

Figure S1. Aerosol particle size distributions measured by the SMPS for 15 flight cases (C298–C314) during the DCMEX campaign, together with two-mode lognormal fits. Blue lines represent observed size distributions, dashed lines indicate individual lognormal modes, and black lines show the total fit. Fitted parameters (number concentration, geometric standard deviation, and mean diameter) are shown in each panel.

Table S1. Summary of the two-mode lognormal fits to the SMPS aerosol measurements, providing the number concentration (N , cm^{-3}), mean diameter (D_m , nm), and geometric standard deviation ($\ln \sigma$, dimensionless) for Mode A and Mode B.

Date	Flight	Mode A			Mode B		
		N_A	D_{mA}	$\ln \sigma_A$	N_B	D_{mB}	$\ln \sigma_B$
Tue 19 Jul	C298	381.49	40	0.40	867.42	104	0.39
Wed 20 Jul	C299	192.27	30	0.29	1263.75	96	0.47
Fri 22 Jul	C300	515.18	55	0.43	710.96	115	0.36
Sun 24 Jul	C302	542.89	50	0.46	762.32	126	0.38
Mon 25 Jul	C303	847.20	40	0.38	624.09	118	0.38
Tue 26 Jul	C304	289.19	43	0.35	395.68	104	0.45
Wed 27 Jul	C305	842.61	53	0.68	695.99	120	0.42
Fri 29 Jul	C306	456.93	48	0.59	942.71	91	0.47
Sat 30 Jul	C307	982.37	58	0.42	687.51	131	0.30
Sun 31 Jul	C308	792.05	59	0.41	508.57	120	0.34
Mon 1 Aug	C309	558.68	70	0.36	689.68	138	0.36
Tue 2 Aug	C310	186.34	49	0.24	913.51	123	0.41
Thu 4 Aug	C312	479.31	66	0.40	681.96	147	0.37
Sat 6 Aug	C313	285.76	48	0.33	795.40	143	0.41
Sun 7 Aug	C314	1357.87	52	0.41	325.46	154	0.32

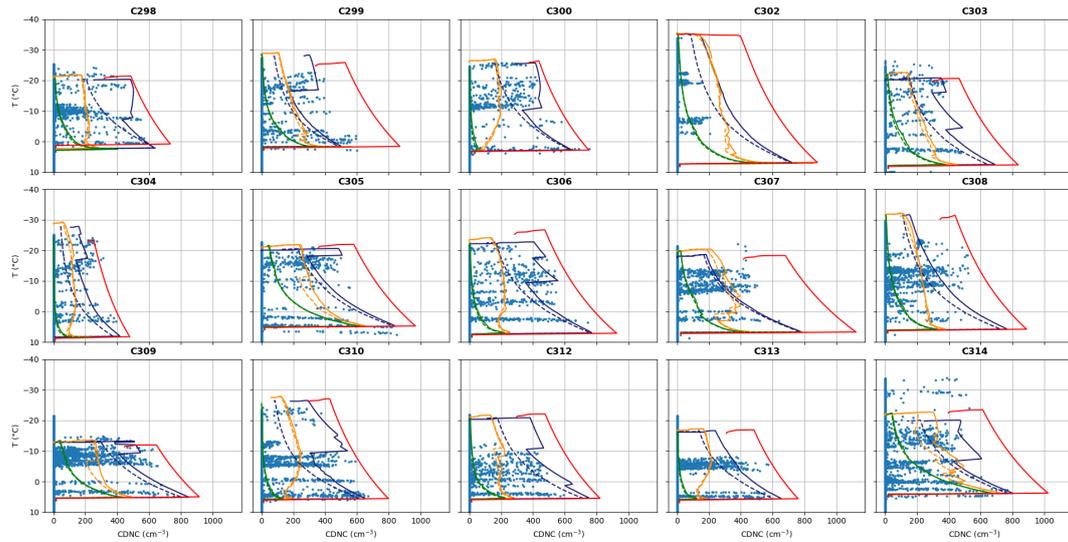


Figure S2. Vertical profiles of cloud droplet number concentration (CDNC) as a function of temperature for 15 flight cases (C298–C314) during the DCMEX campaign. Blue dots indicate observations; red lines denote ADIA; solid blue lines HOM+EA; dashed blue lines HOM; solid orange lines INHOM+EA+RA; dashed orange lines INHOM+RA; solid green lines INHOM+EA; and dashed green lines INHOM.

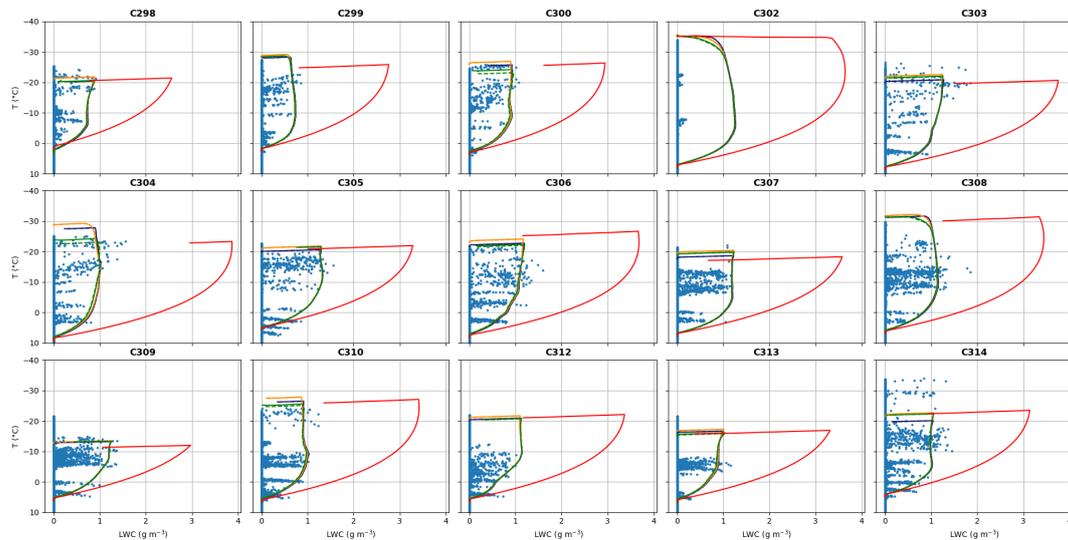


Figure S3. Vertical profiles of liquid water content (LWC) as a function of temperature for 15 flight cases (C298–C314) during the DCMEX campaign. Blue dots indicate observations, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).

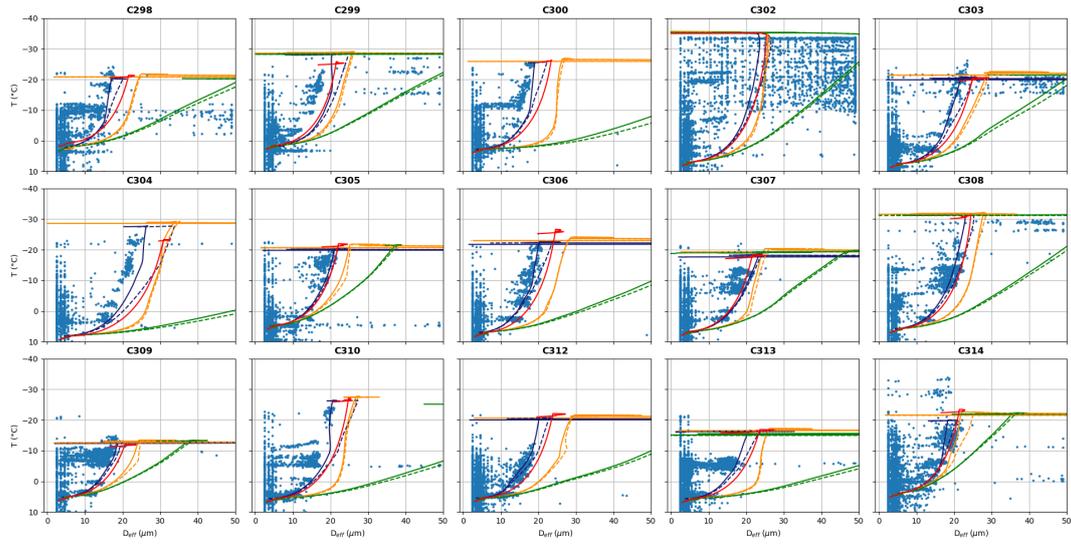


Figure S4. Vertical profiles of cloud droplet effective diameter (D_{eff}) as a function of temperature for 15 flight cases (C298–C314) during the DCMEX campaign. Blue dots indicate observations, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).

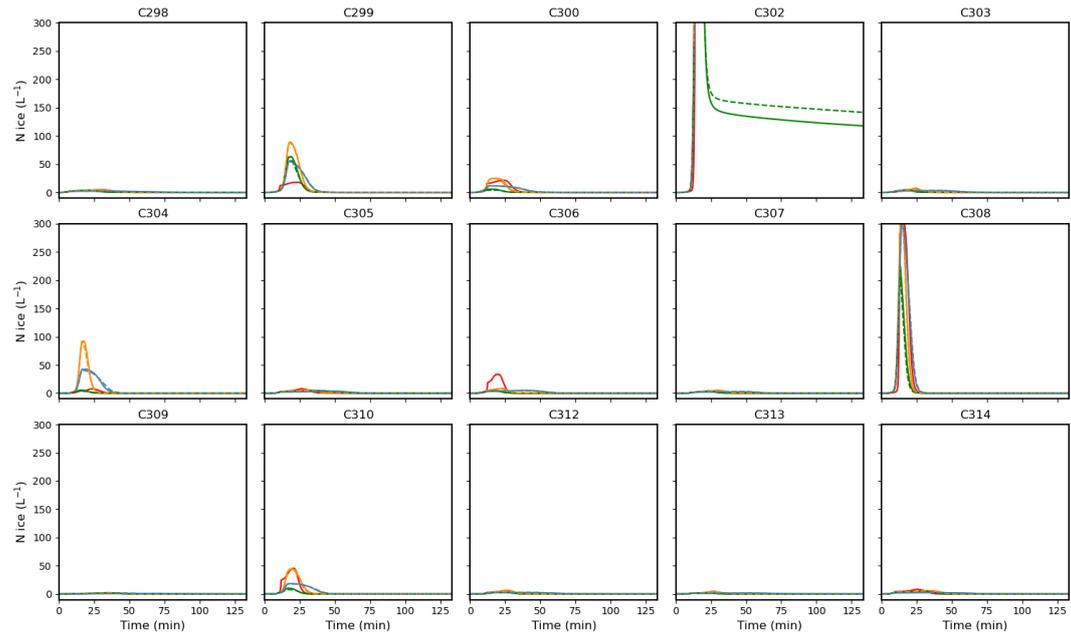


Figure S5. Time series of ice crystal number concentration (N_{ice}) for the 15 simulated flight cases (C298–C314) during the DCMEX campaign. All SIP mechanisms are switched off, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).

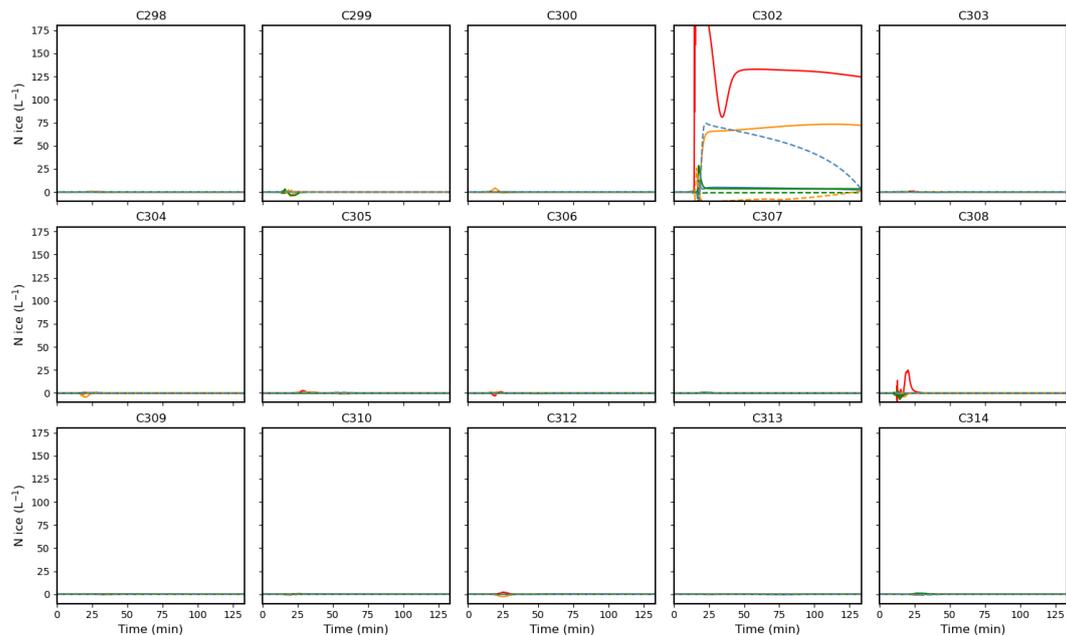


Figure S6. Ice enhancement for the 15 simulated flight cases (C298–C314) during the DCMEX campaign. Only RS is activated, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).

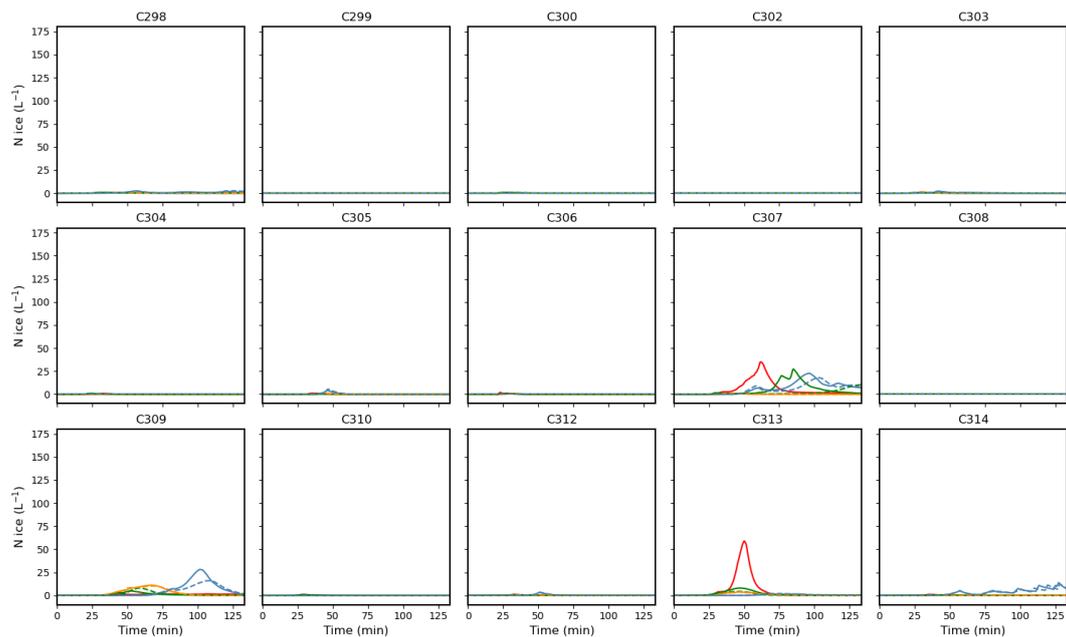


Figure S7. Ice enhancement for the 15 simulated flight cases (C298–C314) during the DCMEX campaign. Only CB is activated, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).

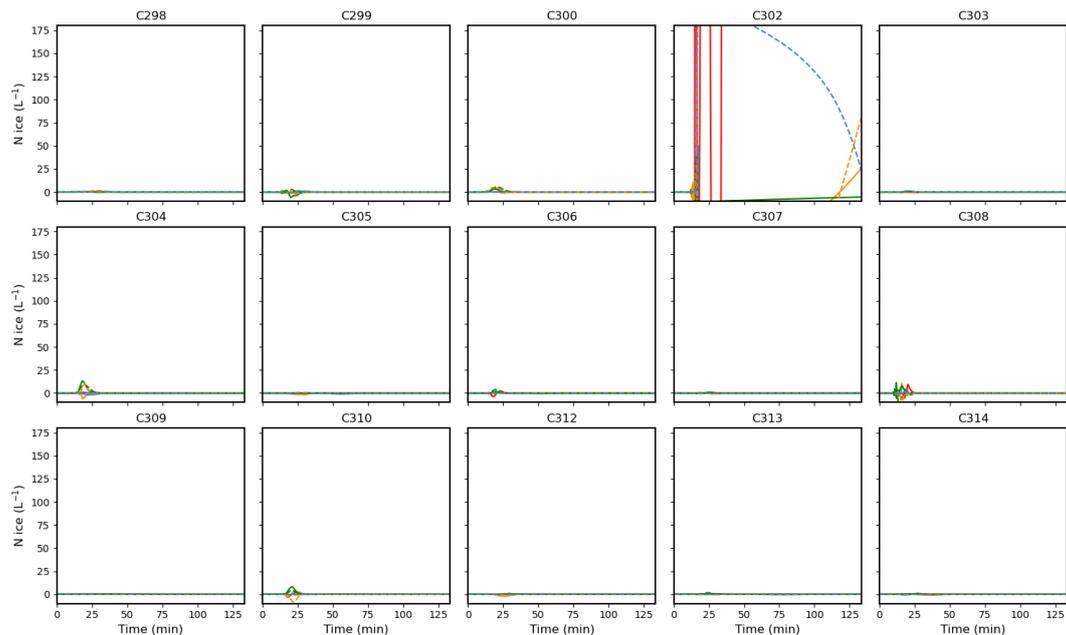


Figure S8. Ice enhancement for the 15 simulated flight cases (C298–C314) during the DCMEX campaign. Only M1 is activated, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).

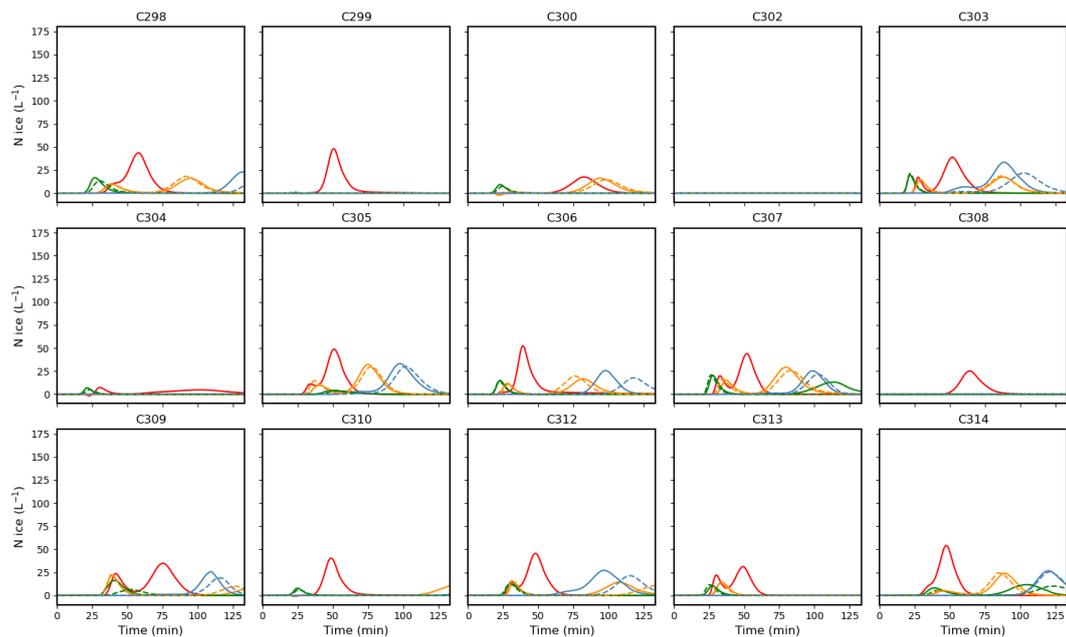


Figure S9. Ice enhancement for the 15 simulated flight cases (C298–C314) during the DCMEX campaign. Only M2 is activated, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).

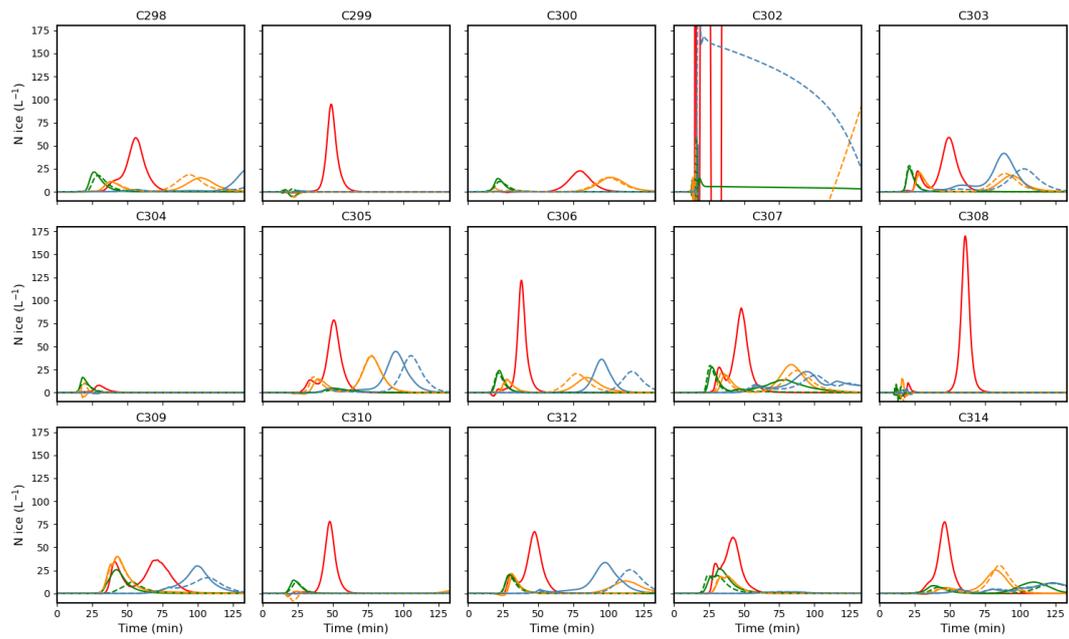


Figure S10. Ice enhancement for the 15 simulated flight cases (C298–C314) during the DCMEX campaign. All SIP mechanisms are activated together, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).

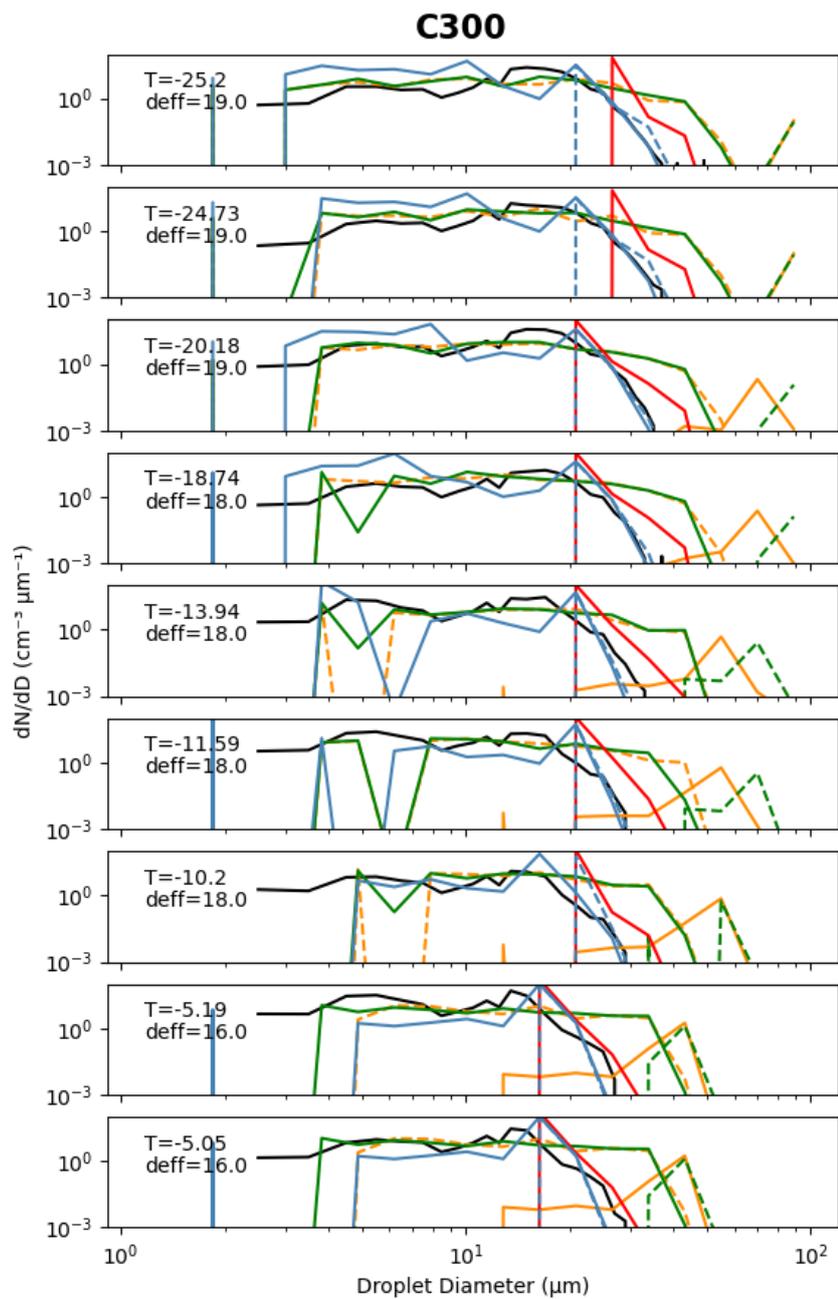


Figure S11. Droplet size distributions (DSDs) for three representative cases of the DCMEX campaign: C300 (22 July 2022), C303 (25 July 2022), and C309 (1 August 2022). Black lines indicate observations, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).

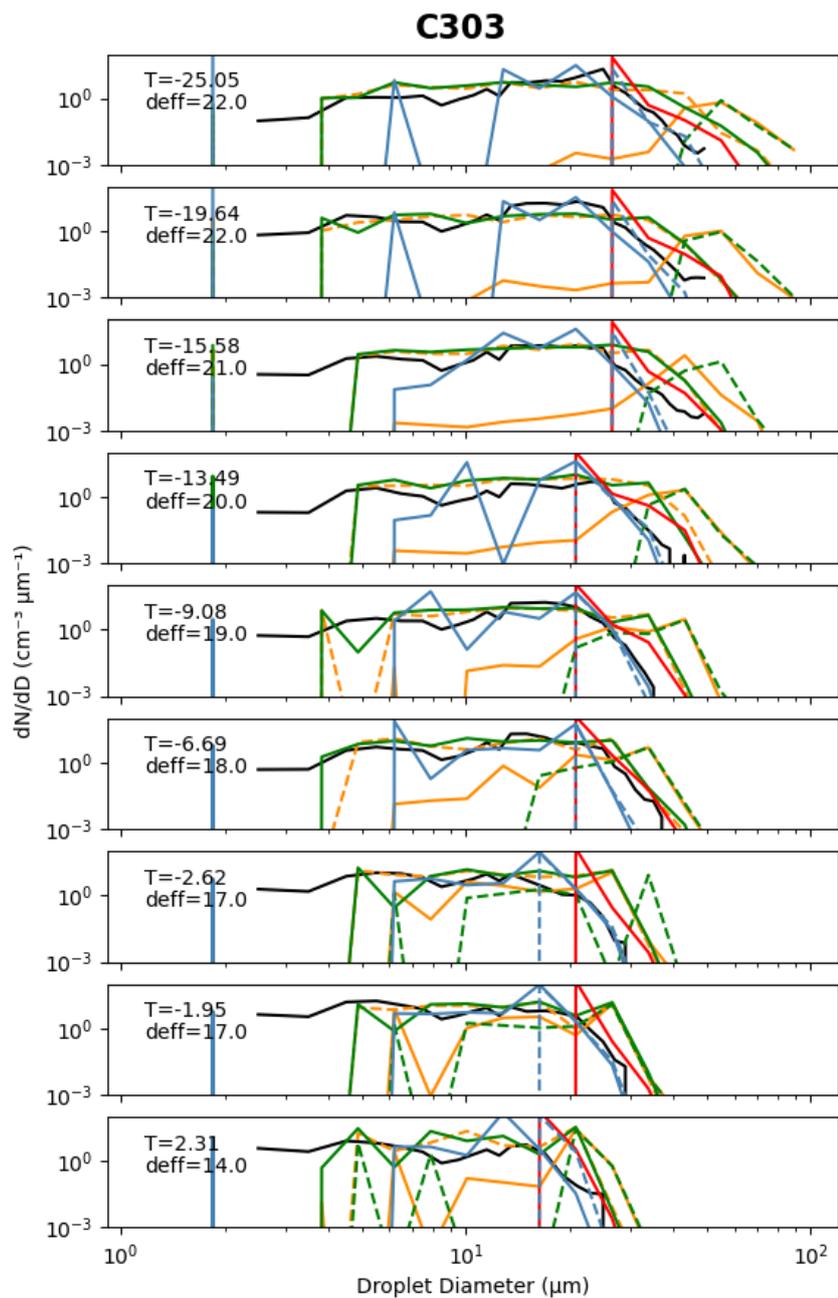


Figure S12. Droplet size distributions (DSDs) for three representative cases of the DCMEX campaign: C300 (22 July 2022), C303 (25 July 2022), and C309 (1 August 2022). Black lines indicate observations, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).

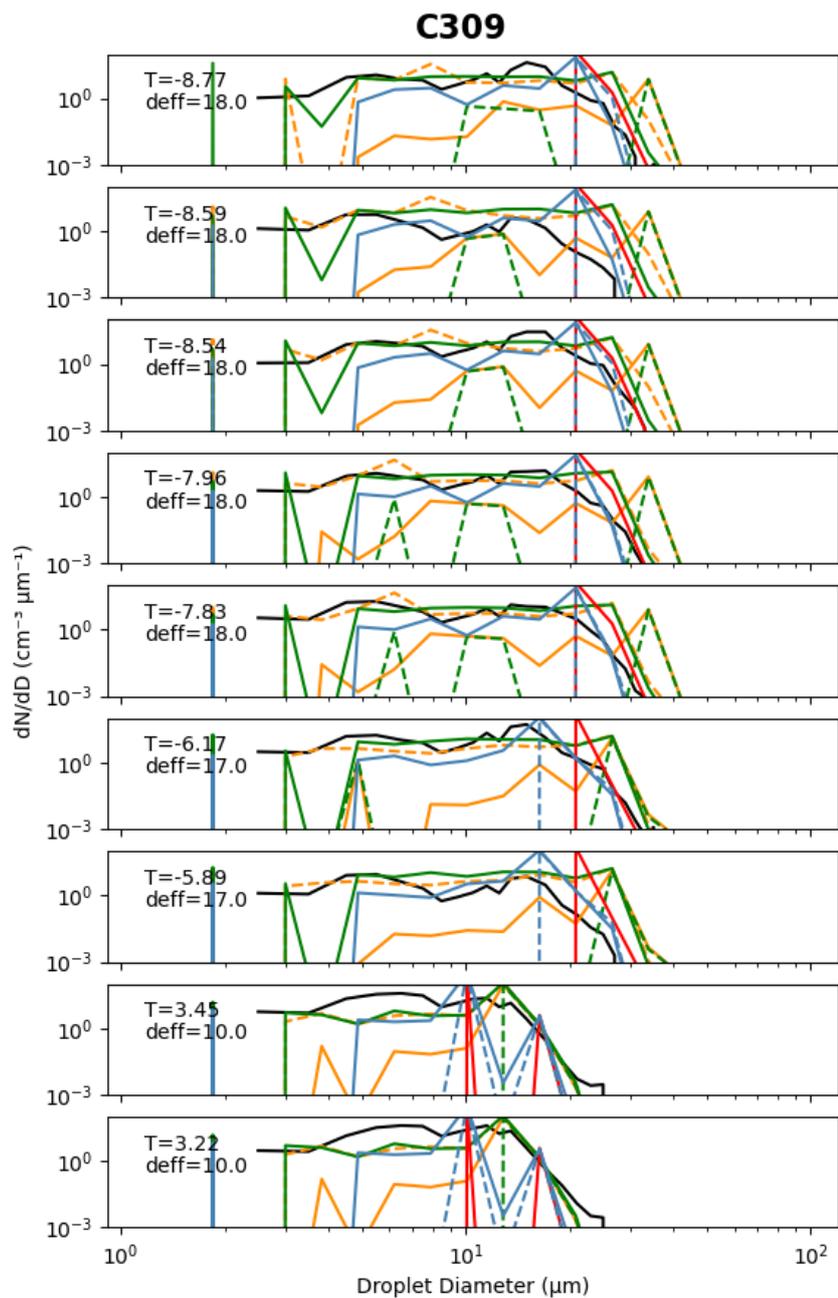


Figure S13. Droplet size distributions (DSDs) for three representative cases of the DCMEX campaign: C300 (22 July 2022), C303 (25 July 2022), and C309 (1 August 2022). Black lines indicate observations, and coloured lines represent parcel model simulations (colour coding follows Fig. S2).