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Supplement of

The efficiency of secondary organic aerosol particles acting as ice-nucleating particles under mixed-phase cloud conditions

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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 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 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.

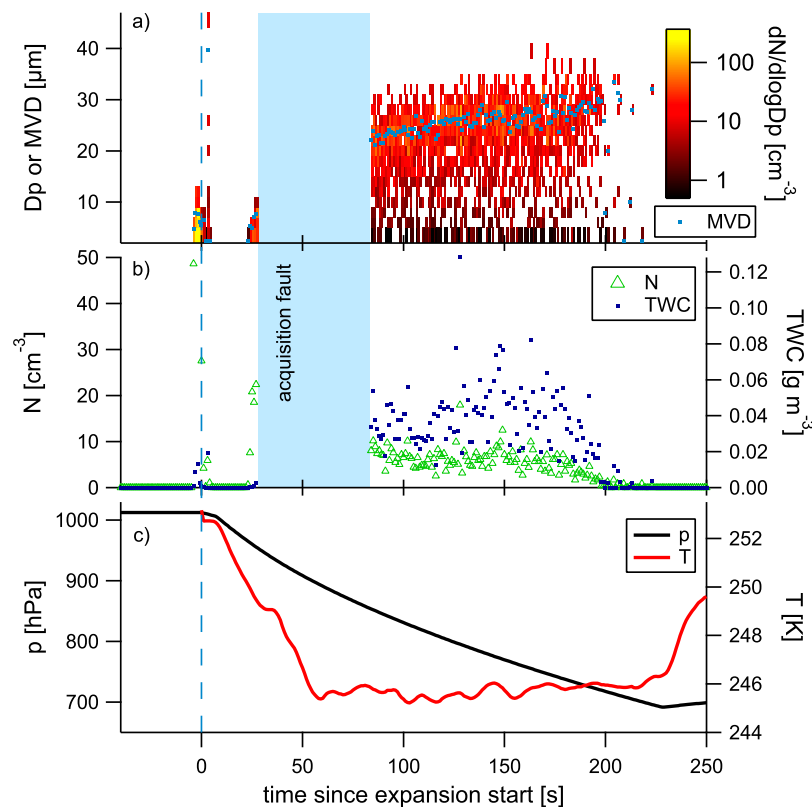


Figure S.1: First cloud activation run after the clean bag transfer (experiment 1, see Table 1 in main manuscript). The panels show the time series of FSSP measurements of size distribution and mean volume diameter (MVD, panel a), total water content (TWC) and number concentration (N, panel b), and temperature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

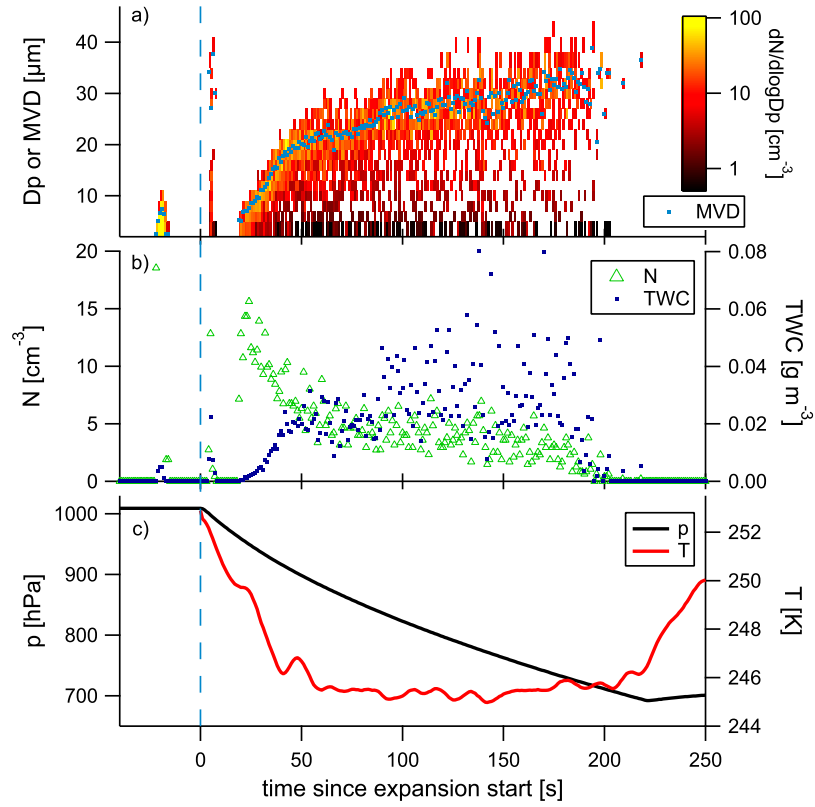


Figure S.2: Second cloud activation run after the clean bag transfer (experiment 1, see Table 1 in main manuscript). Panels as in Fig. S.1.

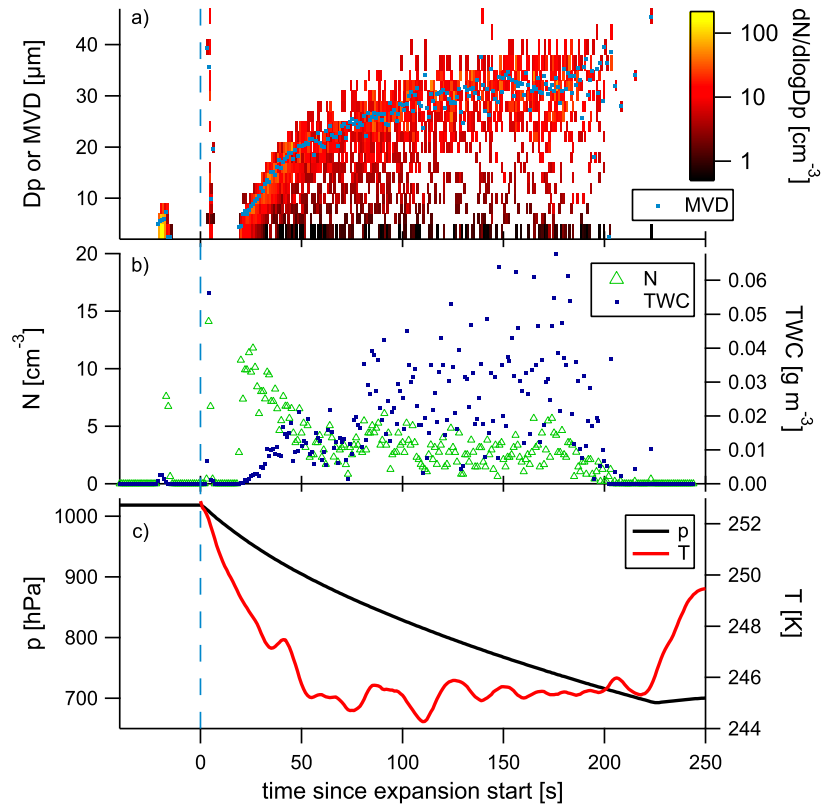


Figure S.3: Third cloud activation run after the clean bag transfer (experiment 1, see Table 1 in main manuscript). Panels as in Fig. S.1.

2 SOA background

Two types of SOA backgrounds were transferred, with varying levels of UV radiation. That means, all chemical substances as in a normal SOA experiment were used, without the actual precursor. In the 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 second background experiment, the 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.

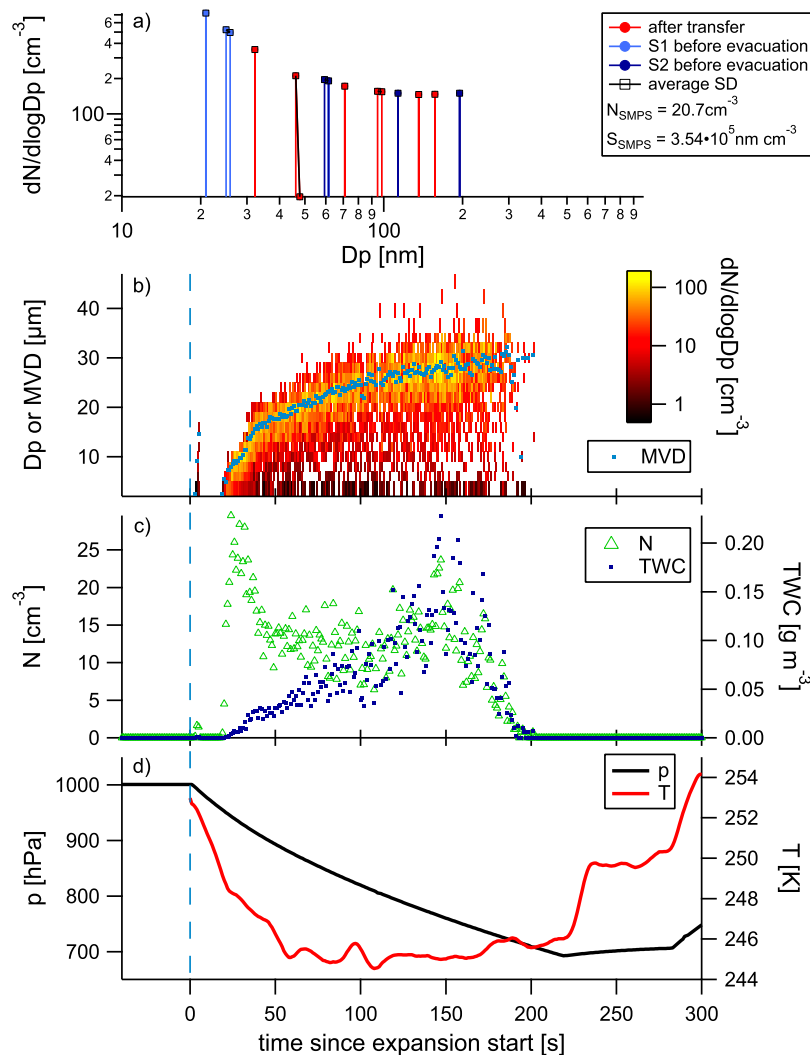


Figure S.4: First cloud activation run during first SOA background measurements (experiment 3, see Table 1 in main manuscript). The uppermost panel shows the SMPS size distributions obtained before the cloud expansion (panel a), followed by time series of FSSP measurements of size distribution and mean volume diameter (MVD, panel b), total water content (TWC) and number concentration (N, panel c), and temperature and pressure (panel d) during evacuation.

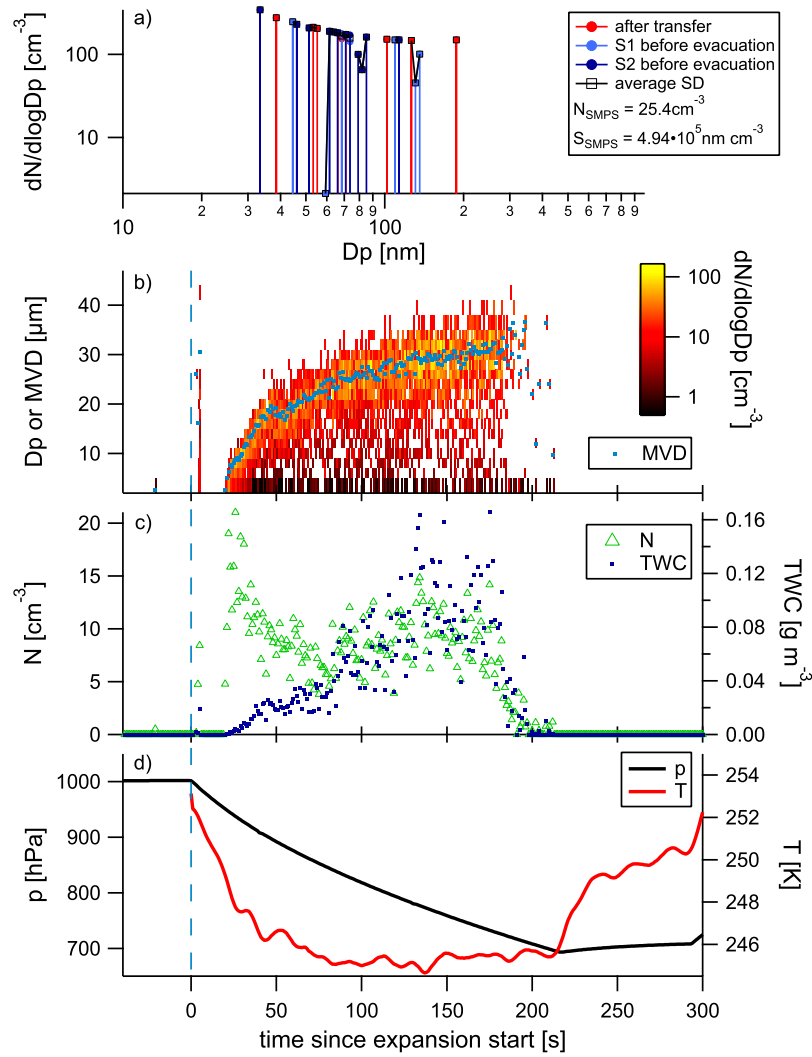


Figure S.5: As above for the second cloud activation run in the first SOA background experiment (experiment 3, see Table 1 in main manuscript).

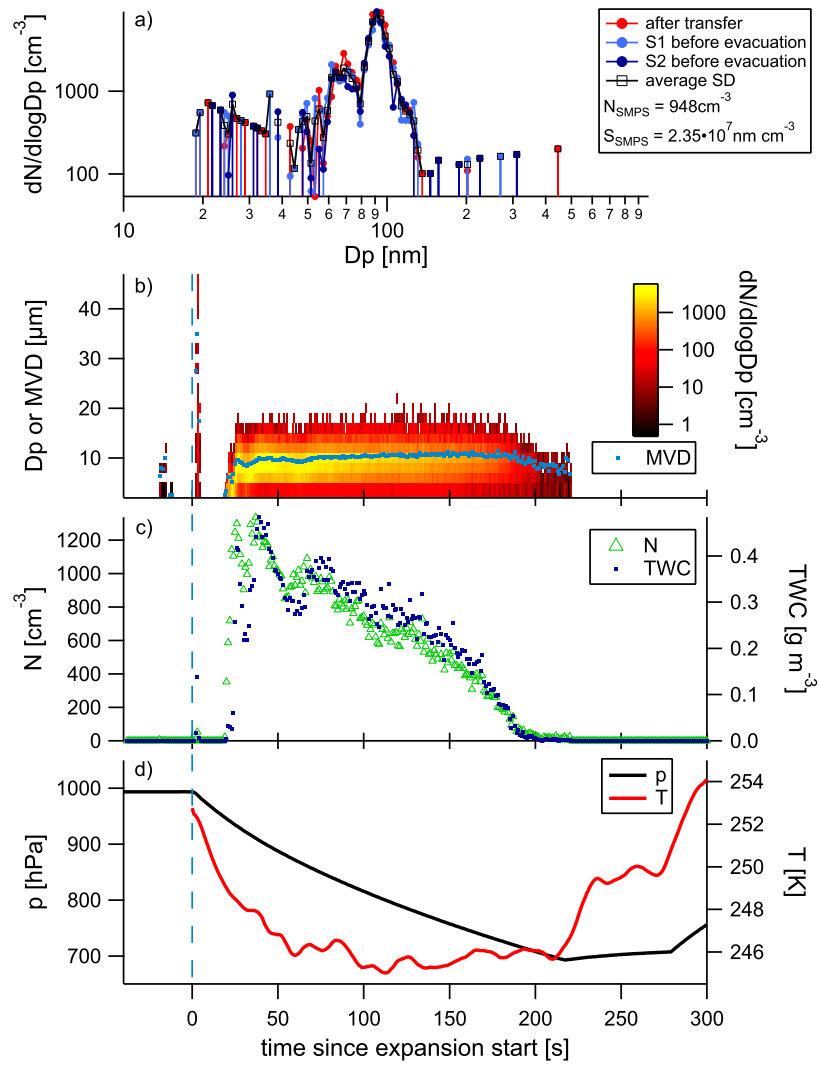


Figure S.6: First cloud activation run on 'harsh UV' SOA background (experiment 5, see Table 1 in main manuscript), panels as in Fig. S.4.

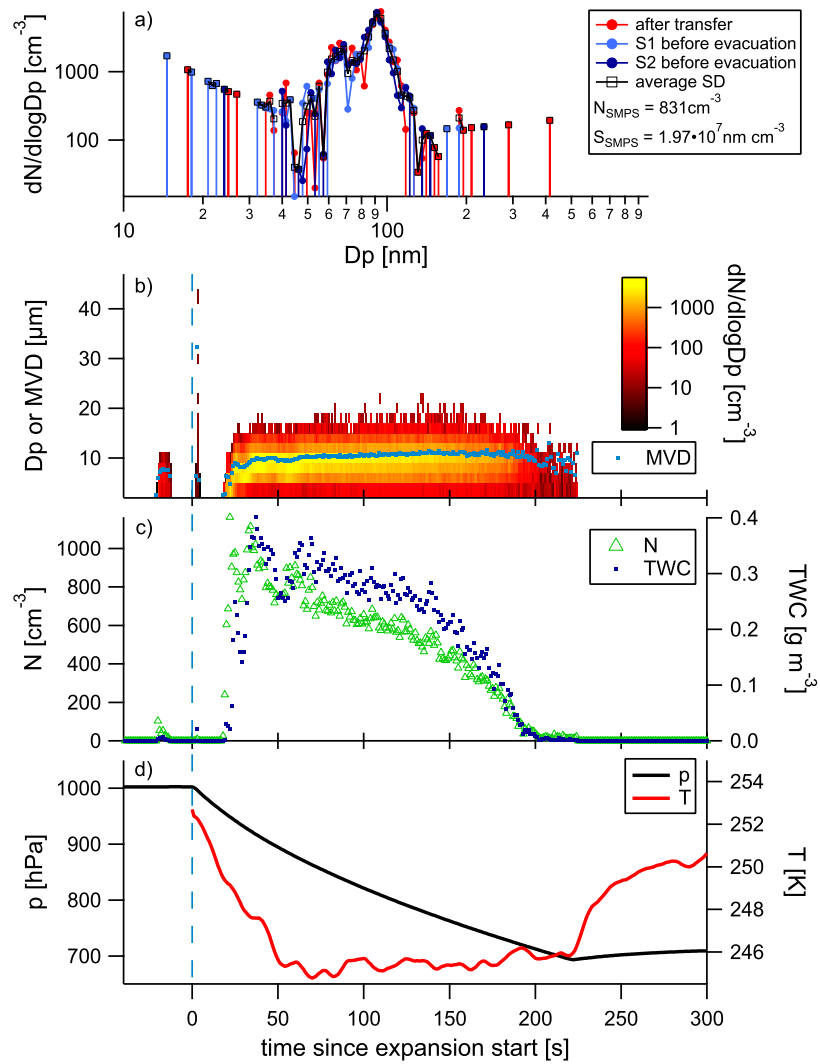


Figure S.7: Second cloud activation run on 'harsh UV' SOA background (experiment 5, see Table 1 in main manuscript), panels as in Fig. S.4.

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.

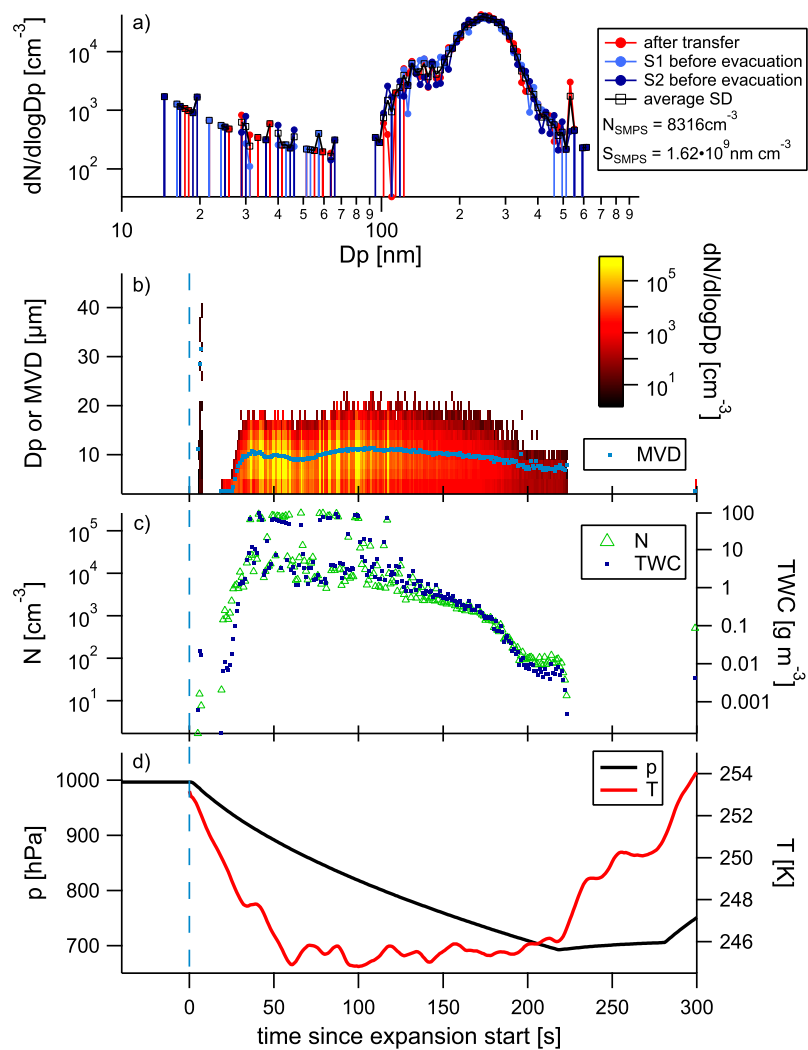


Figure S.8: First cloud activation run performed on SOA from α -pinene precursor (experiment 4, see Table 1 in main manuscript), panels as in Fig. S.4.

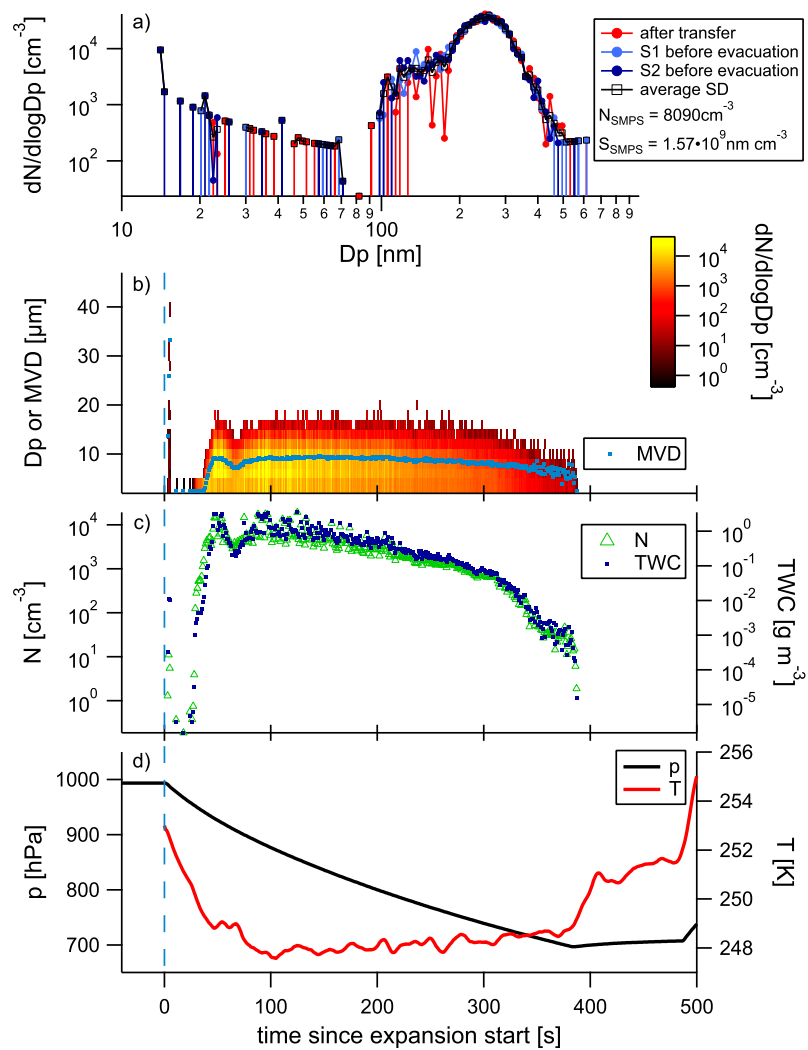


Figure S.9: Second cloud activation run performed on SOA from α -pinene precursor (experiment 4, see Table 1 in main manuscript), panels as in Fig. S.4.

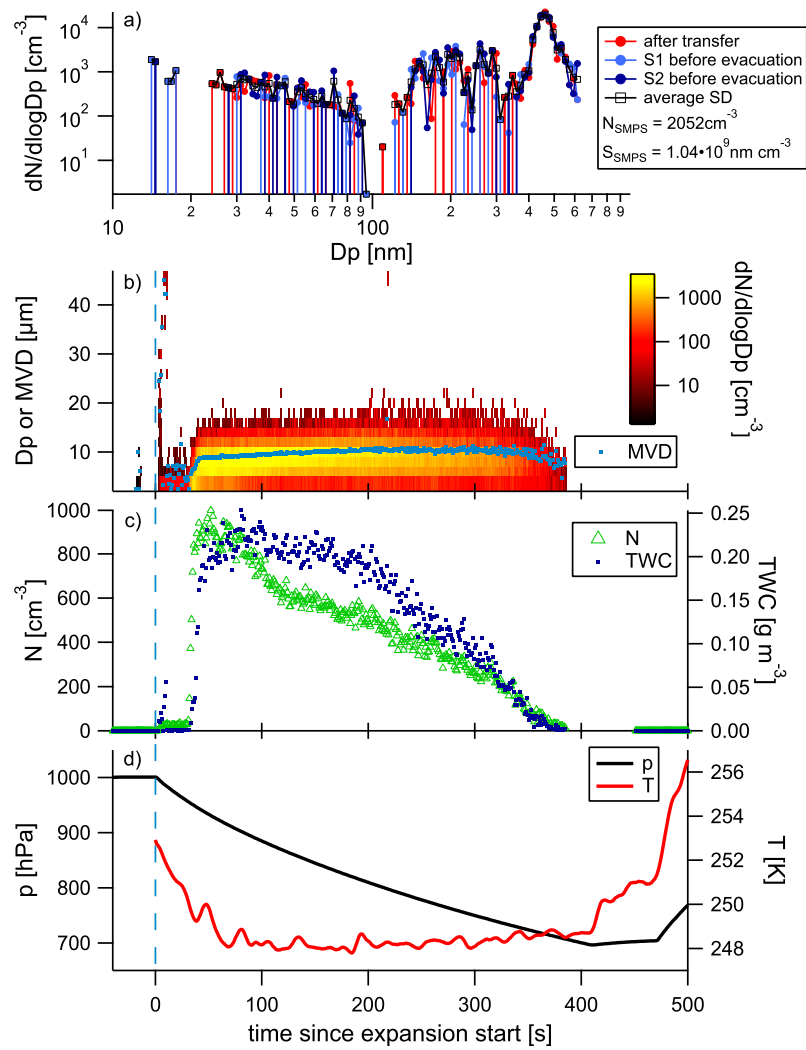


Figure S.10: First cloud activation run performed on SOA from heptadecane precursor (experiment 6, see Table 1 in main manuscript), panels as in Fig. S.4.

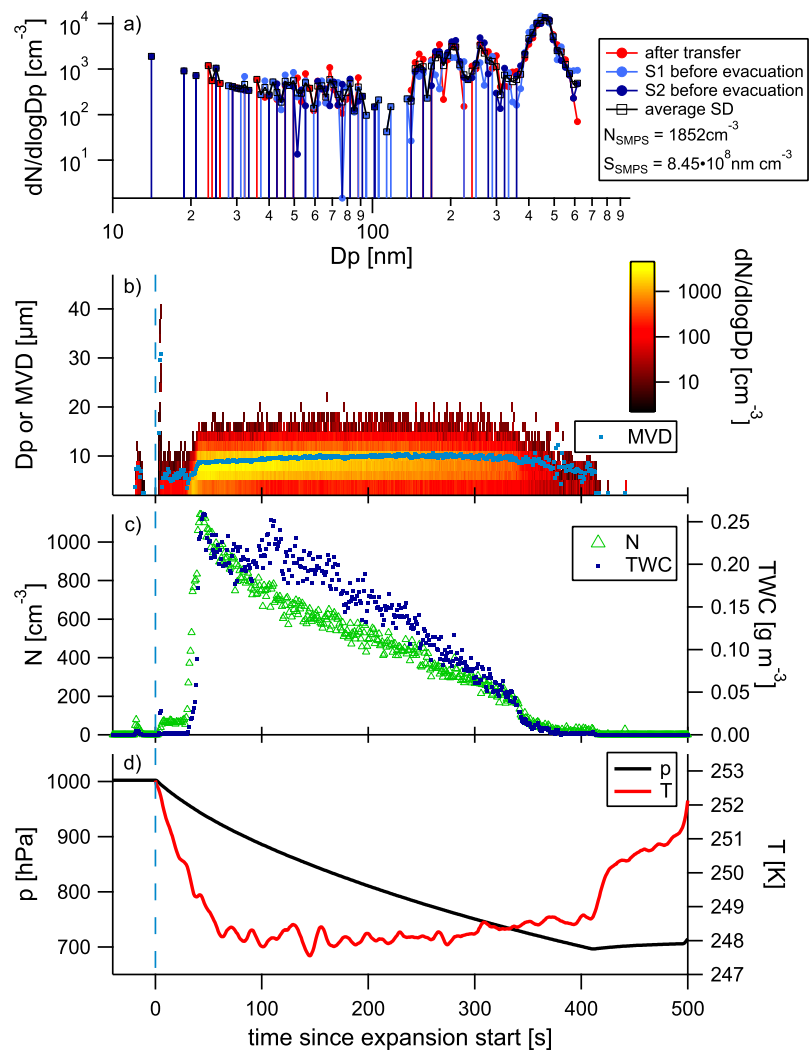


Figure S.11: Second cloud activation run performed on SOA from heptadecane precursor (experiment 6, see Table 1 in main manuscript), panels as in Fig. S.4.

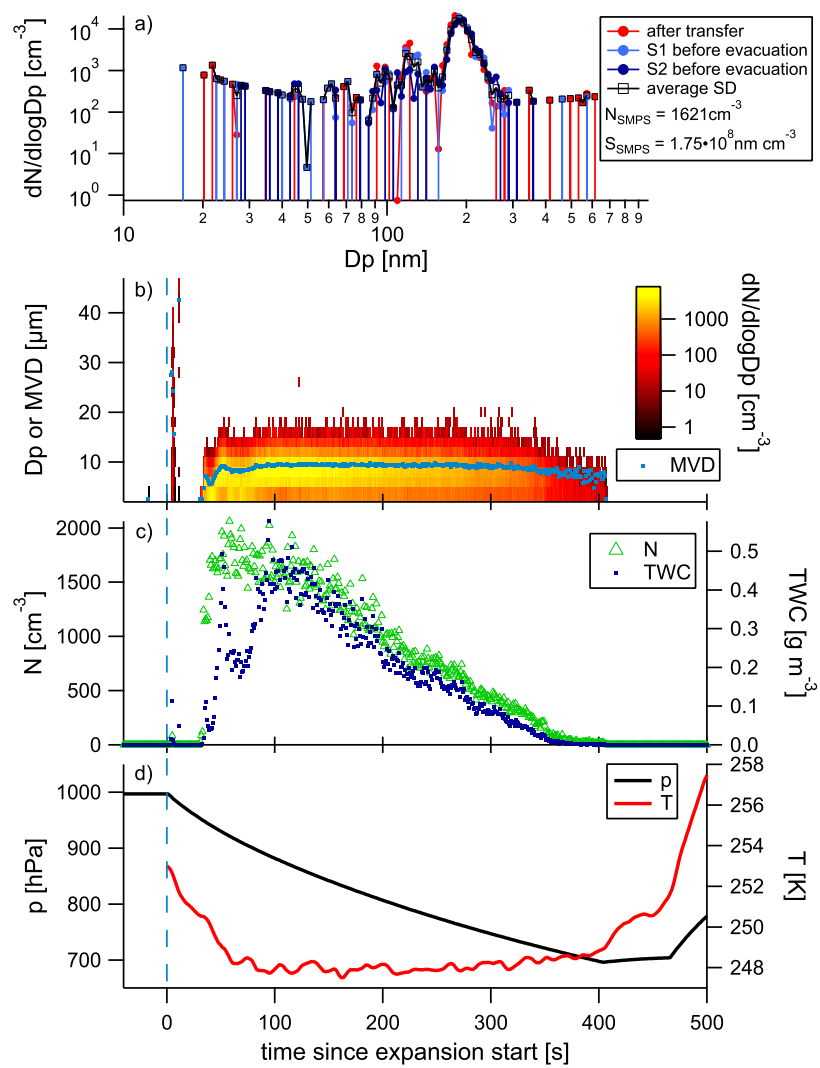


Figure S.12: First cloud activation run performed on SOA from TMB precursor (experiment 7, see Table 1 in main manuscript), panels as in Fig. S.4.

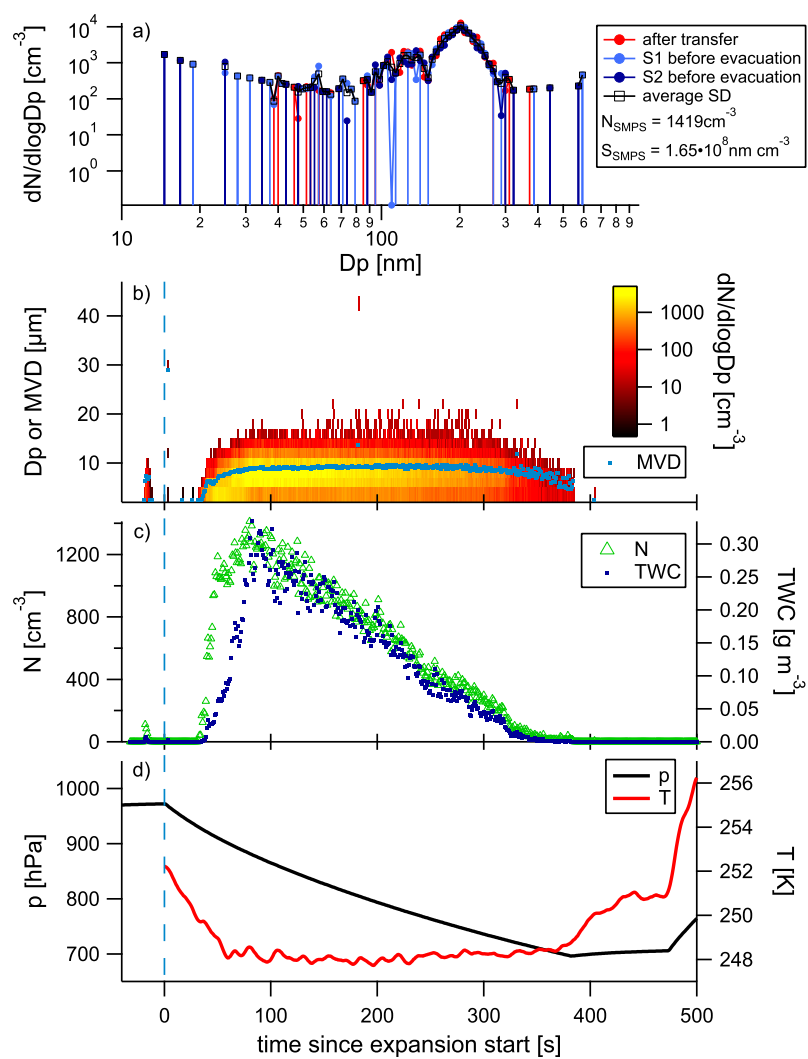


Figure S.13: Second cloud activation run performed on SOA from TMB precursor (experiment 7, see Table 1 in main manuscript), panels as in Fig. S.4.

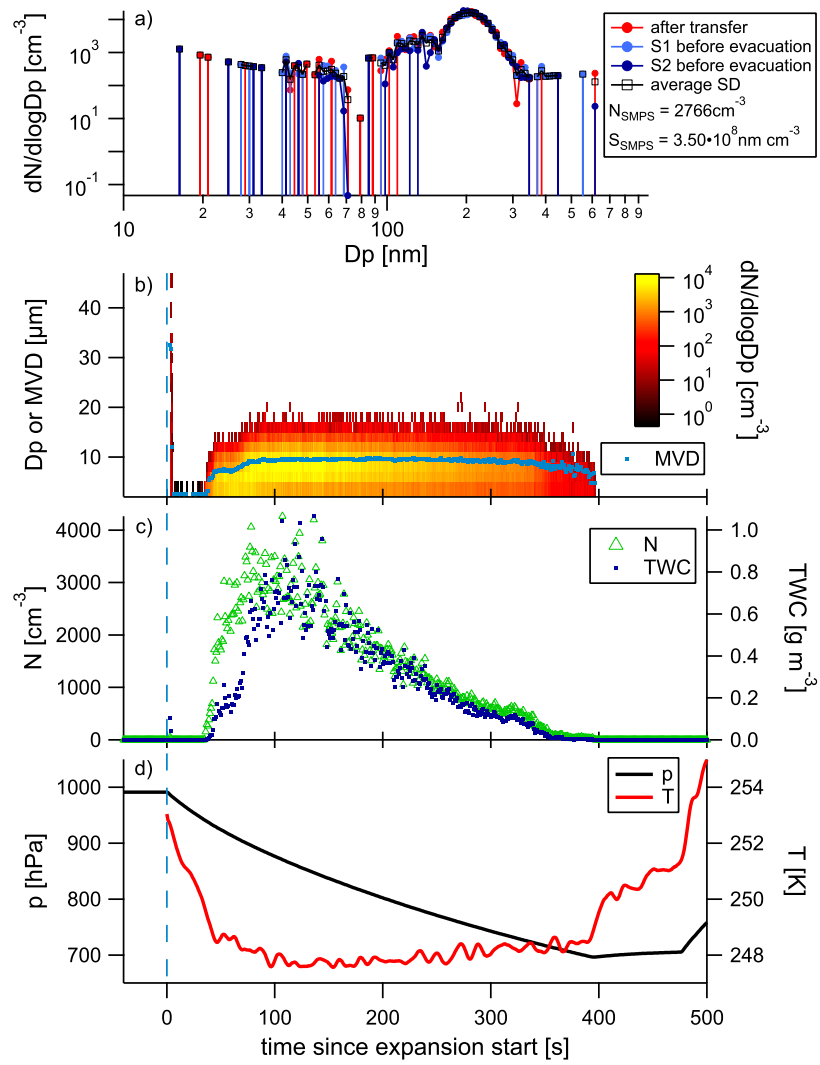


Figure S.14: First cloud activation run performed on α -pinene aerosol precursor (experiment 8, see Table 1 in main manuscript), panels as in Fig. S.4. The second cloud activation run from this experiment is shown in main manuscript.

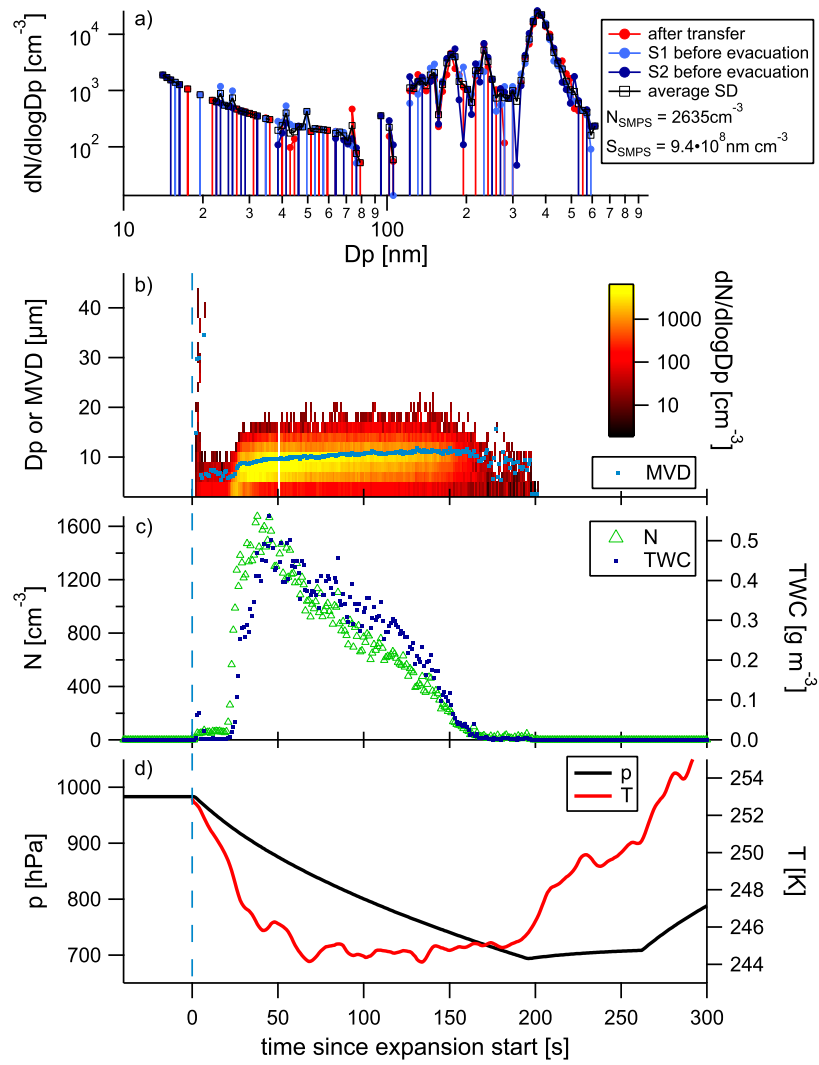


Figure S.15: First cloud activation run performed on SOA from heptadecane precursor (experiment 10, see Table 1 in main manuscript), panels as in Fig. S.4. The second cloud activation run from this experiment is shown in main manuscript.

4 Control experiments with ammonium sulfate

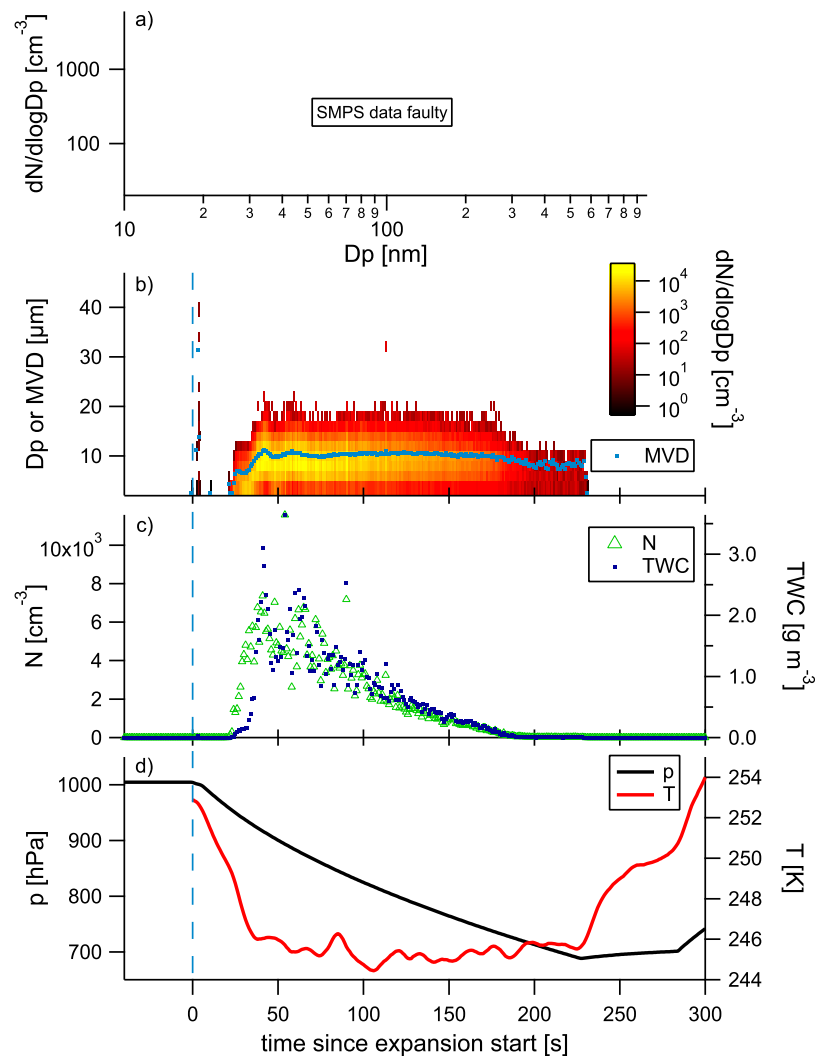


Figure S.16: First cloud activation run performed on ammonium sulfate aerosol (experiment 2, see Table 1 in main text), panels as in Fig. S.4.

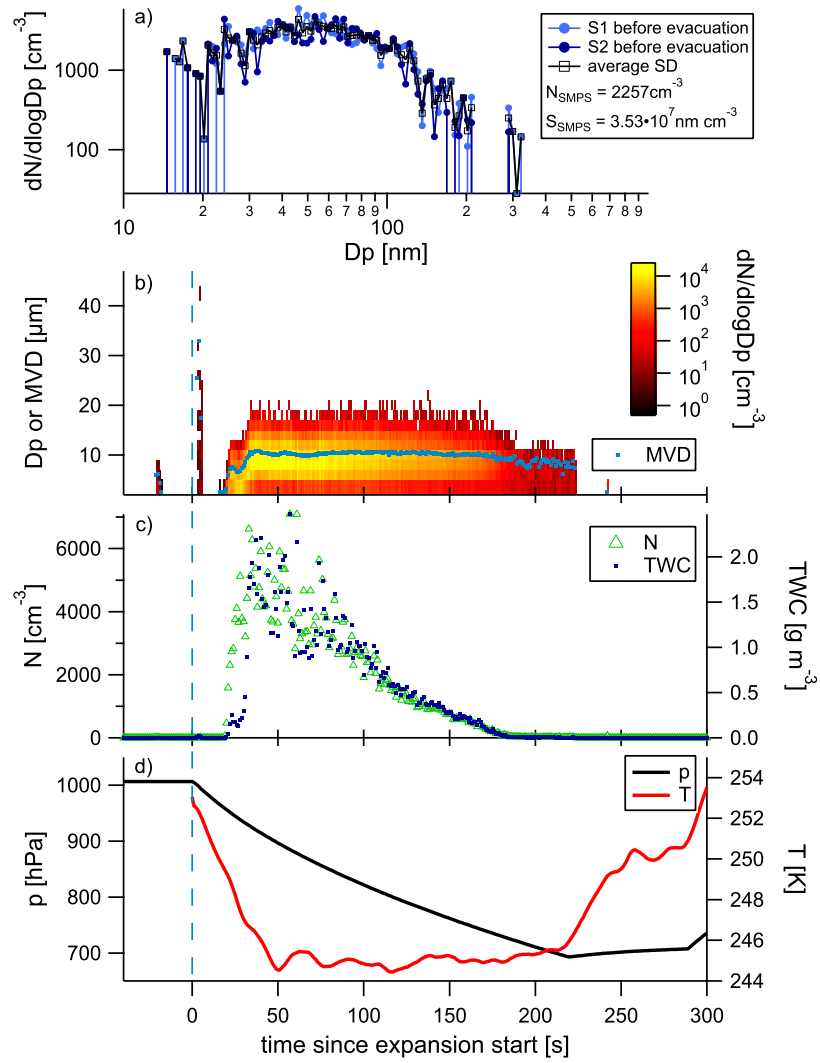


Figure S.17: Second cloud activation run performed on ammonium sulfate aerosol (experiment 2, see Table 1 in main text), panels as in Fig. S.4.

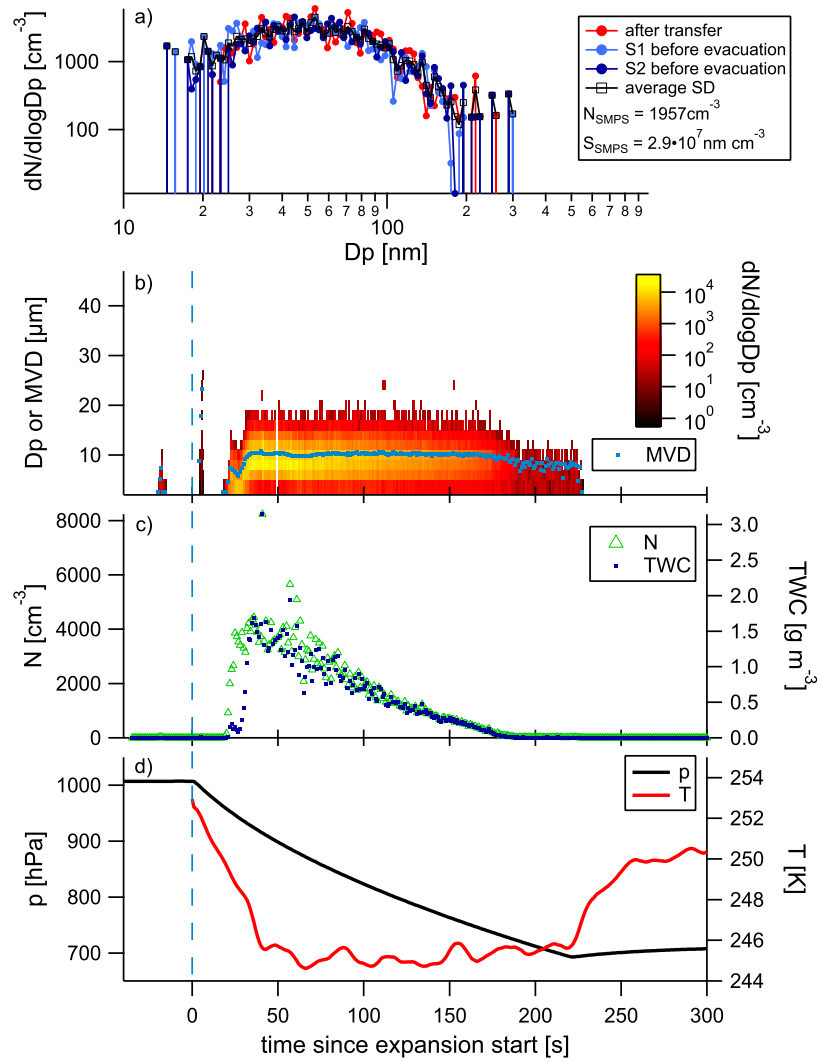


Figure S.18: Third cloud activation run performed on ammonium sulfate aerosol (experiment 2, see Table 1 in main text), panels as in Fig. S.4.

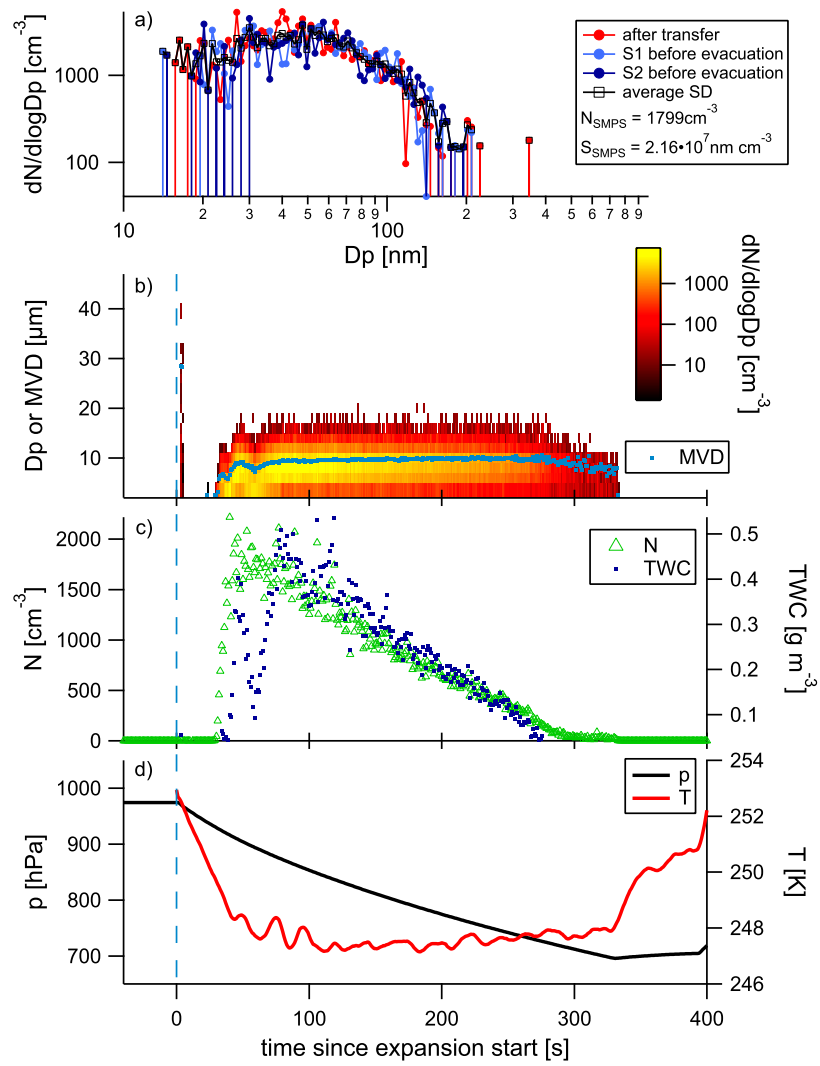


Figure S.19: First cloud activation run performed on ammonium sulfate aerosol (experiment 9, see Table 1 in main text), panels as in Fig. S.4.

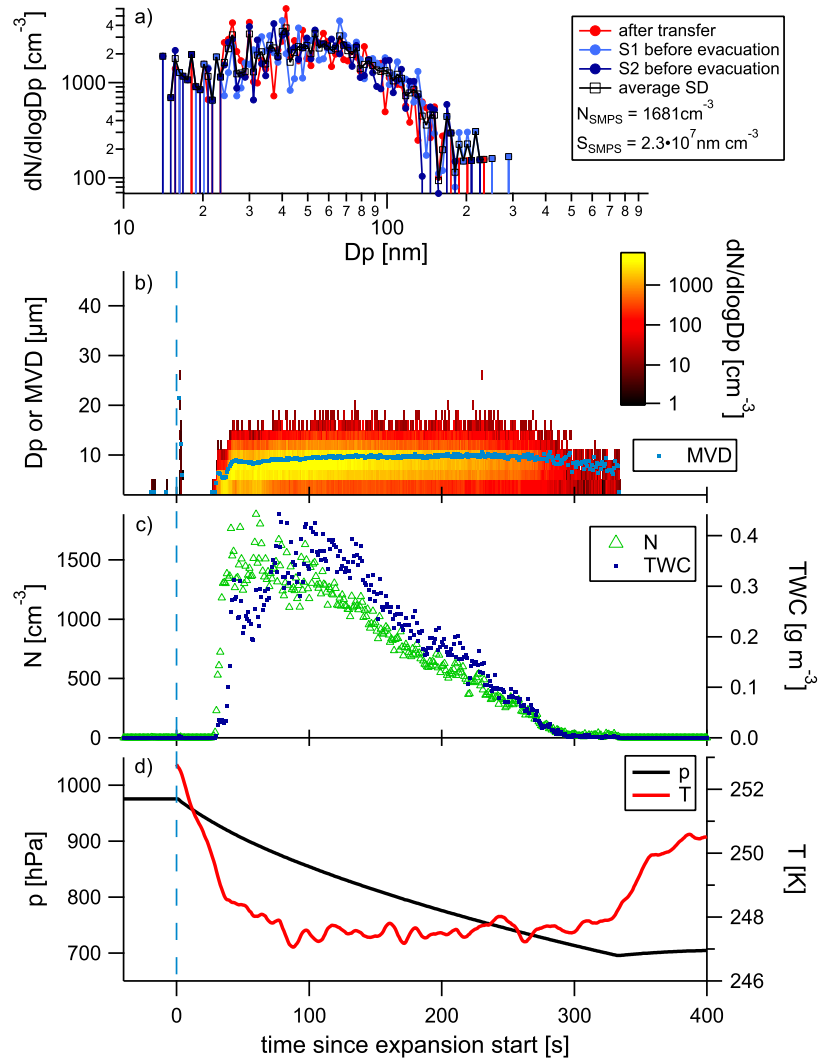


Figure S.20: Second cloud activation run performed on ammonium sulfate aerosol (experiment 9, see Table 1 in main text), panels as in Fig. S.4.

5 Sensitivity experiment with kaolinite

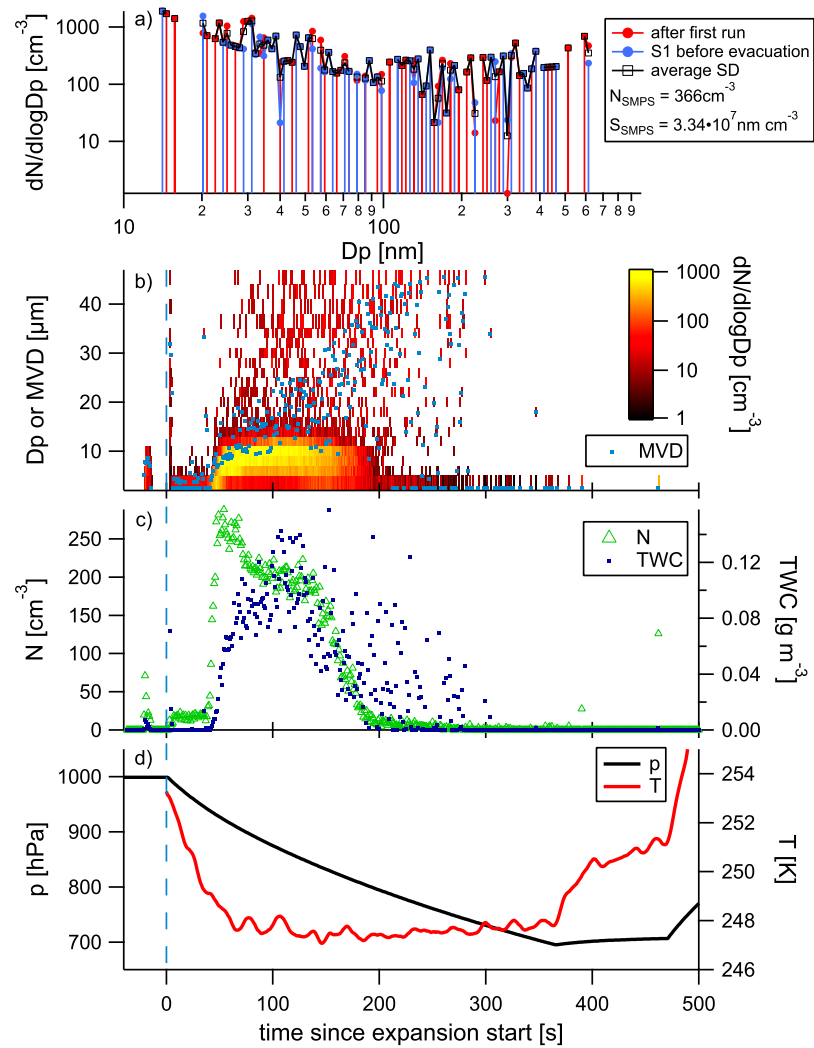


Figure S.21: Second cloud activation run performed on dust (experiment 11, see Table 1 in main manuscript), panels as in Fig. S.4. The first cloud activation run from this experiment is shown in main manuscript.

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