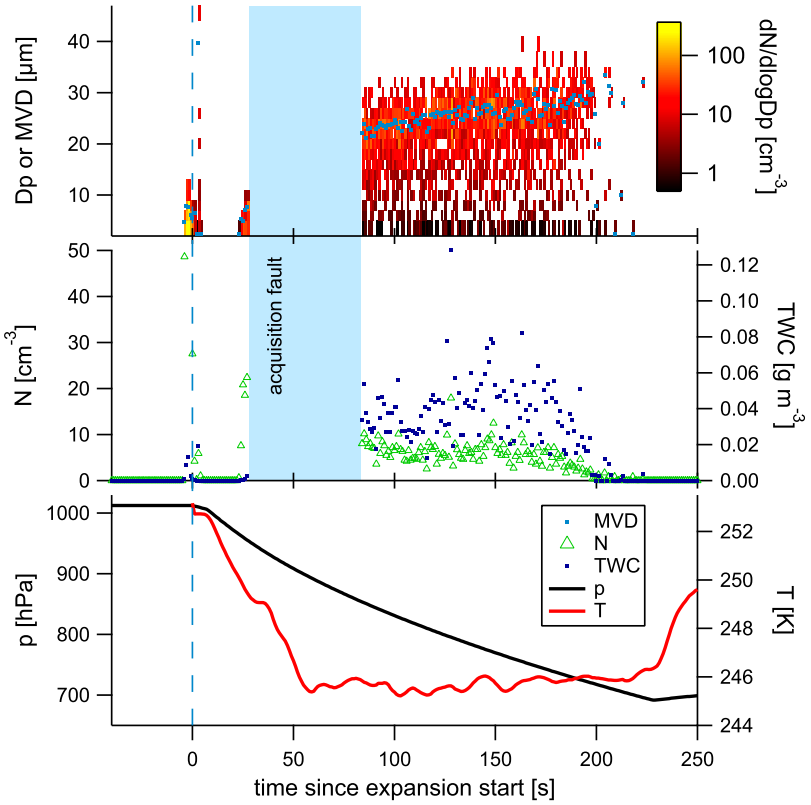

Figure S.1: First cloud evacuation after the clean bag transfer. The panels show the time series of FSSP measurements of size distribution and mean volume diameter (MVD, panel a) and total water content (TWC) and number concentration (N, panel b), and temperature and pressure (panel d) during evacuation.

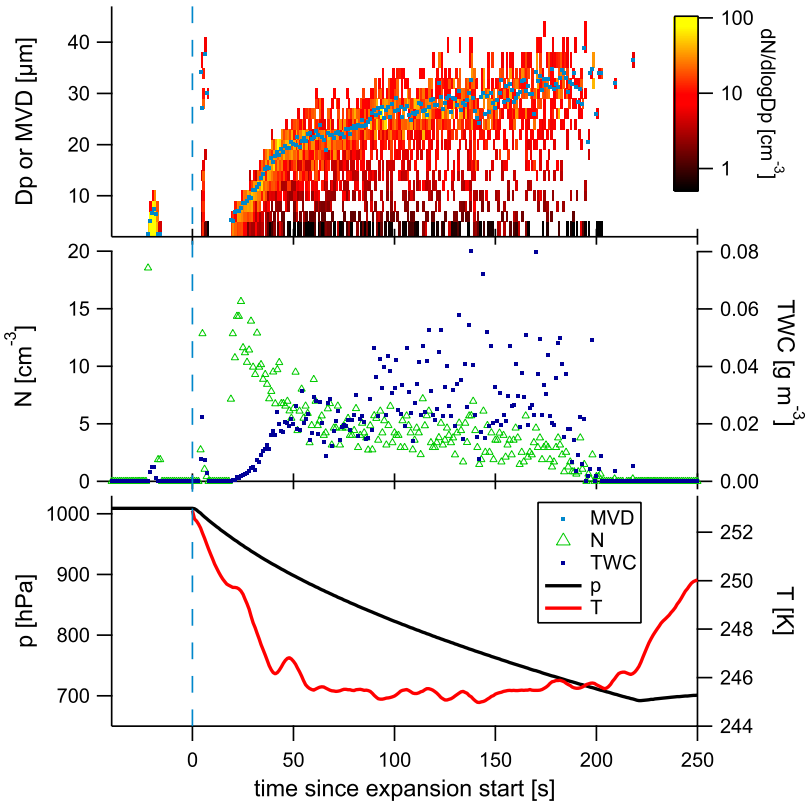

Figure S.2: Second cloud evacuation after the clean bag transfer. Panels as above.

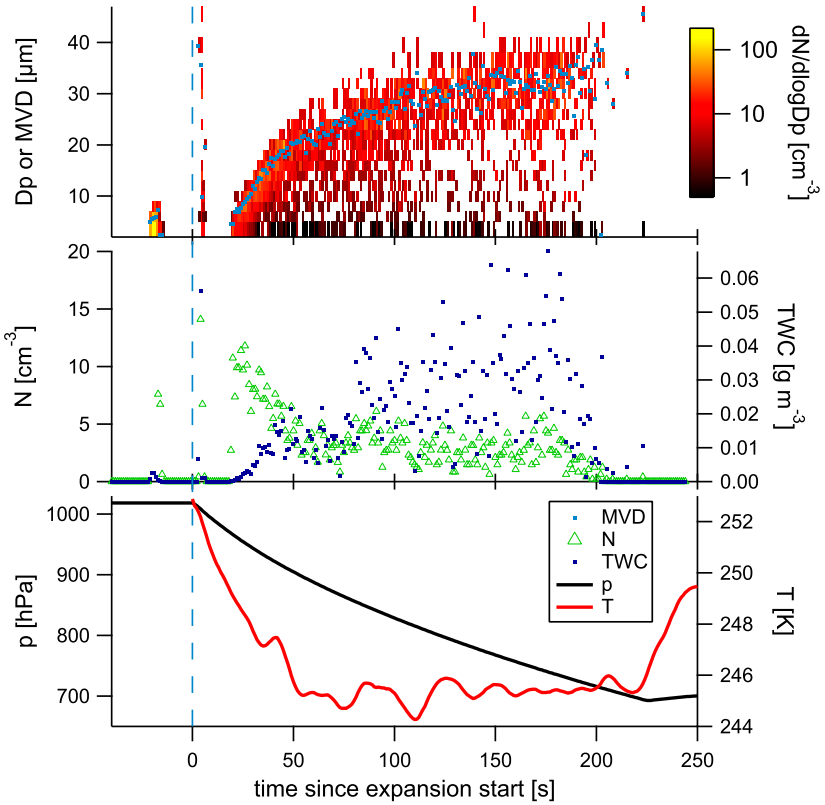

Figure S.3: Third cloud evacuation after the clean bag transfer. Panels as above.

2 Particle bounce measurements

Previous to our measurements, transfer experiments on some of the same (and some additional) systems were performed and the phase state of particles were determined by particle bounce measurements (see Saukko et al., 2012a,b for a detailed desription of the methods). Here an upgraded version of the bounce system, the Aerosol Bounce Instrument (ABI), was employed. ABI consists of a particle size selection unit (neutralizer containing bipolar ^{210}Po strip and Vienna type long DMA), a humidification unit (Permapure PD-240-12SS, Nafion multitube), impactor unit (MOUDI stage #14 with upstream pressure, $p_{initial} = 0.85$ bar, and downstream pressure, $p_{final} = 0.7$ bar, leading to a cut-off aerodynamic diameter $d_a = 67.09$ nm), and two CPCs (TSI, model 3010) for measuring the particle number concentration before and after the impactor. ABI determines a bounced fraction (BF) of particles which is used as an indicator of the phase state of particles; particles with BF $\tilde{0}$ are mechanically liquid whereas particles with $0.1 < BF < 1$ are mechanically solid or semi-solid. Calculation and calibration of bounce measurements are described in more detail by Saukko et al. (2012b).

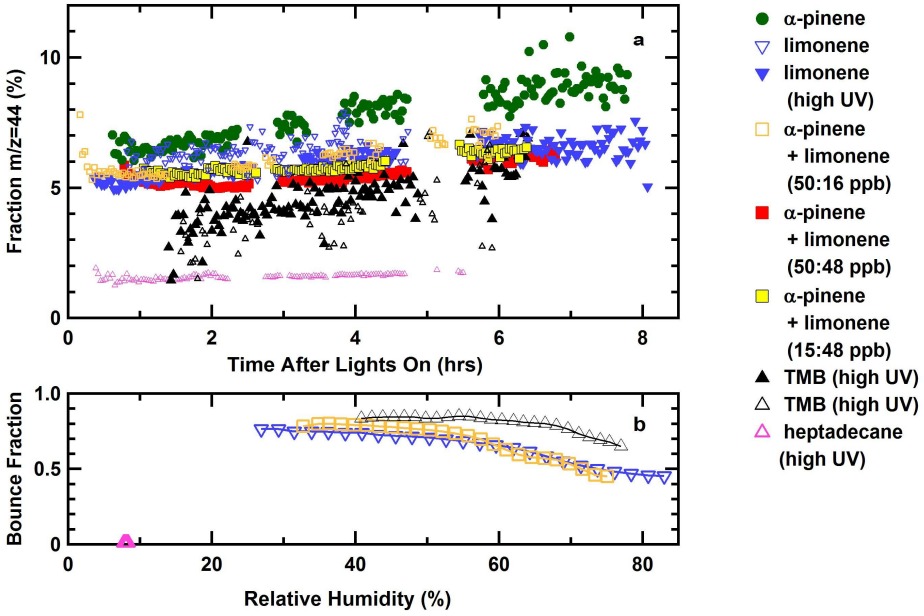

Figure S.4: Composition and bounced fraction of SOA particles in MAC. Open symbols represent data collected in experiments where there was no quantitative ice nucleation data. Panel a shows the mass fraction of the AMS fragments measured at m/z=44 throughout their growth in the aerosol chamber. Panel b shows bounced fractions for heptadecane, α-pinene/limonene and limonene experiments as a function of RH at the latest available time before transfer. In general higher bounce fractions are found at lower relative humidity. It can clearly be seen that SOA from the heptadecane experiment exhibit very different behaviour, maintaining a bounced fraction of less than 1.2% even at the lowest available RH. All other bounced fraction data is similar to the other examples shown. The heptadecane experiment also shows a much lower m/z=44 fraction than in other experiments.

3 SOA background

Two types of SOA backgrounds were transferred, one dark and one light background. That means, all ingredients as in a normal SOA experiment were used, without the actual precursor. In the dark background experiment the lights remained switched off whereas in the light experiment, the lamps responsible for photo-chemical reactions were switched on.

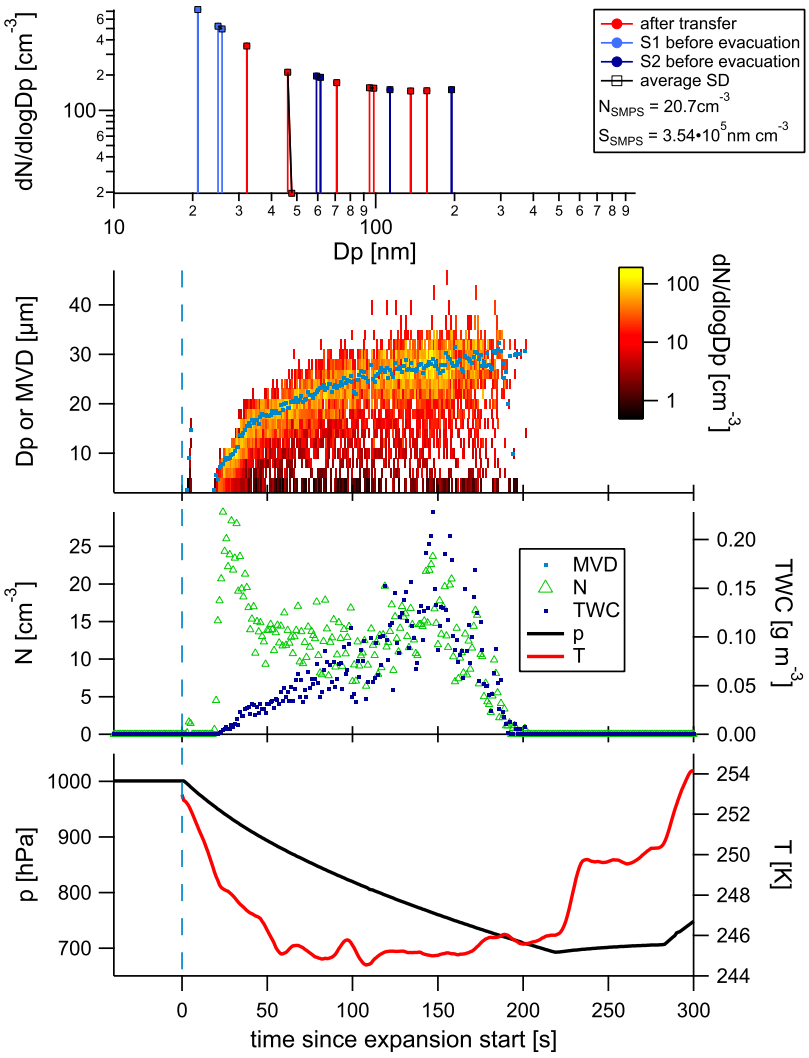

Figure S.5: First cloud evacuation during dark SOA background measurements. The uppermost panel shows the SMPS size distributions obtained before the expansion, followed by time series of FSSP measurements of size distribution and mean volume diameter (MVD, panel b) and total water content (TWC) and number concentration (N, panel c), and temperature and pressure (panel d) during evacuation.

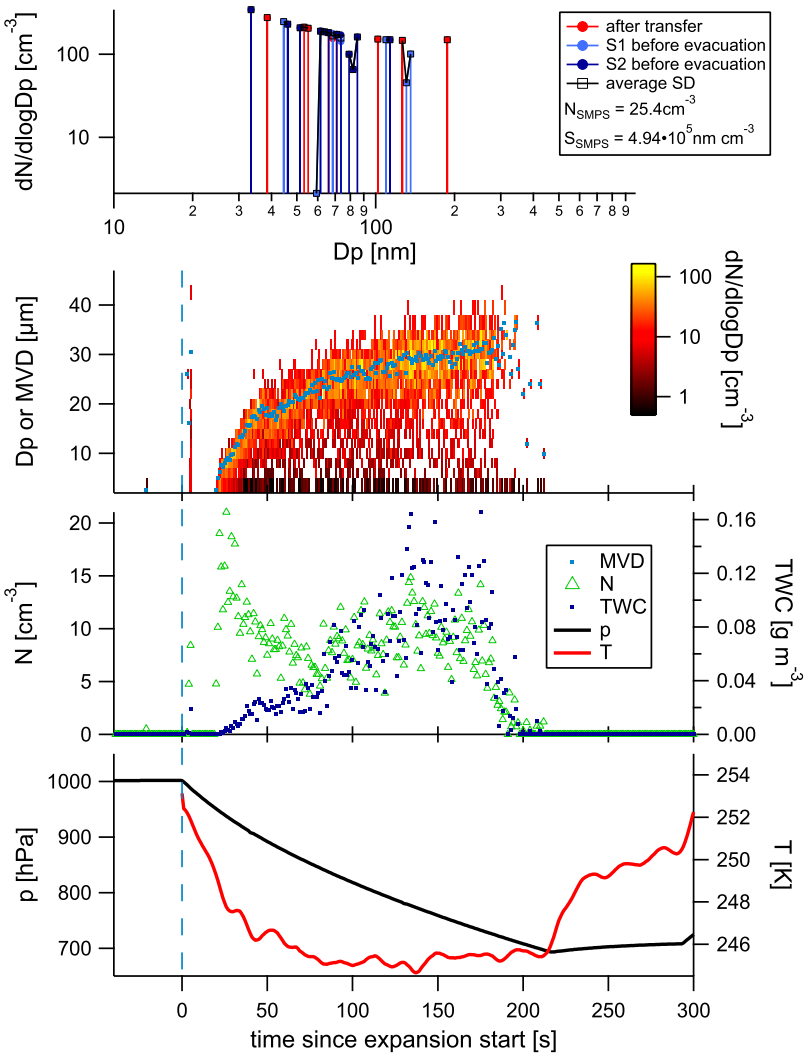

Figure S.6: As above for the second cloud evacuation in the dark SOA background experiment.

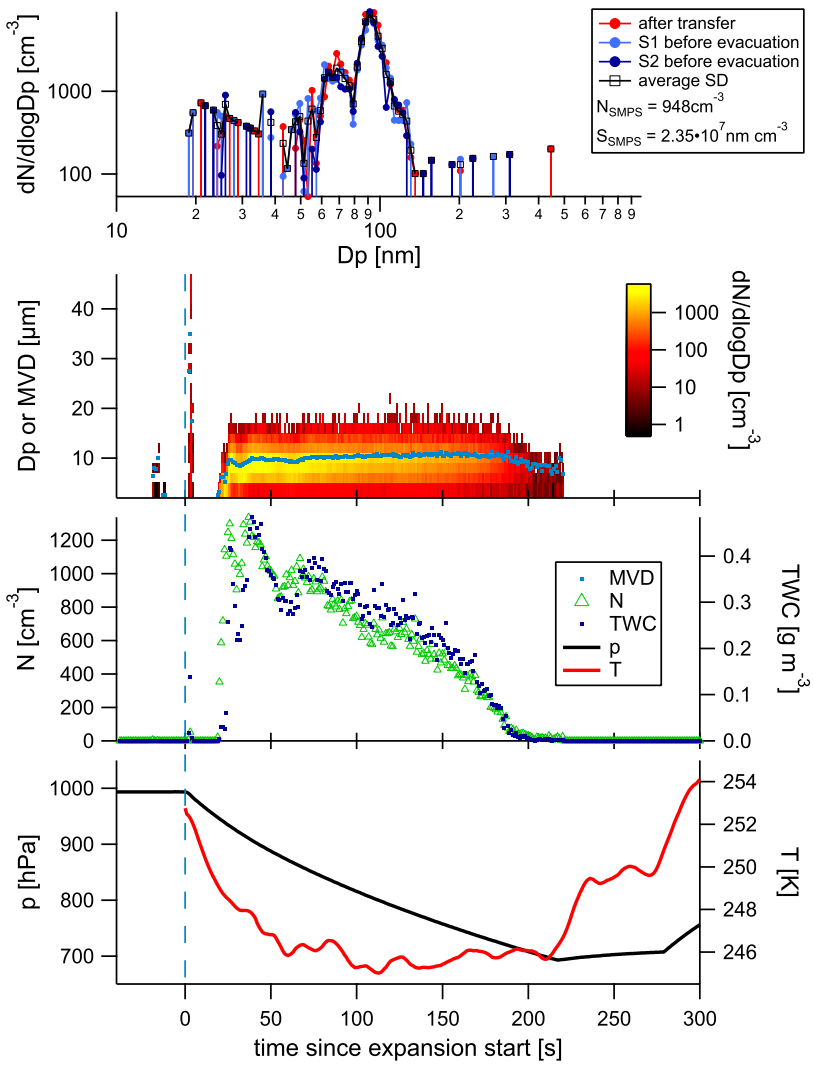

Figure S.7: First cloud evacuation in light SOA background, panels as above.

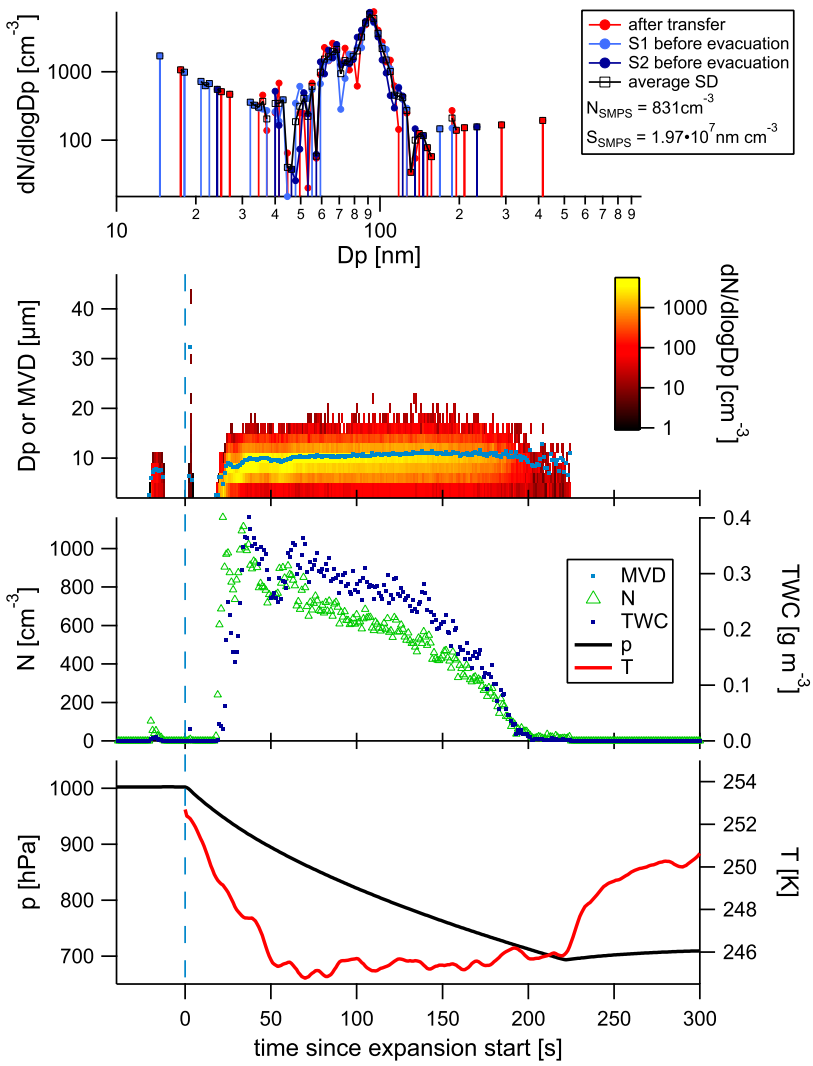

Figure S.8: Second cloud evacuation in light SOA background, panels as above.

4 SOA experiments

In the following all cloud runs performed during the measurement period are shown, except those already shown in the main manuscript.

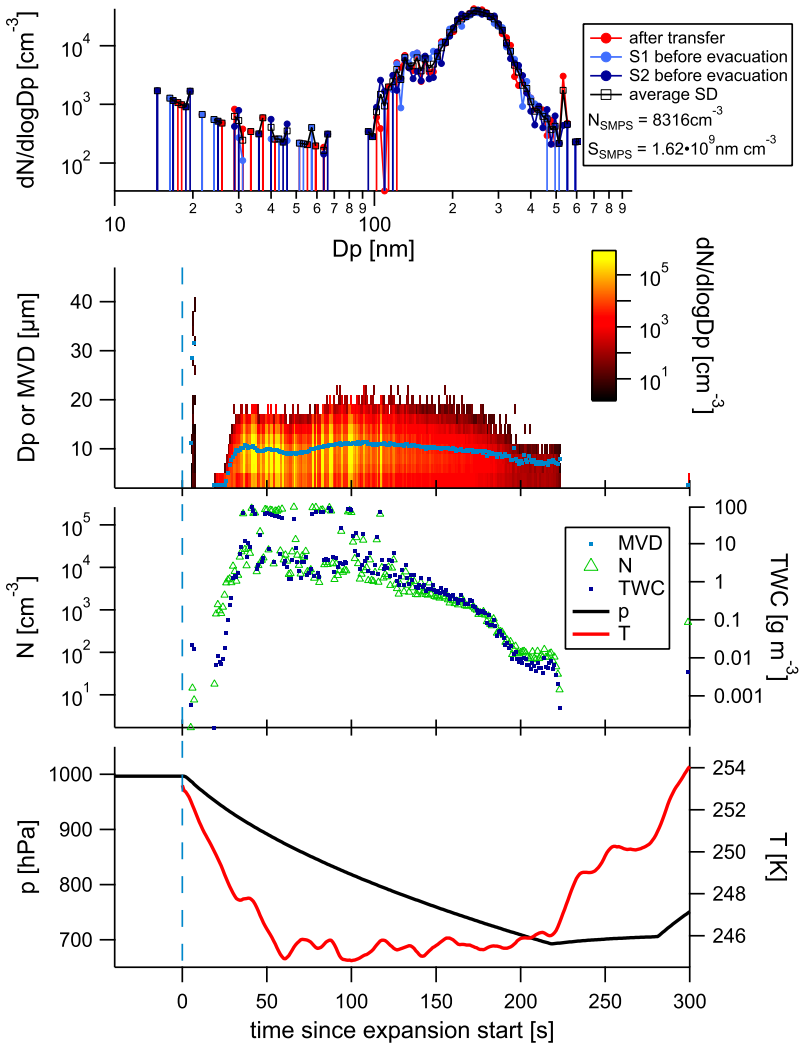

Figure S.9: First cloud evacuation performed on α-pinene aerosol precursor, panels as above.

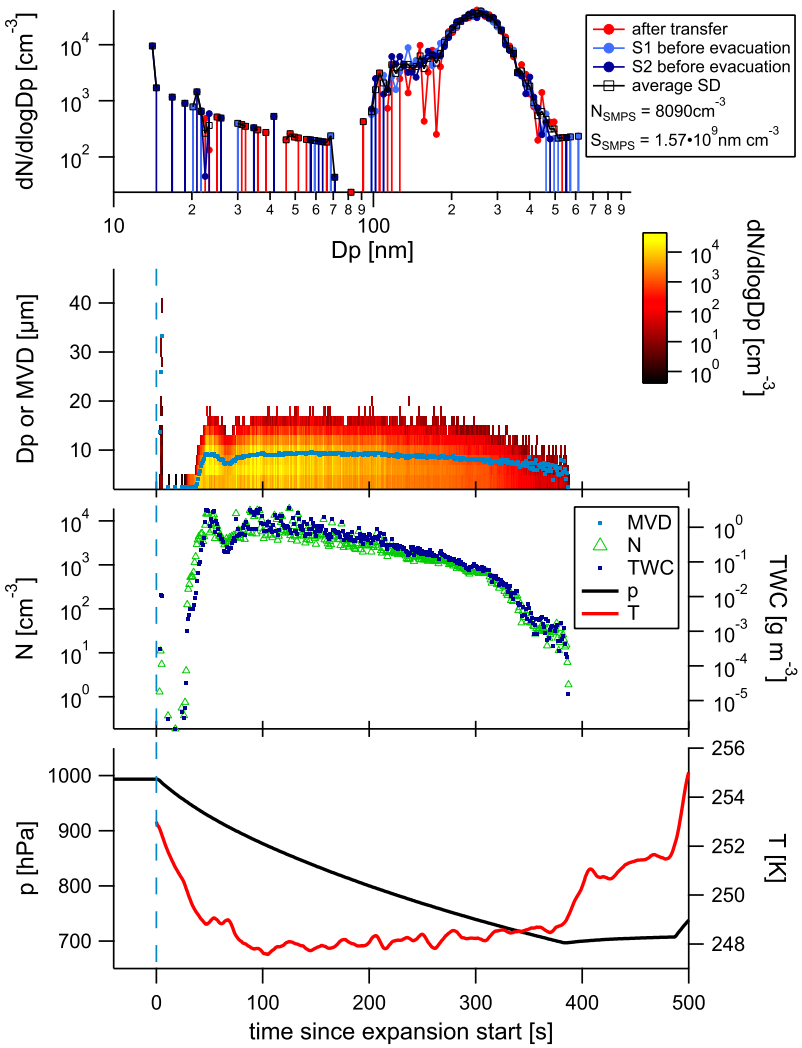

Figure S.10: Second cloud evacuation performed on α-pinene aerosol precursor, panels as above.

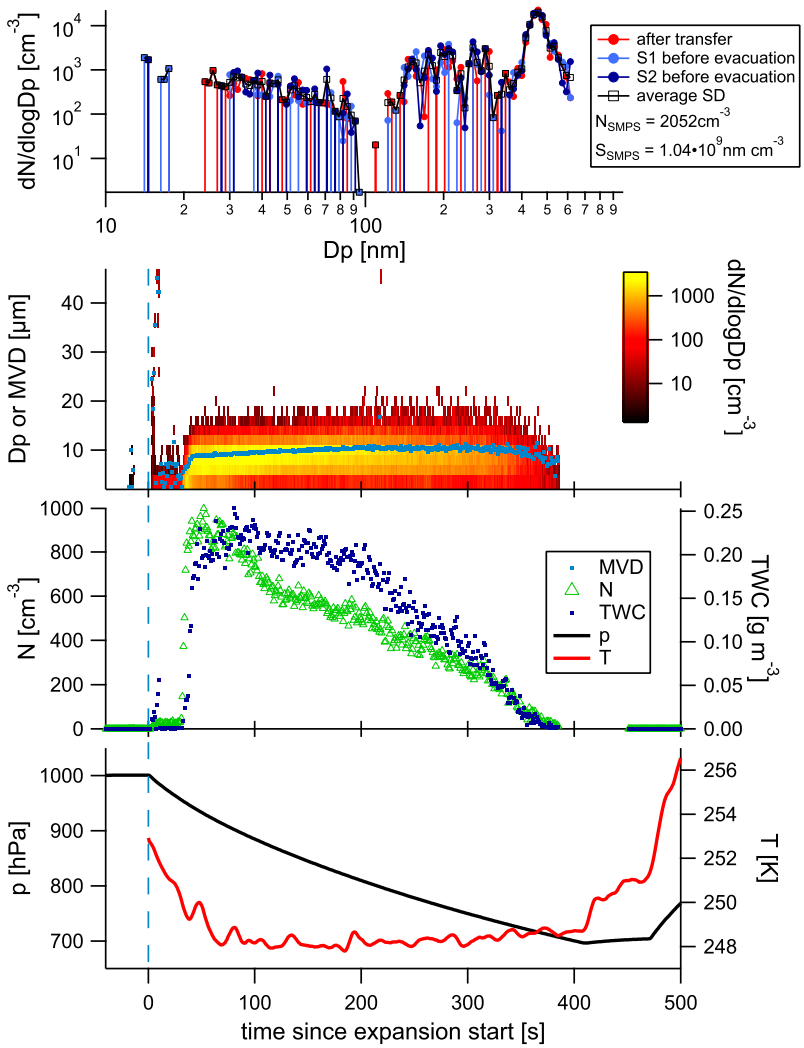

Figure S.11: First cloud evacuation performed on heptadecane precursor, panels as above.

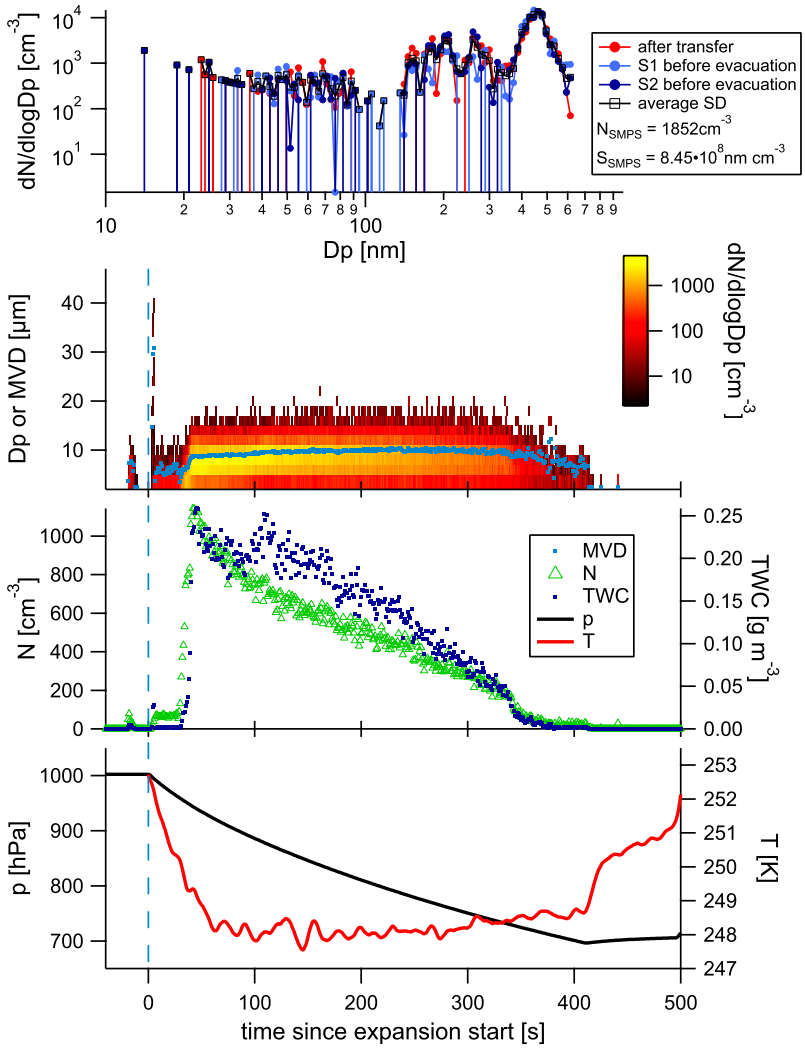

Figure S.12: Second cloud evacuation performed on heptadecane precursor, panels as above.

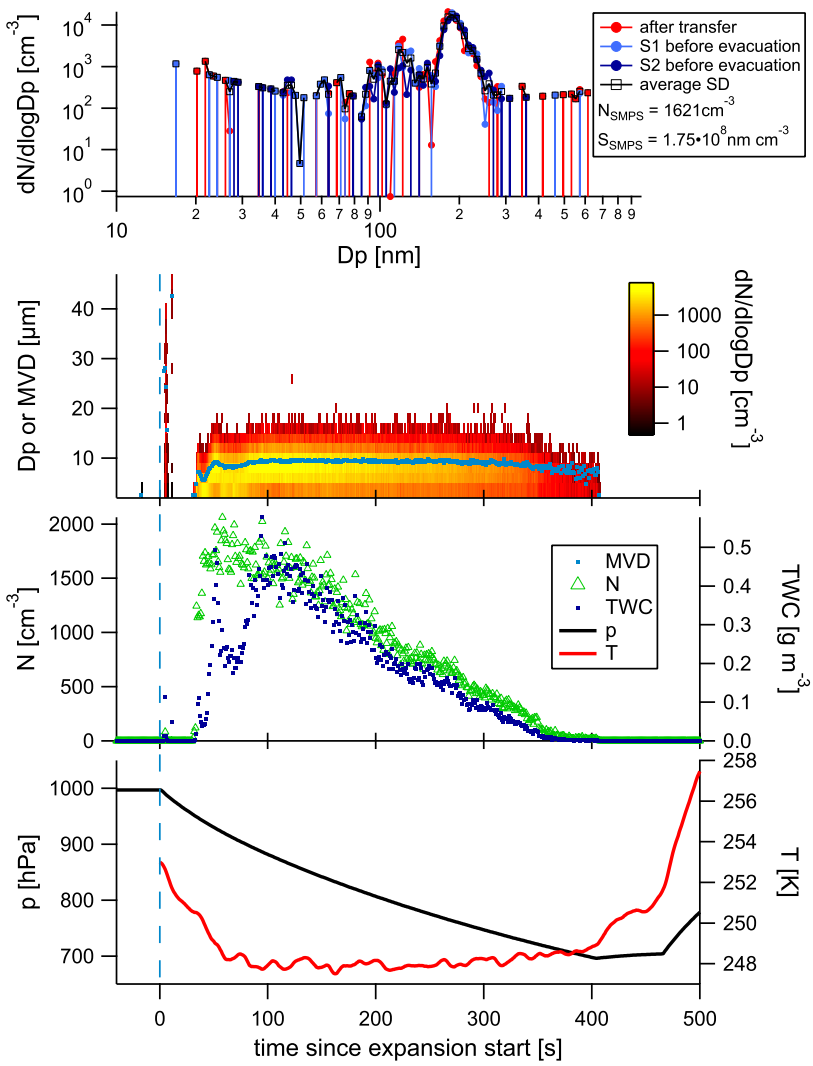

Figure S.13: First cloud evacuation performed on TMB precursor, panels as above.

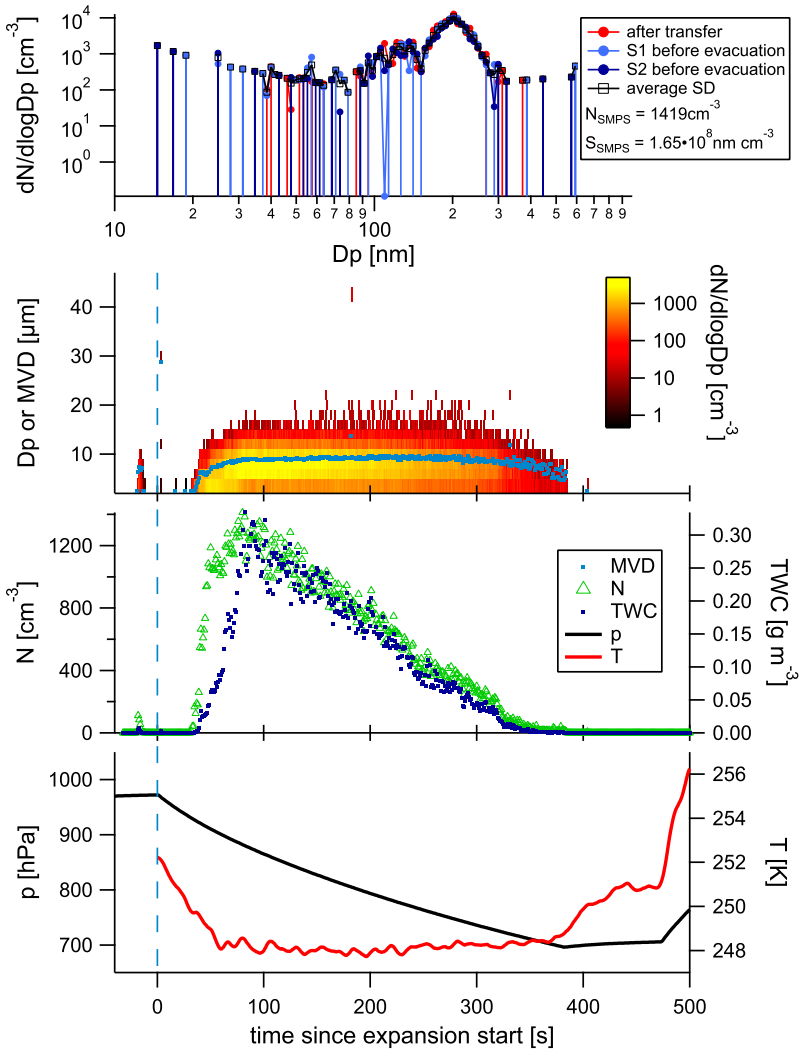

Figure S.14: Second cloud evacuation performed on TMB precursor, panels as above.

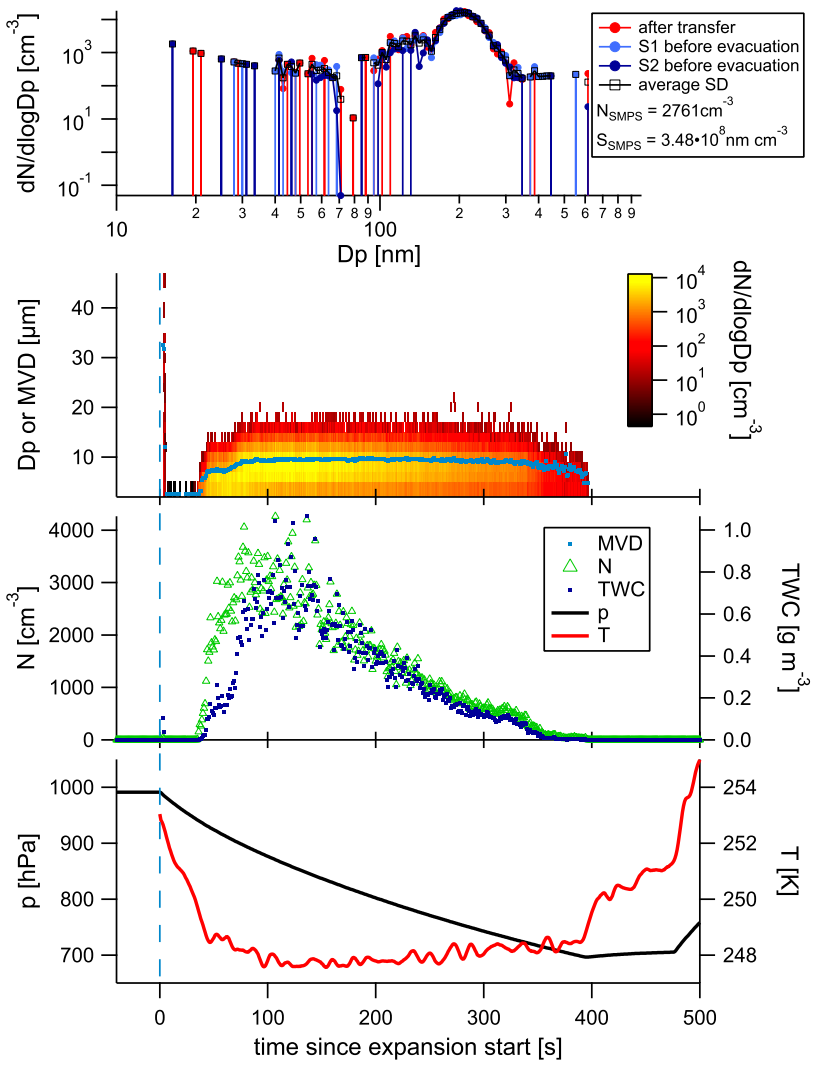

Figure S.15: First cloud evacuation performed on α-pinene aerosol precursor, panels as above. Second cloud evacuation performed on α-pinene aerosol precursor shown in main manuscript.

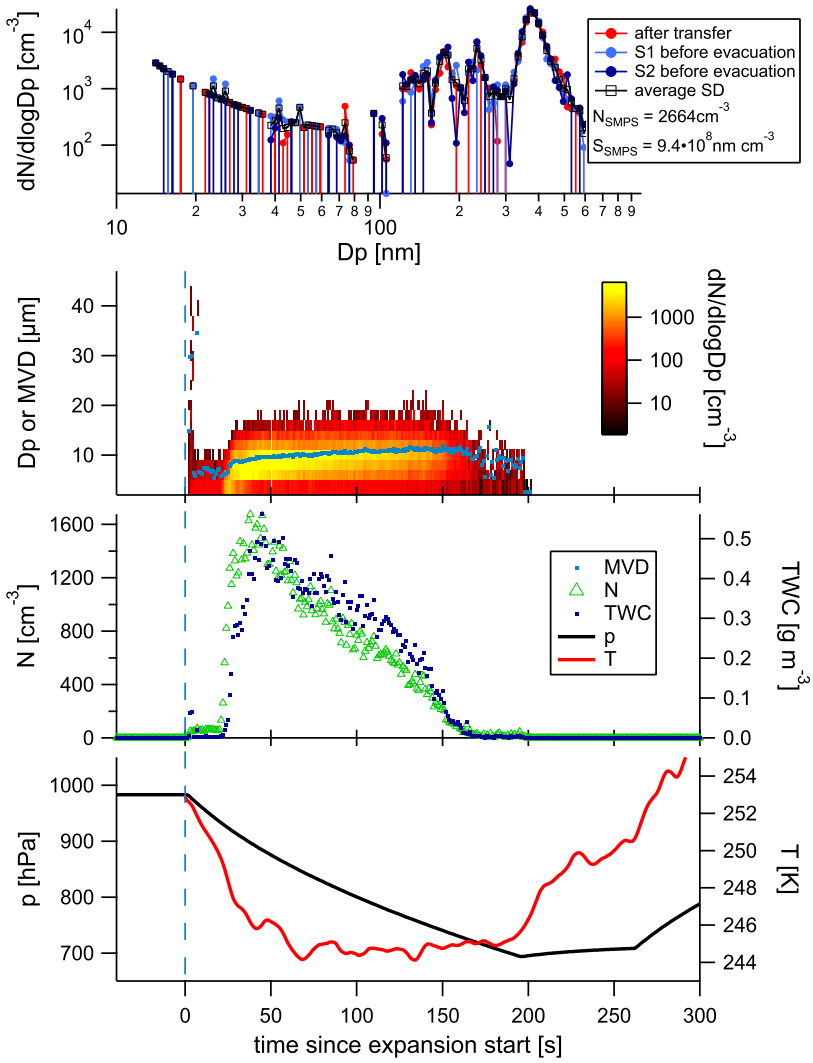

Figure S.16: First cloud evacuation performed on heptadecane precursor, panels as above. Second cloud evacuation performed on heptadecane precursor shown in main manuscript.

5 Control experiments with ammonium sulfate

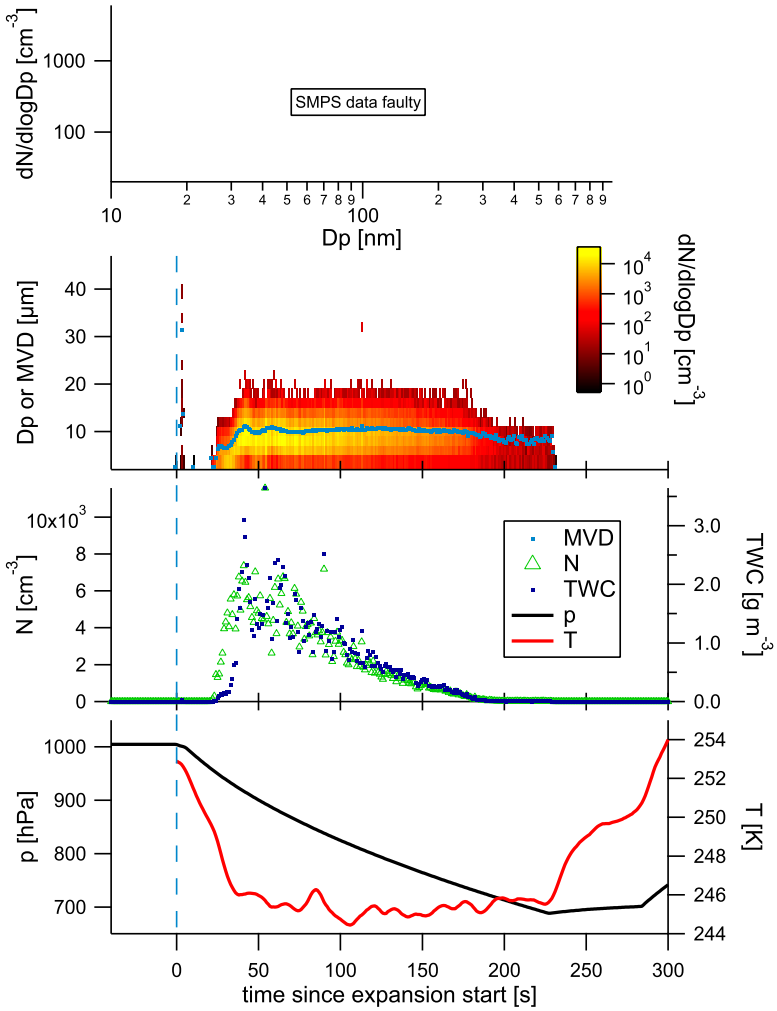

Figure S.17: First cloud evacuation performed on ammonium sulfate aerosol, panels as above.

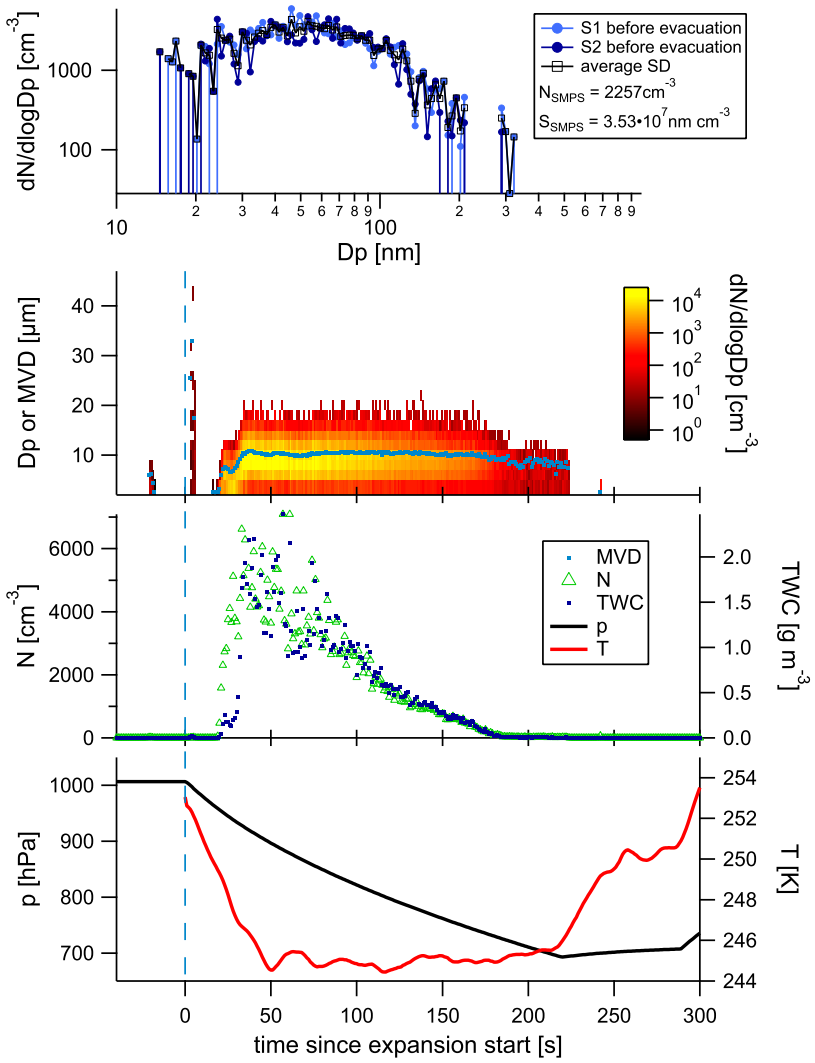

Figure S.18: Second cloud evacuation performed on ammonium sulfate aerosol, panels as above.

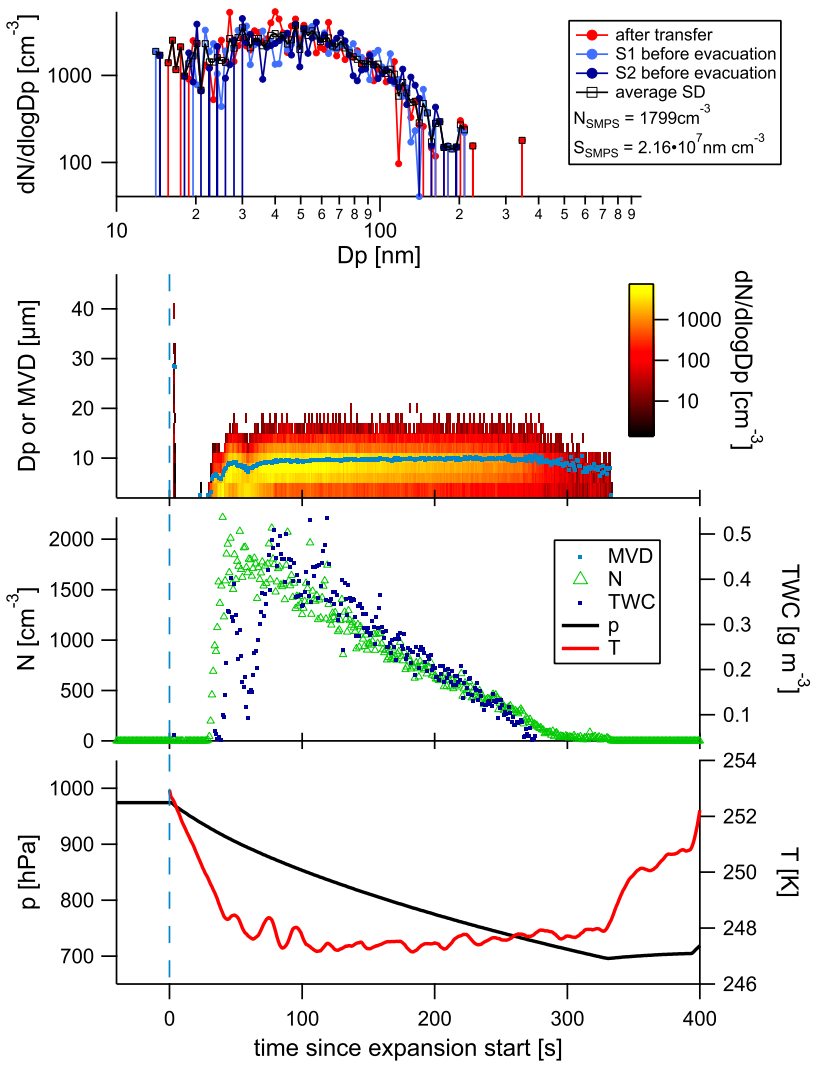

Figure S.19: First cloud evacuation performed on ammonium sulfate aerosol, panels as above.

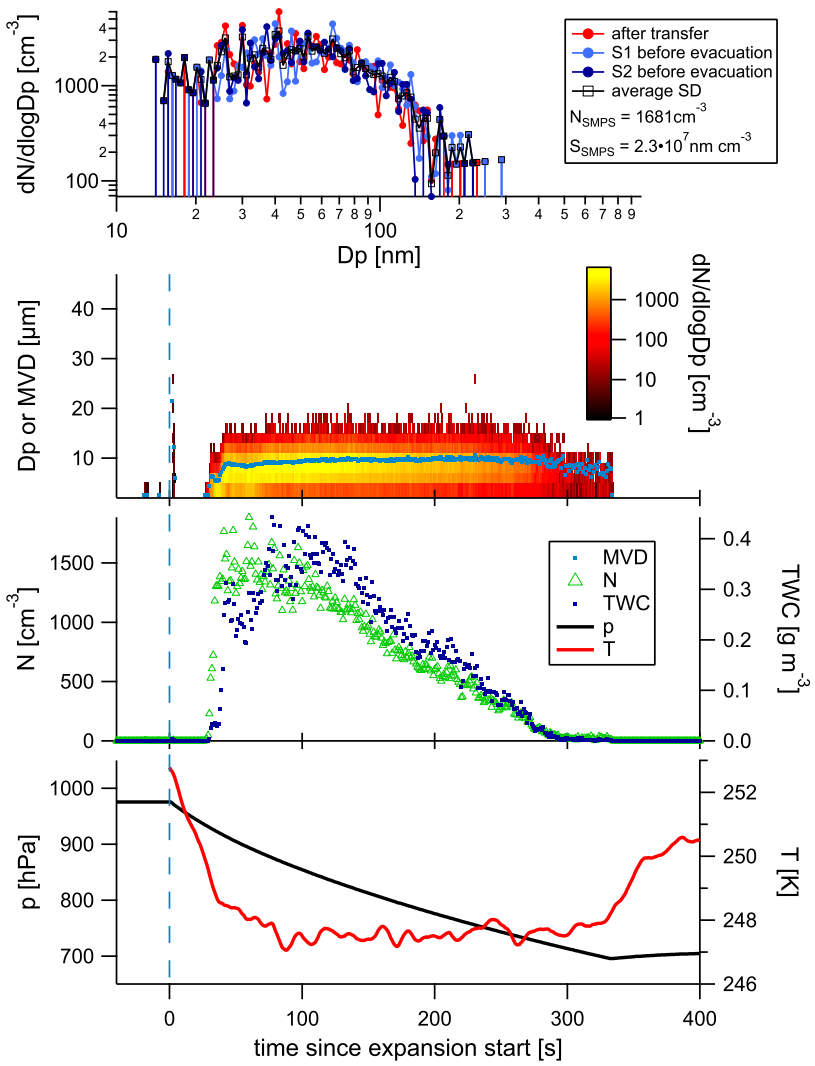

Figure S.20: Second cloud evacuation performed on ammonium sulfate aerosol, panels as above.

6 Sensitivity experiment with kaolinite

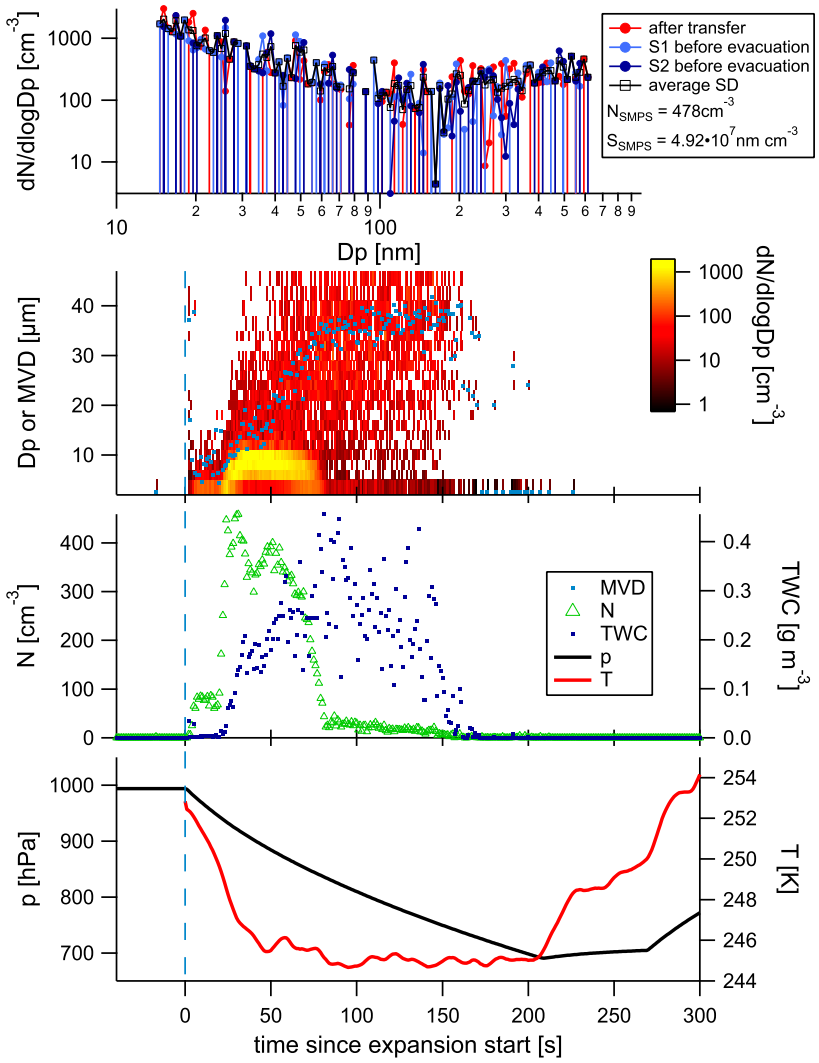

Figure S.21: First cloud evacuation performed on dust, panels as above.

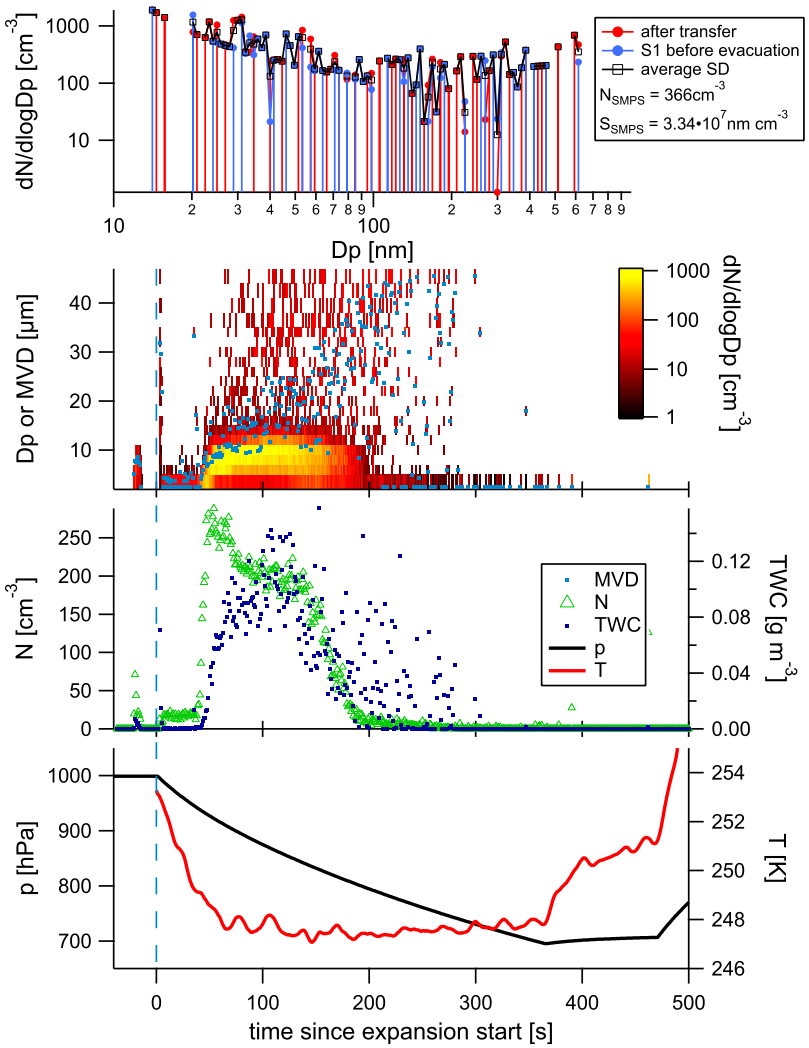

Figure S.22: Second cloud evacuation performed on dust, panels as above.

Table 1: Mean mode diameters (MMD) of the aerosol size distributions before the cloud evacuations.

	system	run #	MMD [nm]
Exp 2	ammonium sulfate	1	data faulty
		2	49.7
		3	50.4
Exp 3	SOA background	1	37.5
		2	38.8
Exp 4	α-pinene	1	244.4
		2	250.4
Exp 5	SOA background	1	92.5
		2	92.5
Exp 6	heptadecane	1	455.9
		2	455.9
Exp 7	TMB	1	187.8
		2	201.7
Exp 8	α-pinene	1	204.2
		2	209.2
Exp 9	ammonium sulfate	1	33.7
		2	39.5
Exp 10	heptadecane	1	376.3
		2	371.8
Exp 11	dust (kaolinite)	1	16.7
		2	14.1

7 References

Saukko, E., Lambe, A. T., Massoli, P., Koop, T., Wright, J. P., Croasdale, D. R., Pedernera, D. A., Onasch, T. B., Laaksonen, A., Davidovits, P., Worsnop, D. R., and Virtanen, A.: Humidity-dependent phase state of SOA particles from biogenic and anthropogenic precursors. Atmos. Chem. Phys., 12, 7517–7529, doi:10.5194/acp-12-7517-2012, 2012a.

Saukko, E., Kuuluvainen, H., and Virtanen, A.: A Method to resolve the phase state of aerosol particles, Atmos. Meas. Tech., 5, 259–265, doi:10.5194/amt-5-259-2012, 2012b.