

Examination of Aerosol Indirect Effects during Cirrus Cloud Evolution

Flor Vanessa Maciel¹, Minghui Diao¹, Ryan Patnaude^{1,2}

¹Department of Meteorology and Climate Science, San Jose State University, San Jose, 95192, USA

²*Current affiliation:* Department of Atmospheric Science, Colorado State University, Fort Collins, 80521, USA

Correspondence to: Minghui Diao (minghui.diao@sjtu.edu)

Table S1. A list of UTC timestamps that were removed from the merged observational dataset based on data quality control and the problematic measurements associated with each time segment.

Campaign	Research Flight	Start UTC (s)	End UTC (s)	Comments
CONTRAST	16	3786	3943	Problem with RHi measurements
CONTRAST	16	3947	4295	Problem with RHi measurements
CONTRAST	16	4309	9815	Problem with RHi measurements
CONTRAST	16	10794	11250	Problem with RHi measurements
HIPPO-2	1	75892	75904	Problem with RHi measurements
HIPPO-2	1	75913	75914	Problem with RHi measurements
HIPPO-2	7	77327	77336	Problem with cloud probe image
HIPPO-2	7	77338	77343	Problem with cloud probe image
HIPPO-2	7	77319	77319	Problem with cloud probe image
HIPPO-2	7	77358	77370	Problem with cloud probe image
HIPPO-2	10	82600	82600	Problem with cloud probe image
HIPPO-2	10	82603	82603	Problem with cloud probe image
HIPPO-2	10	82604	82604	Problem with cloud probe image
HIPPO-4	6	94493	94493	Problem with cloud probe image
HIPPO-4	6	94509	94509	Problem with cloud probe image
HIPPO-4	6	94519	94519	Problem with cloud probe image
HIPPO-4	6	94717	94717	Problem with cloud probe image
ORCAS	18	88386	88386	Problem with cloud probe image
PREDICT	11	60744	60744	Problem with cloud probe image
PREDICT	23	54390	54391	Problem with cloud probe image
PREDICT	23	54393	54393	Problem with cloud probe image
PREDICT	24	54476	54476	Problem with cloud probe image
PREDICT	24	44094	44094	Problem with cloud probe image
PREDICT	24	44098	44098	Problem with cloud probe image
START08	6	78477	78551	Problem with RHi measurements
START08	6	85333	85412	Problem with RHi measurements
TORERO	14	77946	77946	Problem with cloud probe image
TORERO	14	77951	77951	Problem with cloud probe image

Table S2. Linear regression intercept (a) and slope (b), with their associated standard deviations (σ) for Figures 10 and 11.

1-Hz Observations														
dlog ₁₀ (IWC)				dlog ₁₀ (Ni)				dlog ₁₀ (Di)						
Phases	a	σ_a	b	σ_b	a	σ_a	b	σ_b	a	σ_a	b	σ_b		
dlog ₁₀ (Na ₁₀₀)	2	-0.745	0.116	0.331	0.125	-0.531	0.072	0.255	0.077	-0.034	0.012	-0.003	0.012	
	3	-0.235	0.087	0.084	0.073	-0.154	0.051	0.012	0.043	-0.008	0.017	0.021	0.014	
	4	0.722	0.068	0.405	0.052	0.468	0.039	0.231	0.029	0.047	0.009	0.036	0.007	
	5	-0.757	0.077	0.443	0.074	-0.498	0.054	0.364	0.052	-0.059	0.009	0.010	0.009	
	2	-0.846	0.132	1.200	0.241	-0.526	0.087	0.976	0.159	-0.065	0.019	0.070	0.035	
dlog ₁₀ (Na ₅₀₀)	3	-0.309	0.109	0.479	0.132	-0.260	0.052	-0.019	0.064	0.017	0.020	0.164	0.024	
	4	0.438	0.072	0.431	0.065	0.281	0.039	0.162	0.036	0.028	0.007	0.068	0.007	
	5	-1.243	0.150	-0.116	0.243	-0.744	0.115	-0.089	0.187	-0.107	0.018	-0.003	0.030	
430-s Observations														
dlog ₁₀ (IWC)				dlog ₁₀ (Ni)				dlog ₁₀ (Di)						
Phases	a	σ_a	b	σ_b	a	σ_a	b	σ_b	a	σ_a	b	σ_b		
dlog ₁₀ (Na ₁₀₀)	2	-0.201	0.121	0.114	0.111	-0.093	0.086	-0.025	0.079	-0.009	0.016	0.036	0.015	
	3	0.769	0.075	-0.087	0.063	0.736	0.052	-0.091	0.044	0.00006	0.008	-0.014	0.006	
	4	1.546	0.046	0.286	0.035	1.198	0.027	0.198	0.020	0.059	0.008	-0.006	0.006	
	5	0.284	0.061	0.053	0.057	0.356	0.043	0.031	0.040	-0.035	0.006	-0.009	0.006	
	2	-0.401	0.204	0.018	0.190	-0.330	0.150	-0.033	0.140	0.017	0.022	0.003	0.020	
dlog ₁₀ (Na ₅₀₀)	3	0.524	0.090	0.339	0.074	0.487	0.058	0.194	0.048	0.010	0.011	0.032	0.009	
	4	1.344	0.077	0.280	0.062	1.098	0.048	0.181	0.038	0.032	0.008	0.010	0.007	
	5	0.332	0.079	0.604	0.067	0.370	0.061	0.386	0.052	-0.028	0.014	0.040	0.012	
CAM6 Simulations														
dlog ₁₀ (IWC)				dlog ₁₀ (Ni)				dlog ₁₀ (Di)						
Phases	a	σ_a	b	σ_b	a	σ_a	b	σ_b	a	σ_a	b	σ_b		
dlog ₁₀ (Na ₁₀₀)	2	-0.147	0.069	-0.148	0.145	-0.122	0.087	-0.136	0.183	-0.006	0.013	0.007	0.028	
	3	0.141	0.054	0.023	0.105	0.179	0.062	0.061	0.121	-0.018	0.010	-0.016	0.020	
	4	0.301	0.071	-0.232	0.108	0.425	0.064	0.010	0.097	-0.046	0.006	-0.052	0.009	
	5	0.071	0.057	-0.267	0.110	0.076	0.058	-0.292	0.112	-0.006	0.011	0.016	0.022	
	2	-0.132	0.057	-0.170	0.091	-0.134	0.059	-0.248	0.095	0.008	0.010	0.032	0.016	
dlog ₁₀ (Na ₅₀₀)	3	0.079	0.073	-0.105	0.075	0.120	0.059	-0.089	0.060	-0.013	0.009	0.005	0.009	
	4	0.335	0.071	0.071	0.069	0.474	0.069	0.159	0.067	-0.049	0.007	-0.024	0.007	
	5	0.178	0.067	-0.093	0.071	0.230	0.057	-0.081	0.061	-0.019	0.011	0.005	0.011	

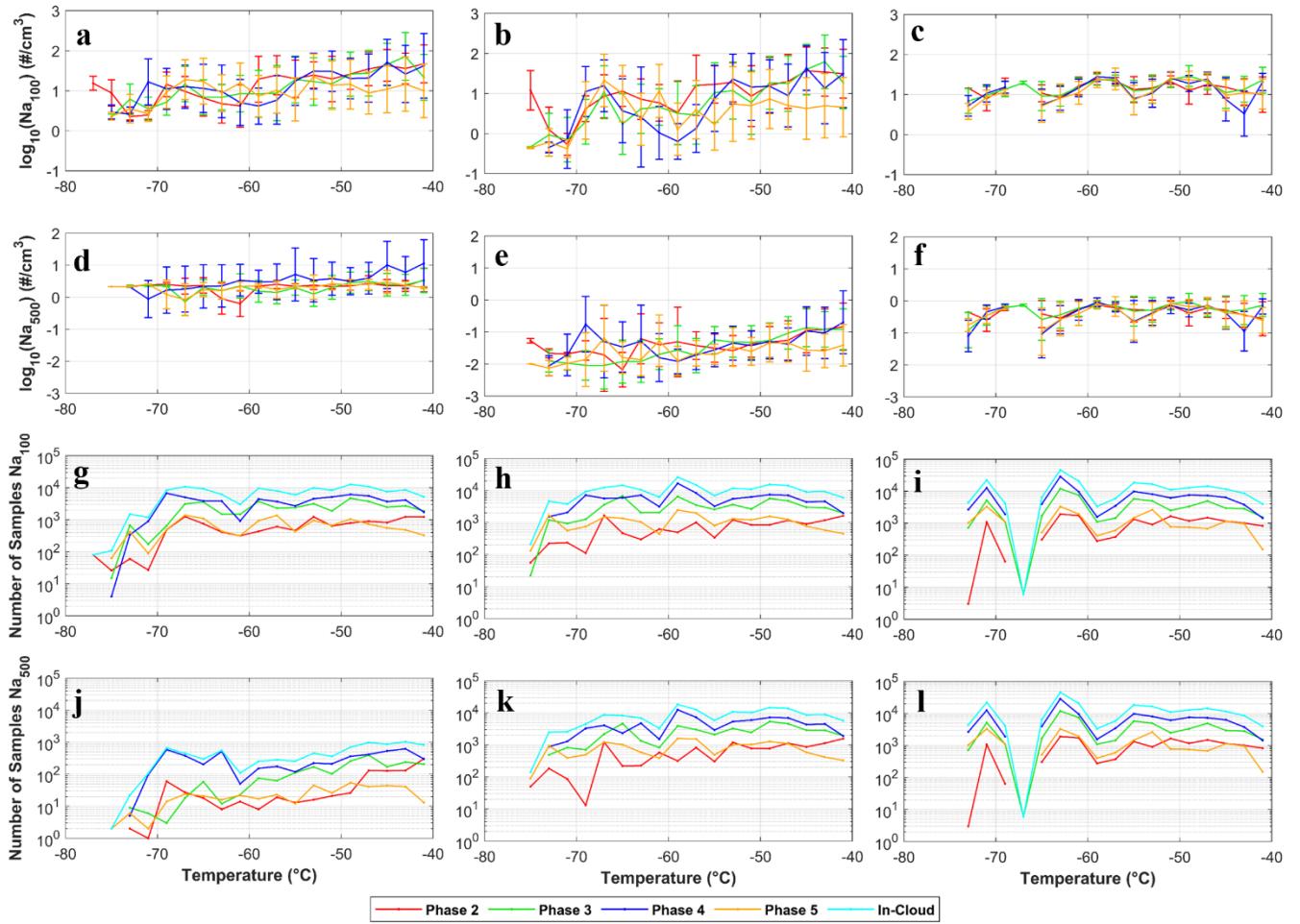


Figure S1. Averages of $\log_{10}(\text{Na}_{100})$ and $\log_{10}(\text{Na}_{500})$ in each 2-degree temperature bin for evolution phases 2 to 5 using 1-s observations, 430-s observations, and the simulations in column 1, 2 and 3, respectively. The number of samples is shown in the last two rows for $\log_{10}(\text{Na}_{100})$ and $\log_{10}(\text{Na}_{500})$.

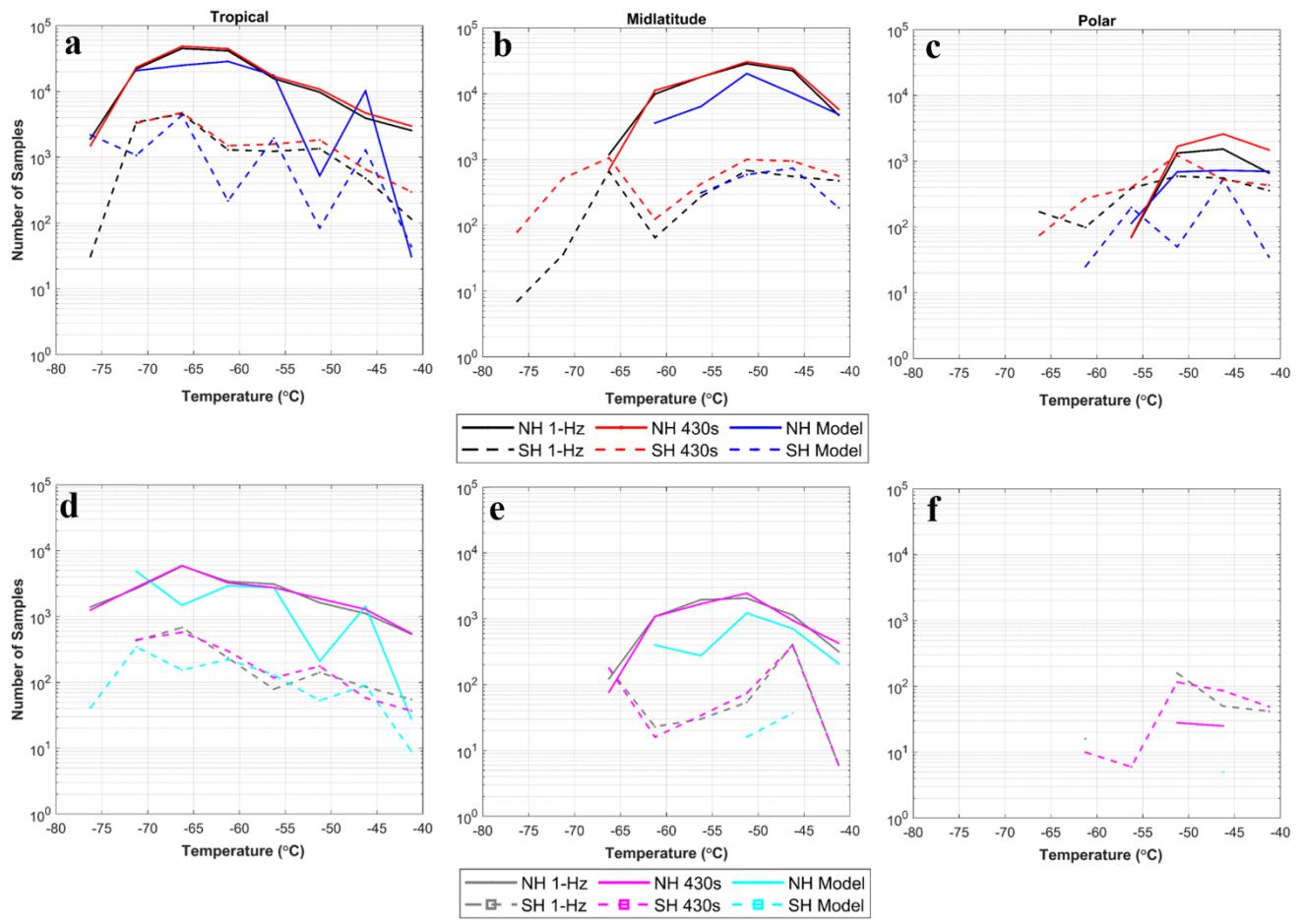
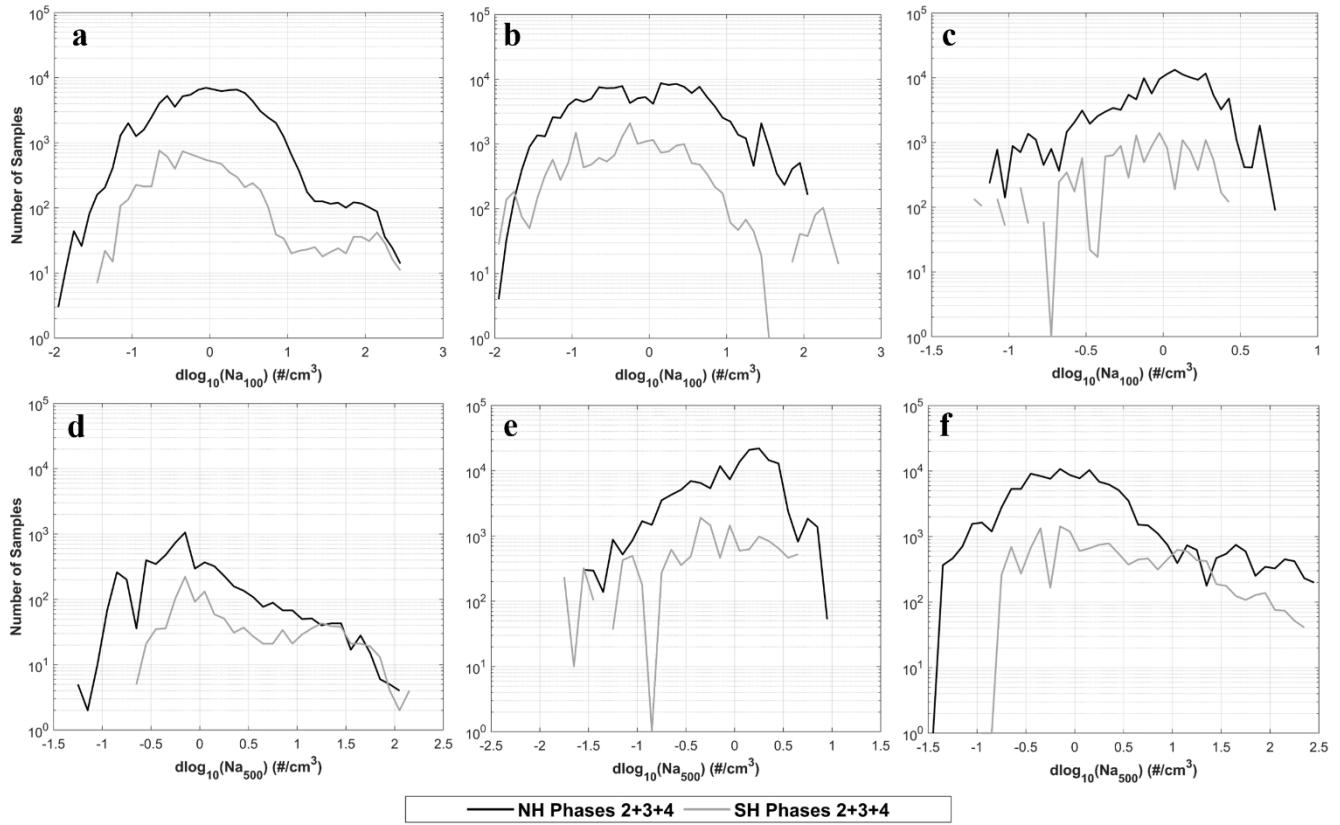


Figure S2. Number of in-cloud samples for Figure 12, showing (a-c) evolution phase 2+3+4 and (d-f) phase 5.



20 **Figure S3.** Number of samples for Figure 13, showing 1-s observations, 430-s observations, and model simulations in column 1, 2 and 3, respectively.