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~~ refilling 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'~~ photochemically produced 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.

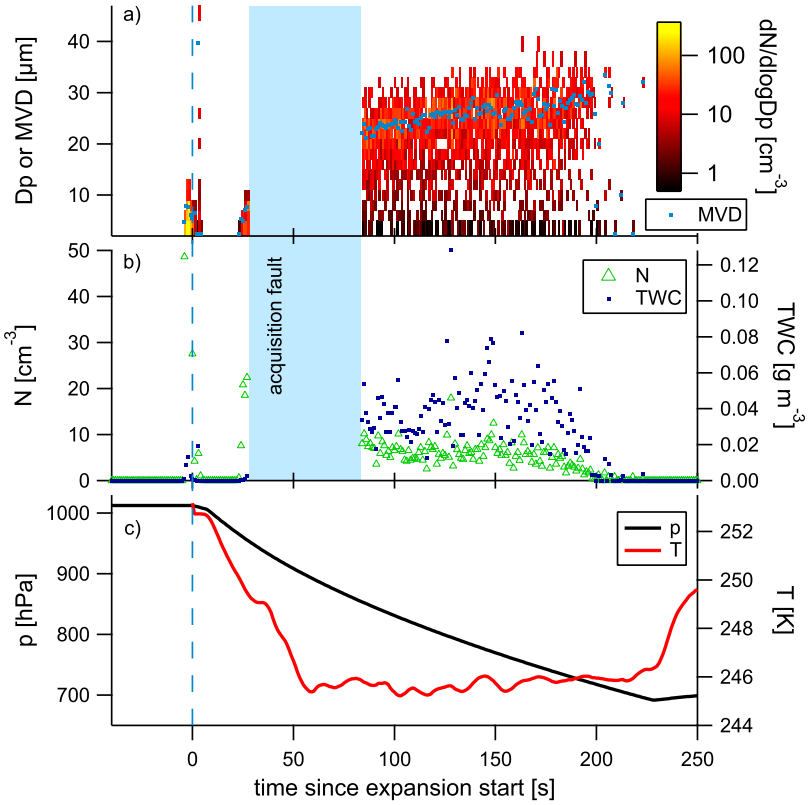

Figure S.1: First cloud ~~evacuation~~ activation run after the clean bag transfer (experiment 1, see Table 1 in main manuscript). The panels show the time series of FSSP measurements of size distribution and mean volume diameter (MVD, panel a) ~~and~~ , total water content (TWC) and number concentration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

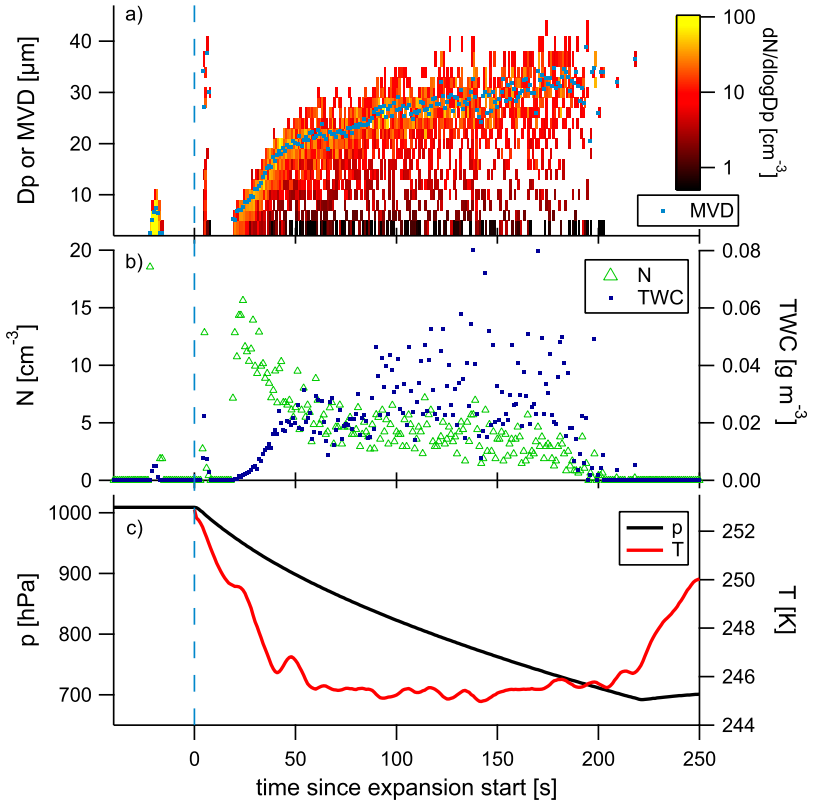

Figure S.2: Second cloud ~~evacuation~~ activation run after the clean bag transfer (experiment 1, see Table 1 in main manuscript). Panels as ~~above~~in Fig. S.1.

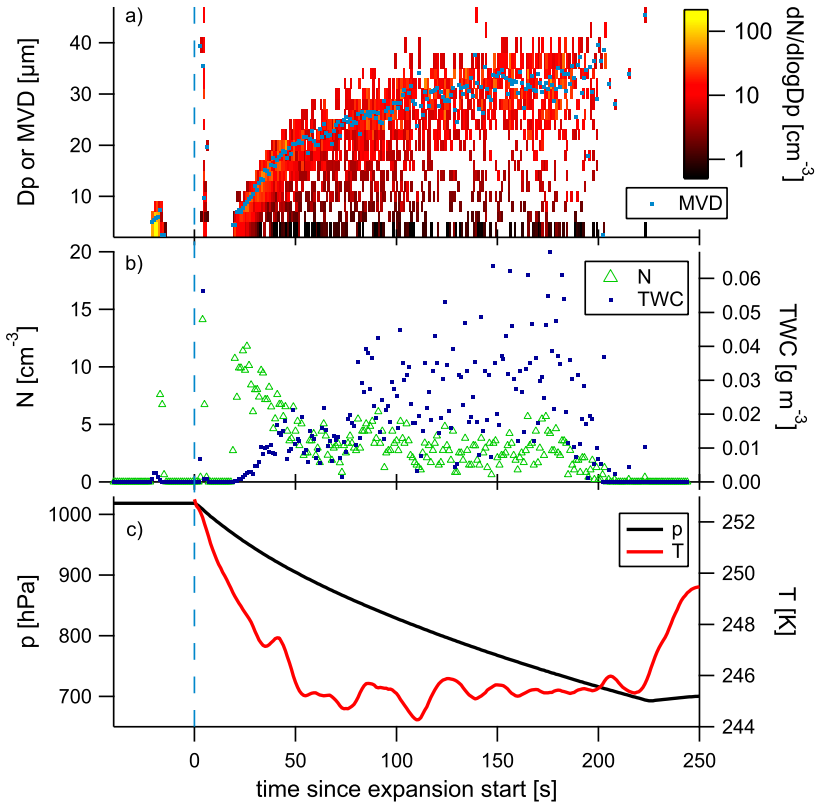

Figure S.3: Third cloud ~~evacuation~~ activation run after the clean bag transfer (experiment 1, see Table 1 in main manuscript). Panels as ~~above~~in Fig. S.1.

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 ~ 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). 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.~~

2 SOA background

Two types of SOA backgrounds were transferred, ~~one dark and one light background~~with varying levels of UV radiation. That means, all ~~ingredients~~ chemical substances as in a normal SOA experiment were used, without the actual precursor. In the ~~dark background experiment the lights remained switched off~~ first background experiment filters were installed in front of the lamps responsible for photochemical reactions to only allow tropospheric UV radiation to illuminate the chamber, whereas in the ~~light~~ second background experiment, the ~~lamps responsible for photo-chemical reactions were switched on~~filters were removed, allowing hard UV light into the chamber. This second background was used before SOA experiments with heptadecane and TMB precursors, as aerosol is harder to form from these precursors and strong UV light fosters the SOA generation. Also ozone is added in the second SOA background experiment, thus, it can also be seen as a harsh cleaning experiment at the same time.

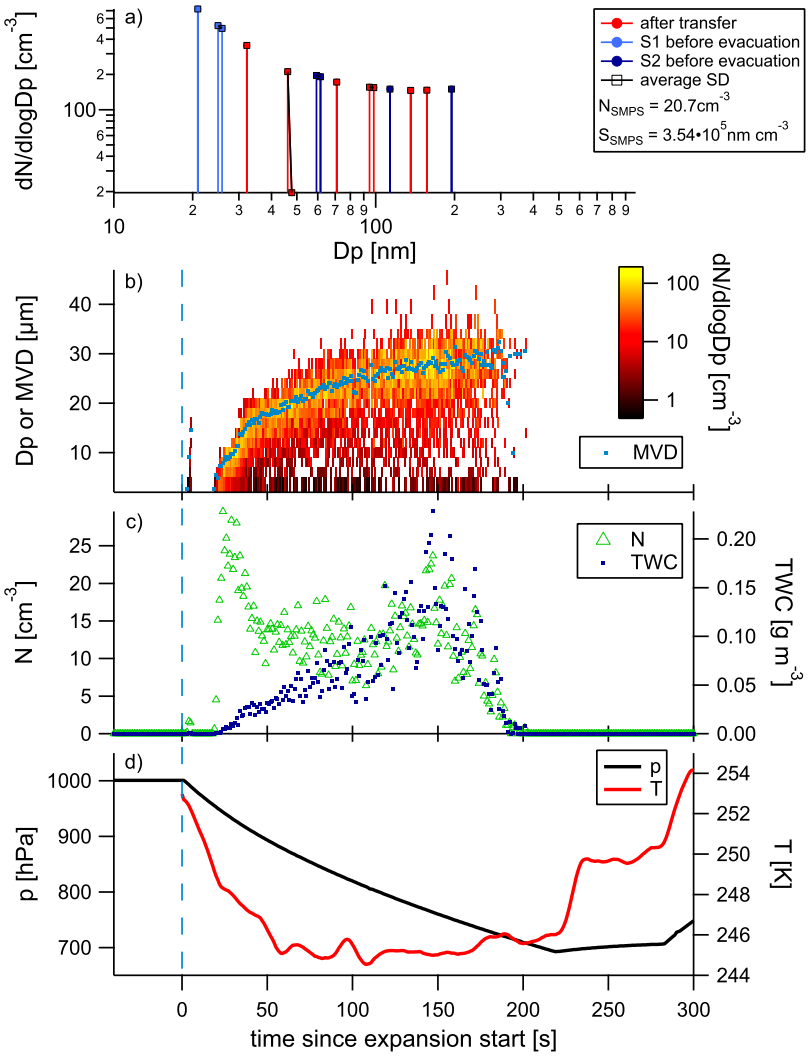

Figure S.4: First cloud ~~evacuation~~ activation run during ~~dark~~ first SOA background measurements (experiment 3, see Table 1 in main manuscript). The uppermost panel shows the SMPS size distributions obtained before the cloud expansion (panel a), followed by time series of FSSP measurements of 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.

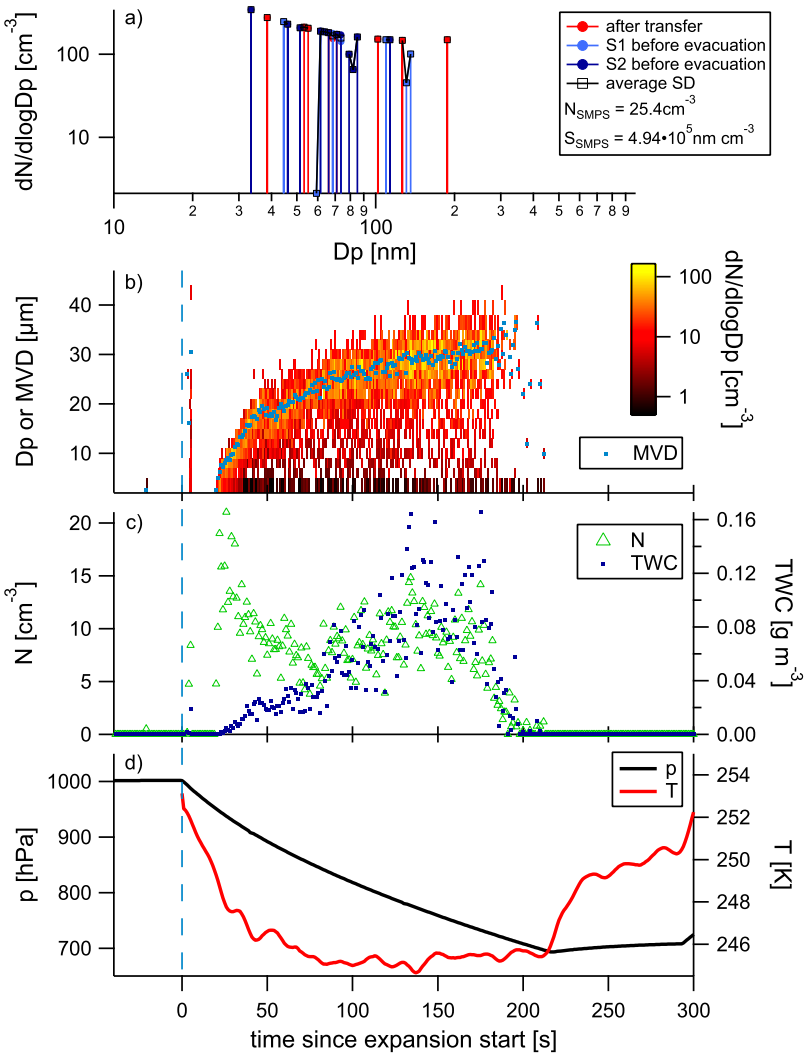

Figure S.5: As above for the second cloud ~~evacuation~~ activation run in the ~~dark~~ first SOA background experiment (experiment 3, see Table 1 in main manuscript).

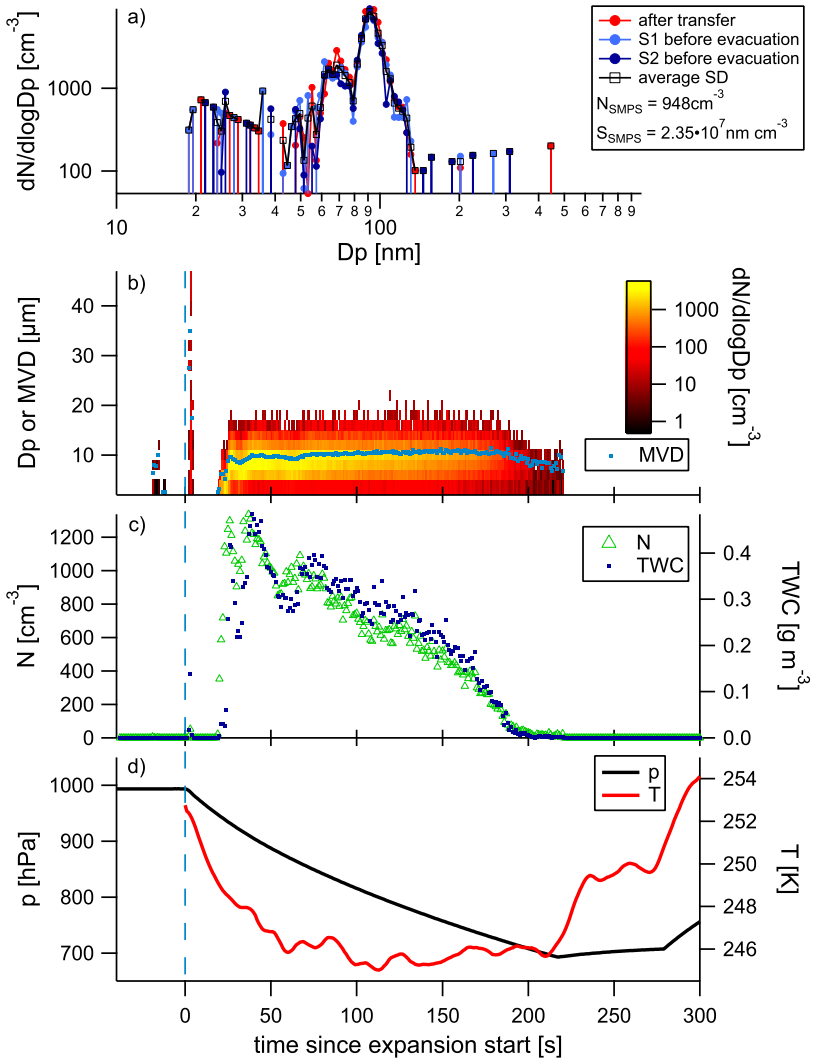

Figure S.6: First cloud ~~evacuation in light~~ activation run on 'harsh UV' SOA background (experiment 5, see Table 1 in main manuscript), panels as ~~above~~in Fig. S.4.

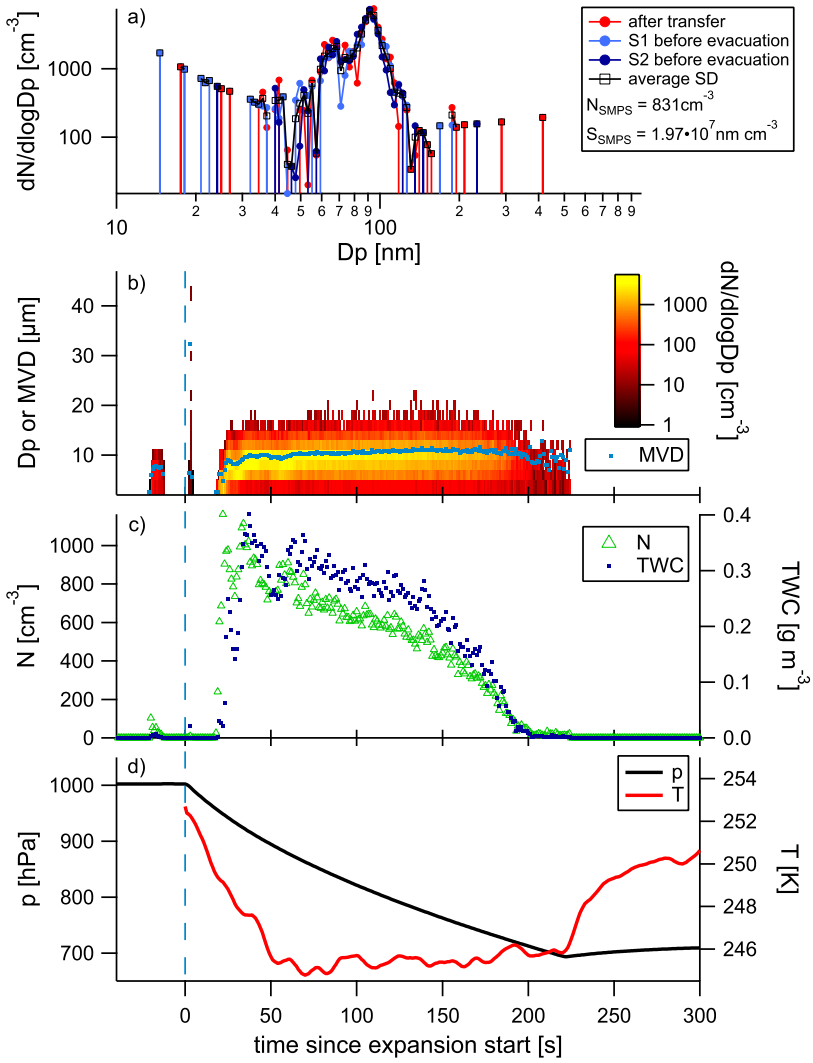

Figure S.7: Second cloud ~~evacuation in light~~ activation run on 'harsh UV' SOA background (experiment 5, see Table 1 in main manuscript), panels as ~~above~~in Fig. S.4.

3 SOA experiments

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

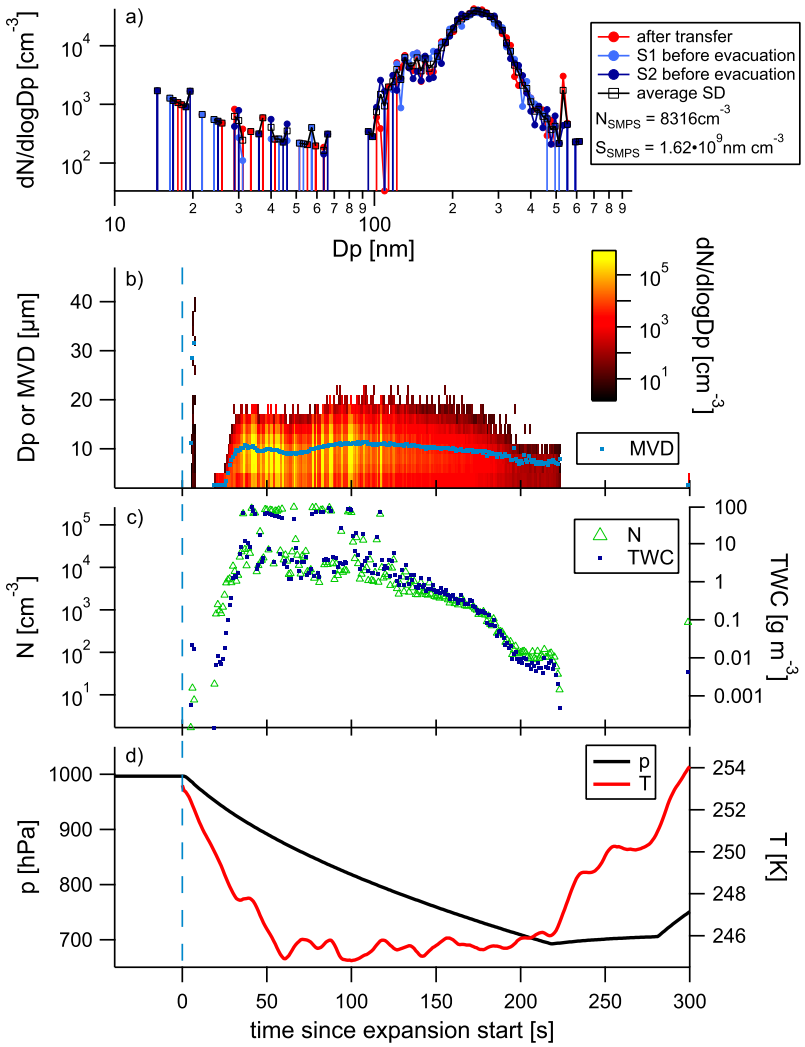

Figure S.8: First cloud ~~evacuation~~ activation run performed on SOA from α-pinene ~~aerosol~~ precursor (experiment 4, see Table 1 in main manuscript), panels as ~~above~~in Fig. S.4.

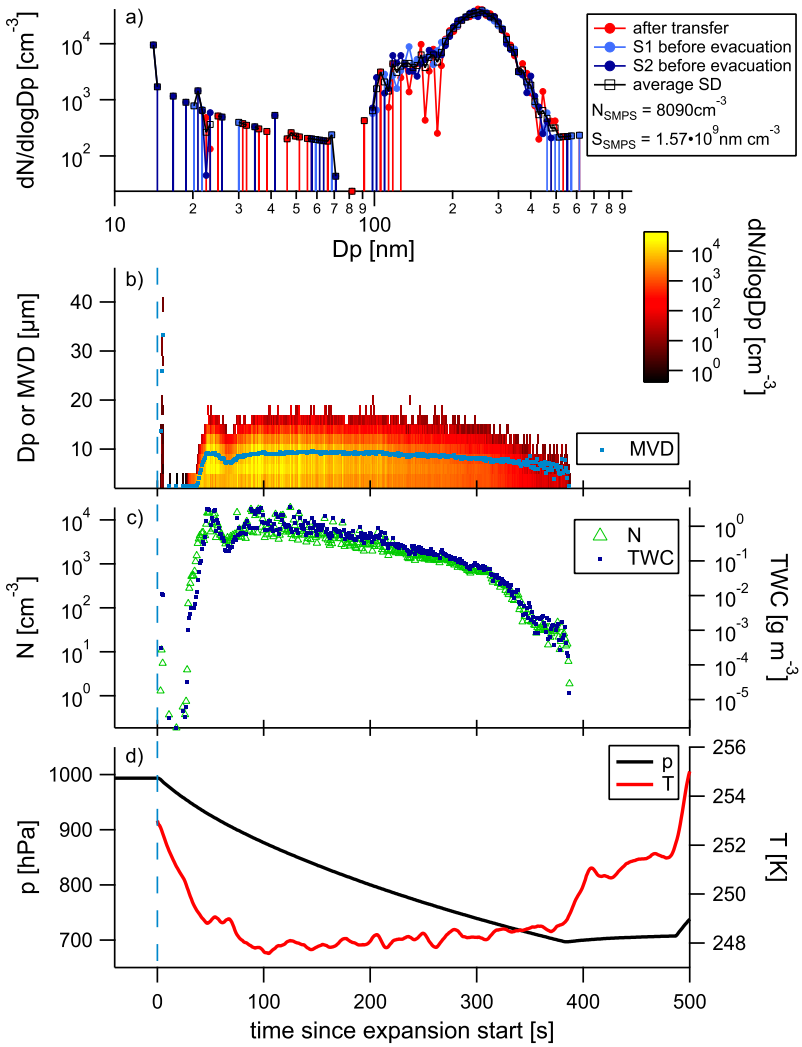

Figure S.9: Second cloud ~~evacuation~~ activation run performed on SOA from α-pinene ~~aerosol~~ precursor (experiment 4, see Table 1 in main manuscript), panels as ~~above~~in Fig. S.4.

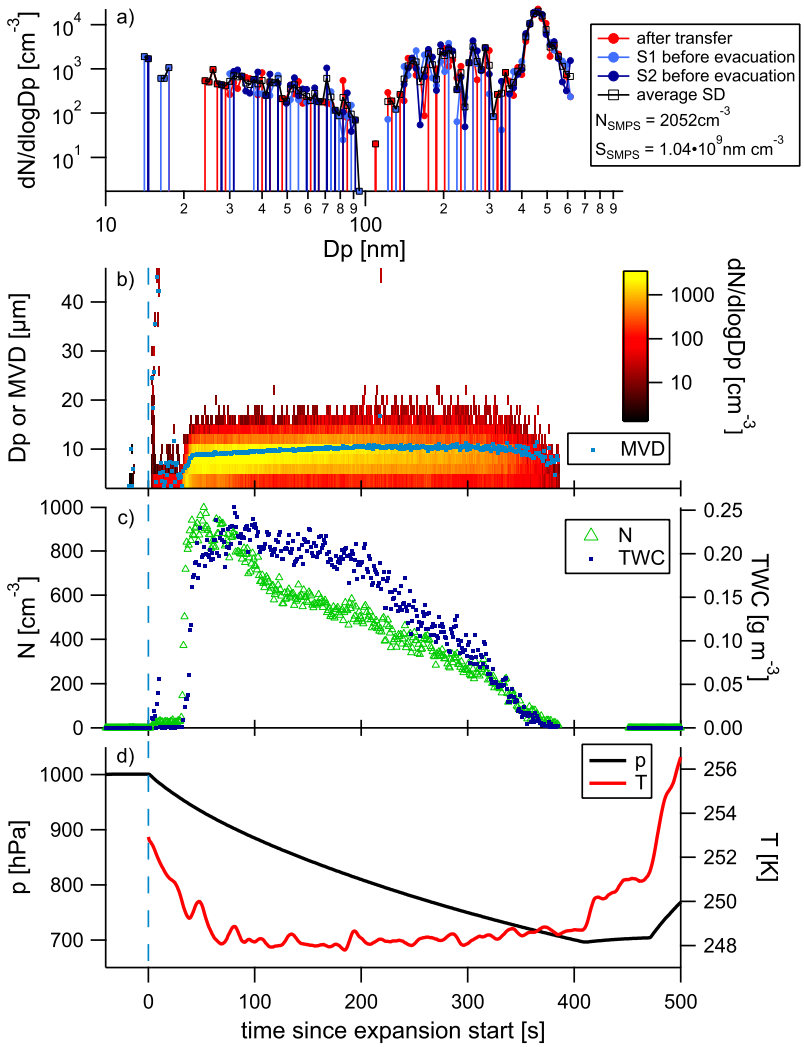

Figure S.10: First cloud ~~evacuation~~ activation run performed on SOA from heptadecane precursor (experiment 6, see Table 1 in main manuscript), panels as ~~above~~ in Fig. S.4.

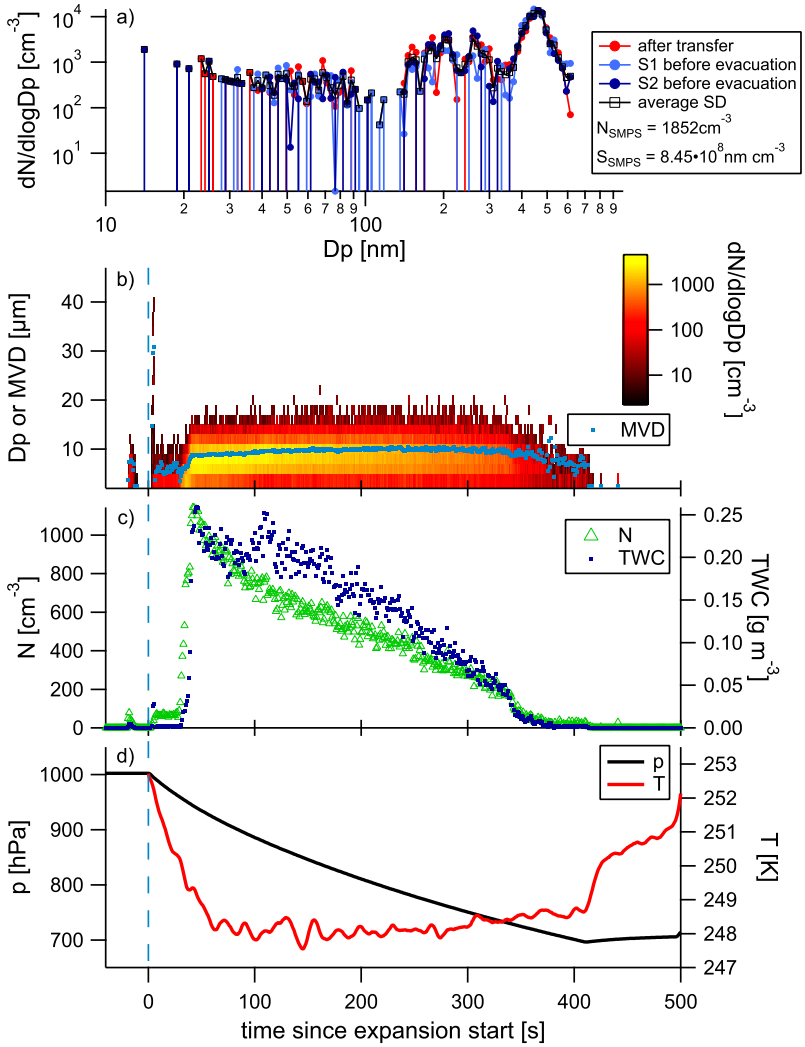

Figure S.11: Second cloud ~~evacuation~~ activation run performed on SOA from heptadecane precursor (experiment 6, see Table 1 in main manuscript), panels as ~~above~~in Fig. S.4.

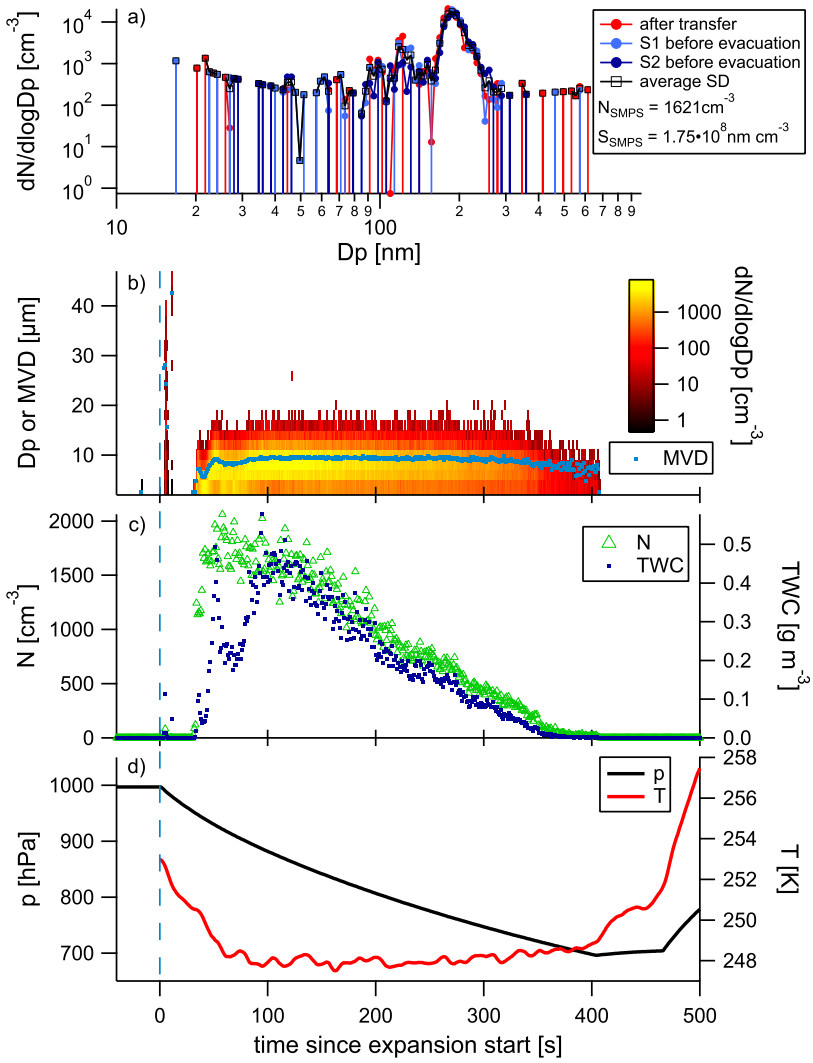

Figure S.12: First cloud ~~evacuation~~ activation run performed on SOA from TMB precursor (experiment 7, see Table 1 in main manuscript), panels as ~~above~~in Fig. S.4.

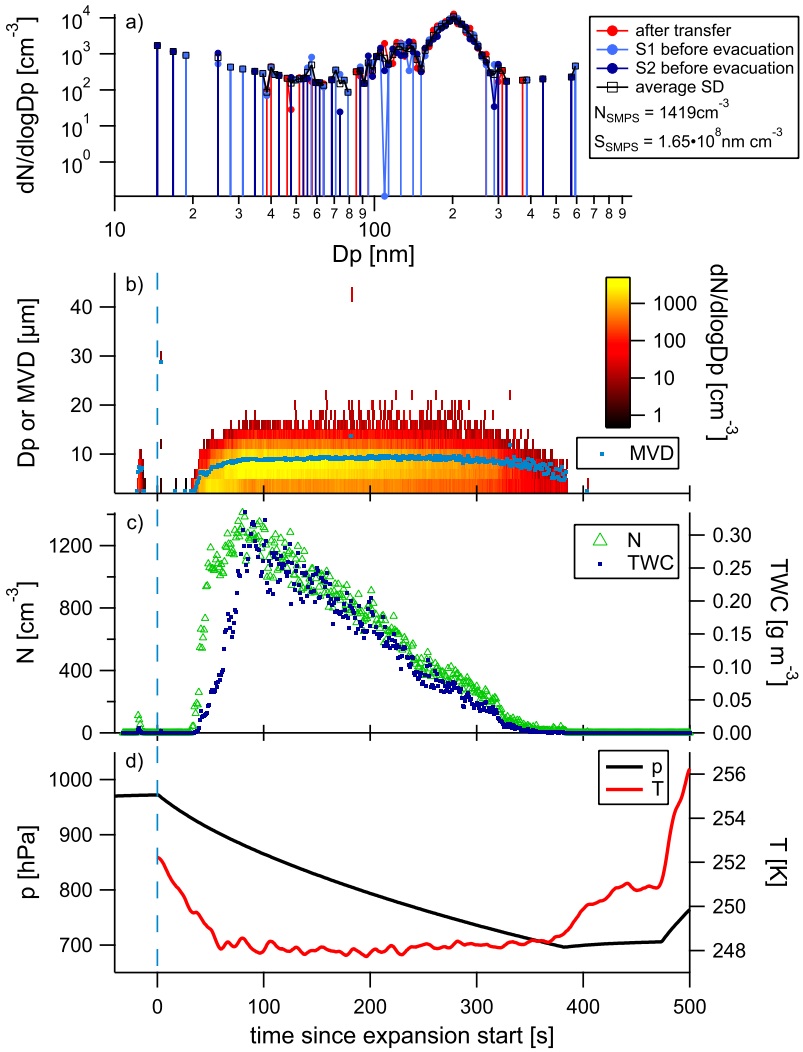

Figure S.13: Second cloud ~~evacuation~~ activation run performed on SOA from TMB precursor (experiment 7, see Table 1 in main manuscript), panels as ~~above~~in Fig. S.4.

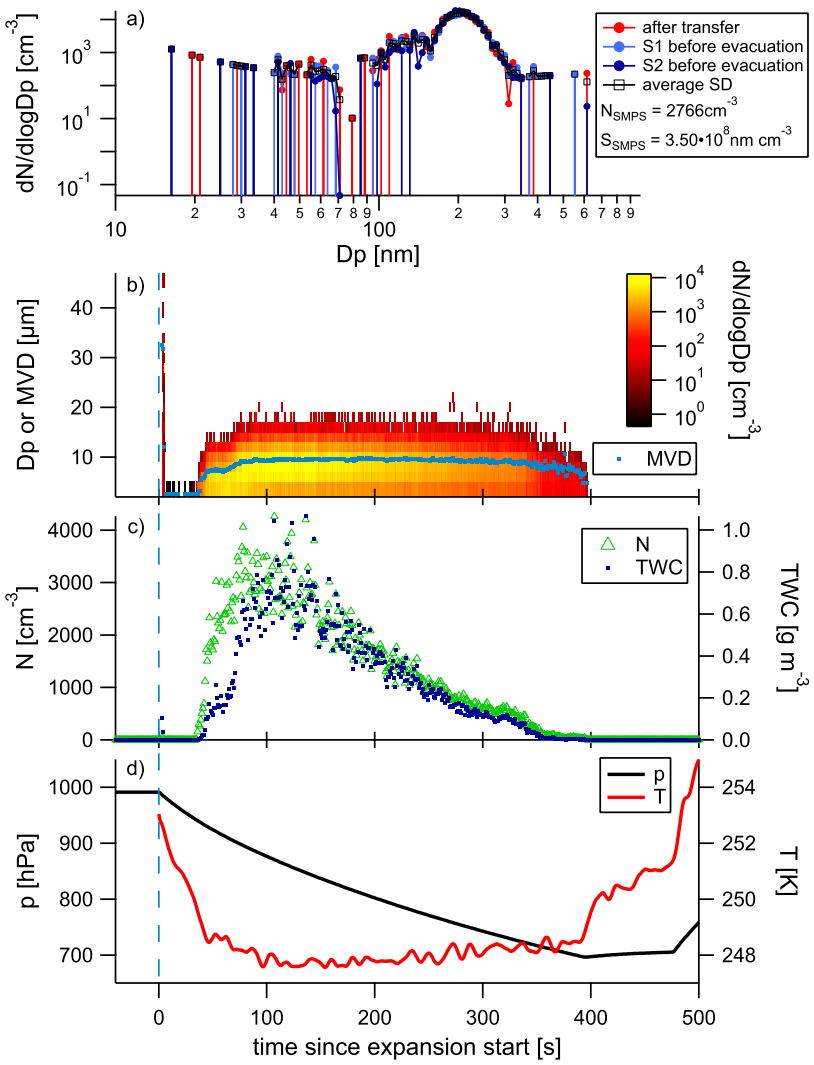

Figure S.14: First cloud ~~evacuation~~ activation run performed on α-pinene aerosol precursor (experiment 8, see Table 1 in main manuscript), panels as ~~above~~in Fig. S.4.
~~Second~~ The second cloud ~~evacuation performed on α-pinene aerosol precursor~~ activation run from this experiment is shown in main manuscript.

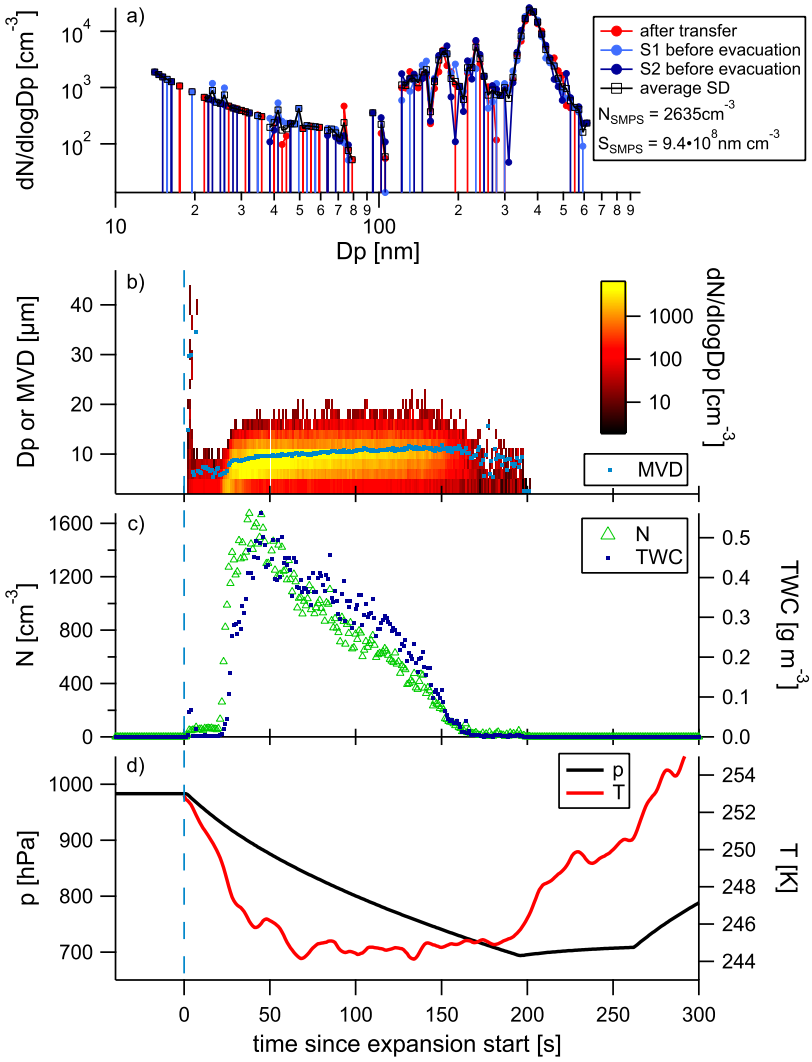

Figure S.15: First cloud ~~evacuation~~ activation run performed on SOA from heptadecane precursor (experiment 10, see Table 1 in main manuscript), panels as ~~above~~in Fig. S.4.
~~Second~~ The second cloud ~~evacuation performed on heptadecane precursor~~ activation run from this experiment is shown in main manuscript.

4 Control experiments with ammonium sulfate

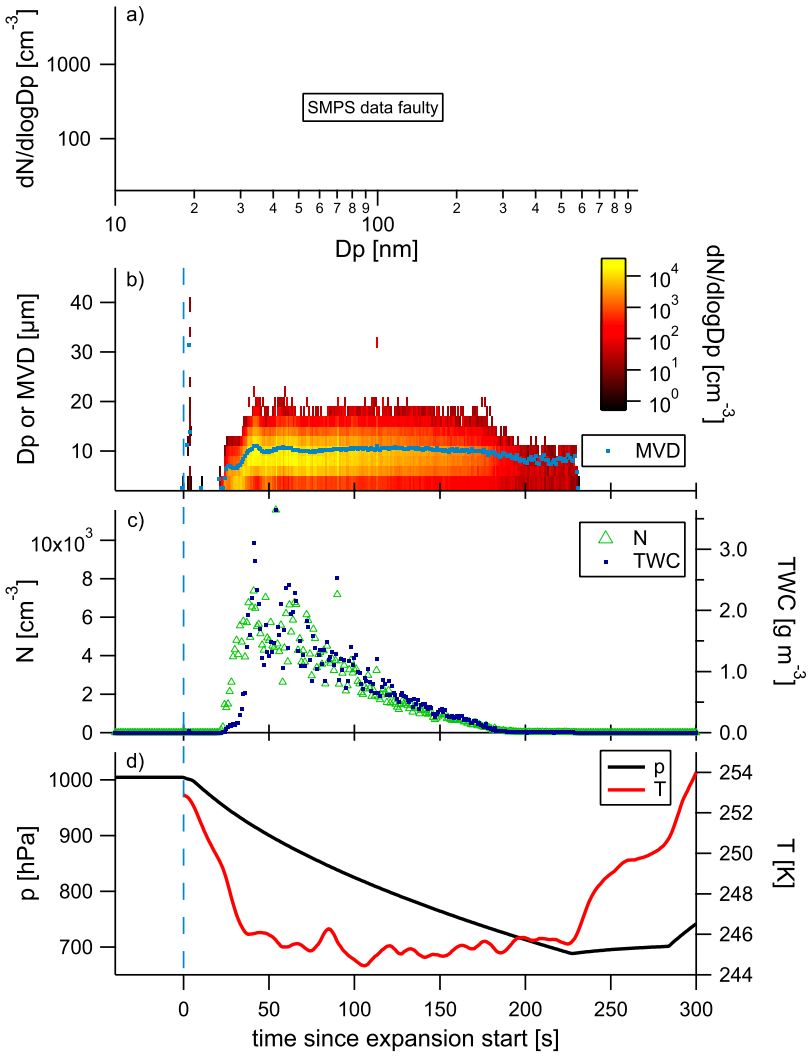

Figure S.16: First cloud ~~evacuation~~ activation run performed on ammonium sulfate aerosol (experiment 2, see Table 1 in main text), panels as ~~above~~in Fig. S.4.

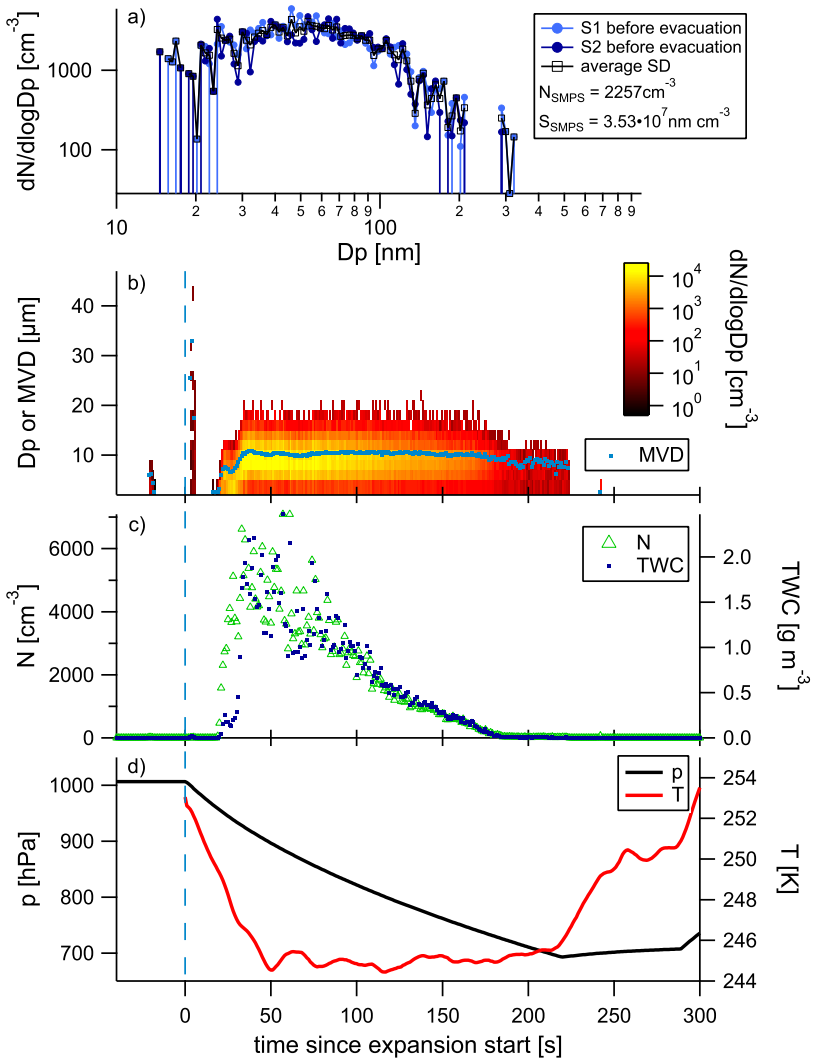

Figure S.17: Second cloud ~~evacuation~~ activation run performed on ammonium sulfate aerosol (experiment 2, see Table 1 in main text), panels as ~~above~~in Fig. S.4.

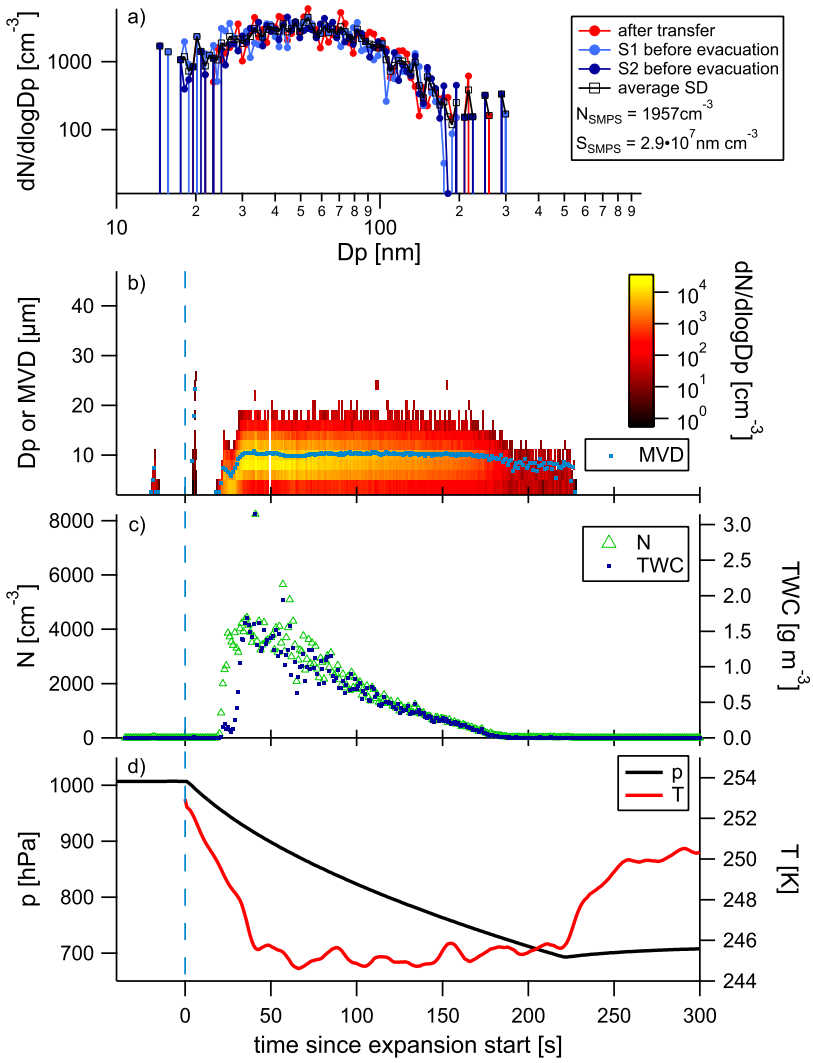

Figure S.18: Third cloud activation run performed on ammonium sulfate aerosol (experiment 2, see Table 1 in main text), panels as in Fig. S.4.

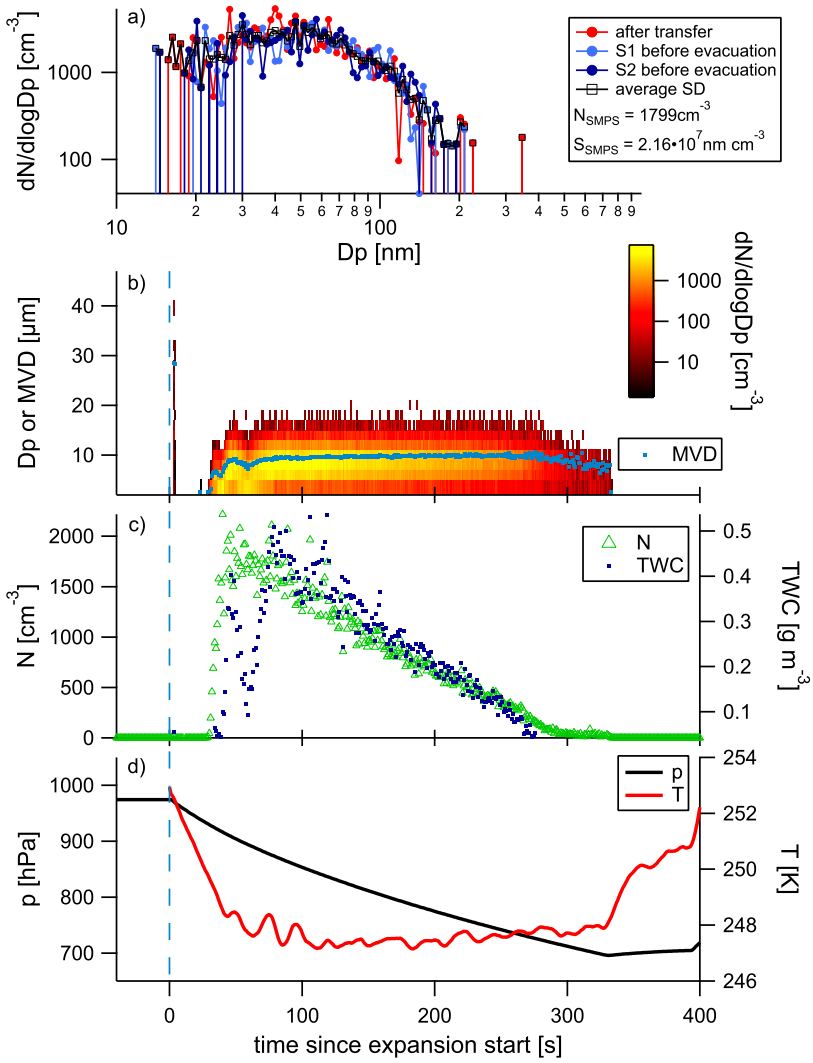

Figure S.19: First cloud ~~evacuation~~ activation run performed on ammonium sulfate aerosol (experiment 9, see Table 1 in main text), panels as ~~above~~in Fig. S.4.

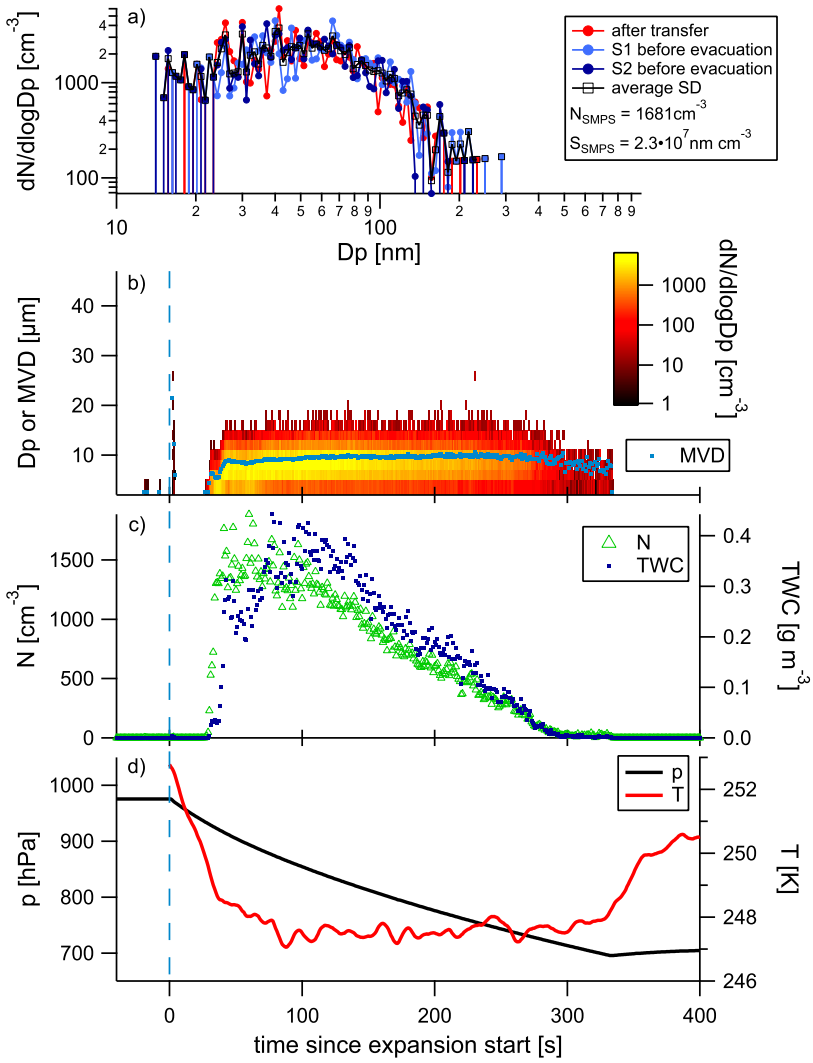

Figure S.20: Second cloud ~~evacuation~~ activation run performed on ammonium sulfate aerosol (experiment 9, see Table 1 in main text), panels as ~~above~~in Fig. S.4.

5 Sensitivity experiment with kaolinite

~~First cloud evacuation performed on dust, panels as above.~~

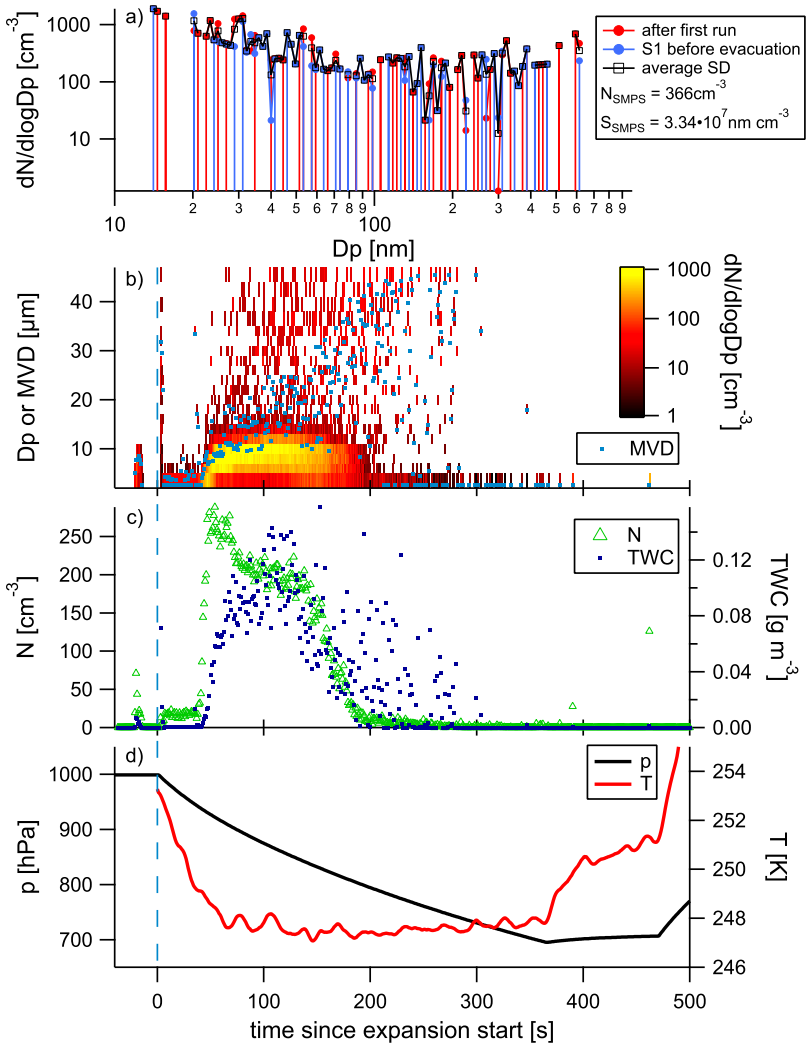

Figure S.21: Second cloud ~~evacuation~~ activation run performed on dust (experiment 11, see Table 1 in main manuscript), panels as ~~above~~in Fig. S.4.
The first cloud activation run from this experiment is shown in main manuscript.

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

	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

6 ~~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.~~