Supplement of Atmos. Chem. Phys., 21, 3777–3802, 2021
https://doi.org/10.5194/acp-21-3777-2021-supplement

Atmospheric Chemistry and Physics
Open Access
EGU

Supplement of

Measurement report: Long-range transport patterns into the tropical northwest Pacific during the CAMP^{2}Ex aircraft campaign: chemical composition, size distributions, and the impact of convection

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Table S1: Sensitivity analysis in terms of percentage contribution. Percentage contributions for classified trajectories (i.e., excluding Other) are provided in parentheses. Total number of trajectories (N) is also provided. Mixed-source trajectories are also included with the most recently passed source region listed first (e.g., PSEA-EA). Blanks denote zero contribution, rounded to the nearest tenth decimal. Source regions are Peninsular Southeast Asia (PSEA), Maritime Continent (MC), East Asia (EA), and West Pacific (WP).

		PSEA	MC	EA	WP	PSEA-MC	EA-PSEA	PSEA-EA	MC-PSEA	Other	N
Trajectory Height Threshold	**0.5 km**	1.4 (9.5)	4.0 (28.1)	2.9 (19.9)	5.6 (38.9)				0.5 (3.6)	85.6	1534
	1 km	3.1 (14.0)	6.0 (26.8)	4.4 (19.5)	7.9 (35.3)				1.0 (4.4)	77.6	1534
	2 km	7.8 (21.4)	10.2 (28.1)	7.8 (21.6)	8.8 (24.3)				1.6 (4.5)	63.8	1534
	3 km	10.4 (23.3)	12.0 (26.7)	9.3 (20.8)	10.8 (24.0)				2.3 (5.2)	55.1	1534
Trajectory Run Time	**200 h**	8.0 (19.5)	12.5 (30.6)	9.0 (22.1)	8.8 (21.6)				2.5 (6.2)	59.3	1534
	150 h	7.8 (20.3)	11.6 (30.4)	8.6 (22.5)	8.3 (21.8)				1.9 (4.9)	61.8	1534
	120 h	7.8 (21.4)	10.2 (28.1)	7.8 (21.6)	8.8 (24.3)				1.6 (4.5)	63.8	1534
	72 h	5.0 (18.0)	7.8 (28.4)	5.5 (20.1)	8.4 (30.5)				0.8 (3.1)	72.4	1534
Vertical Profile Filtering	**All Data**	3.2 (12.2)	9.3 (35.3)	8.3 (31.5)	5.5 (21.0)	(0.1)			(0.1)	73.7	7286
	Profiles Only	5.7 (17.3)	11.3 (34.2)	8.5 (25.5)	7.6 (23.0)					66.8	1534
Monsoon Shift	**SWM (< 20 Sep)**	10.0 (28.9)	20.6 (59.8)	0.1 (0.3)	3.3 (9.6)		0.4 (1.0)	0.1 (0.3)		65.5	843
	MT (> 20 Sep)	0.1 (0.4)	0.4 (1.2)	18.8 (51.4)	16.9 (46.2)				0.3 (0.8)	63.4	691
Sampling Location (6-hourly)[a]	**East of Luzon**	6.2 (26.0)	7.4 (30.8)	3.7 (15.4)	6.6 (27.4)				0.1 (0.5)	76.1	870
	North of Luzon	7.8 (26.2)	6.0 (20.0)	9.4 (31.5)	6.7 (22.3)					70.1	870
	Sally Ride	2.8 (11.9)	8.2 (35.3)	1.5 (6.5)	10.7 (46.3)					76.9	870
	Sulu Sea	3.2 (10.9)	24.8 (84.0)	0.1 (0.4)	0.9 (3.1)	0.2 (0.8)			0.2 (0.8)	70.5	870
	West of Luzon	12.3 (39.8)	7.0 (22.7)	7.0 (22.7)	3.9 (12.6)	0.3 (1.1)			0.3 (1.1)	69.1	870

[a] Back trajectories were generated every 6 hours (Aug 23 – Oct 5 2019) for the sampling location test. Exact locations are provided in Fig. S1.

Table S2: Significance (*p*) values for Table 3 computed with a two-tailed t-test between boundary layer (< 2 km) and free troposphere (> 2 km) data per source region. Bold values denote significant statistical differences (p < 0.05). Source regions are East Asia (EA), Maritime Continent (MC), Peninsular Southeast Asia (PSEA), and West Pacific (WP). The EA column was left blank due to the infrequent sampling of EA air in the FT. AMS total is provided minus RF9 for better comparison to BC (no RF9 SP2 data). Statistics exclude RF18 (local pollution flight).

	EA	MC	PSEA	WP
$N_{100\text{-}1000nm}$ (cm^{-3})		**< 0.01**	**< 0.01**	**< 0.01**
CO (ppm)		**< 0.01**	0.50	0.87
O_3 (ppbv)		**< 0.01**	**< 0.01**	**< 0.01**
CH_4 (ppm)		**< 0.01**	0.22	0.10
SO_4^{2-} (µg m^{-3})		**< 0.01**	**< 0.01**	**< 0.01**
NO_3^- (µg m^{-3})		**< 0.01**	**< 0.01**	0.10
NH_4^+ (µg m^{-3})		**< 0.01**	**< 0.01**	**0.04**
OA (µg m^{-3})		**< 0.01**	**< 0.01**	**0.02**
BC (ng m^{-3})		**< 0.01**	**< 0.01**	**0.02**
AMS Total (µg m^{-3})		**< 0.01**	**< 0.01**	**< 0.01**

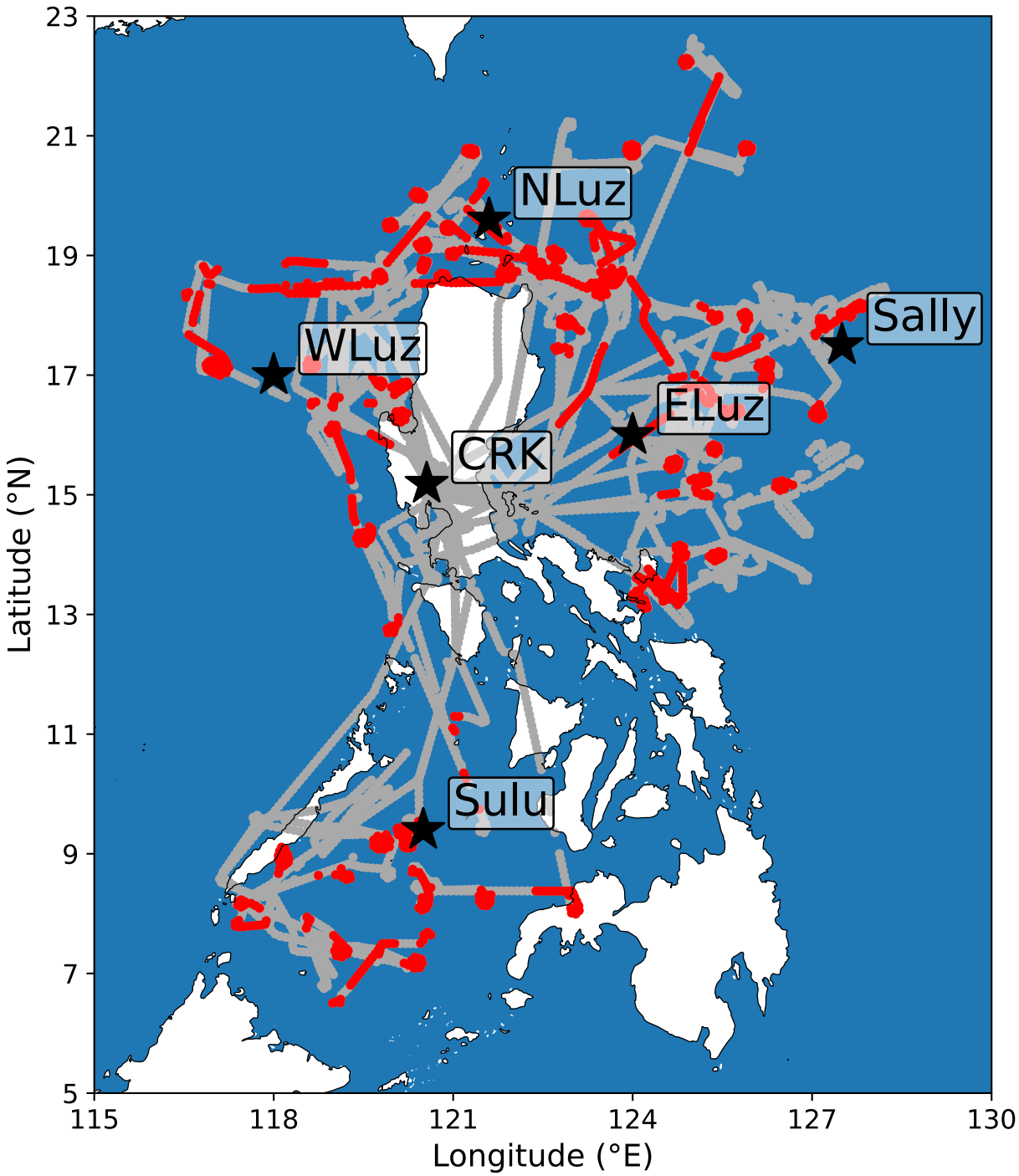


Figure S1: Flight tracks and classified vertical profiles marked in red. Identified is the base of operations, Clark International Airport (CRK). Locations for the sampling location sensitivity test (Table S1) are also depicted: West of Luzon (WLuz), North of Luzon (NLuz), East of Luzon (ELuz), Sulu Sea (Sulu), and the approximate location of the research vessel R/V Sally Ride (Sally) from the Office of Naval Research Propagation of InterSeasonal Tropical OscillatioNs (PISTON) project.

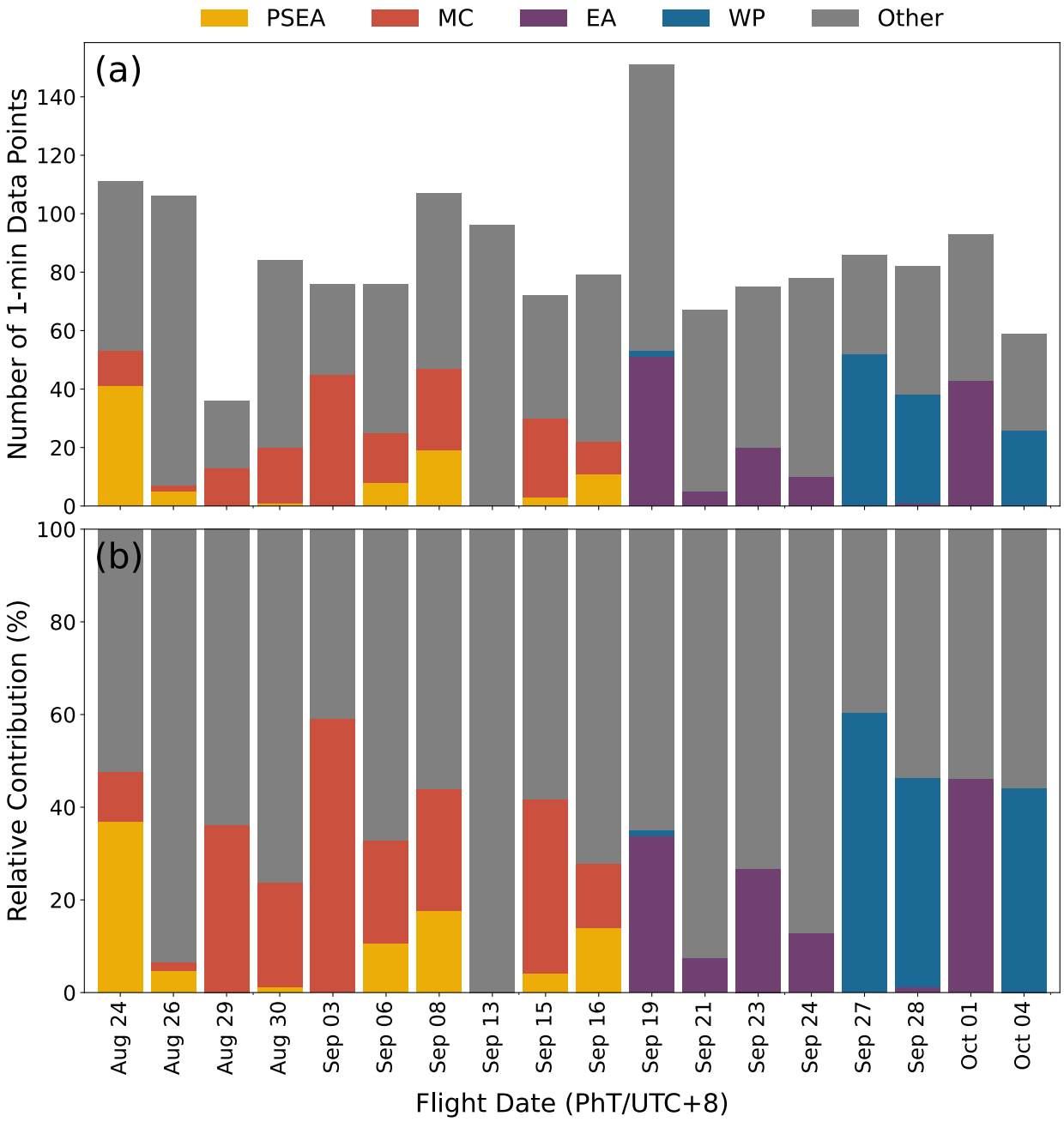


Figure S2: (a) Distribution of 1-minute averaged data points per research flight colored by classified source region, and (b) relative contributions (%) of source attribution per research flight. Note that the research flight on 4 October 2019 was excluded due to the dominance of local emissions. Source regions are Peninsular Southeast Asia (PSEA), Maritime Continent (MC), East Asia (EA), and West Pacific (WP). Note that classification of an air mass as PSEA or MC was only considered during the SWM (< 20 Sep) while classification into EA or WP was only done during the MT (> 20 Sep).

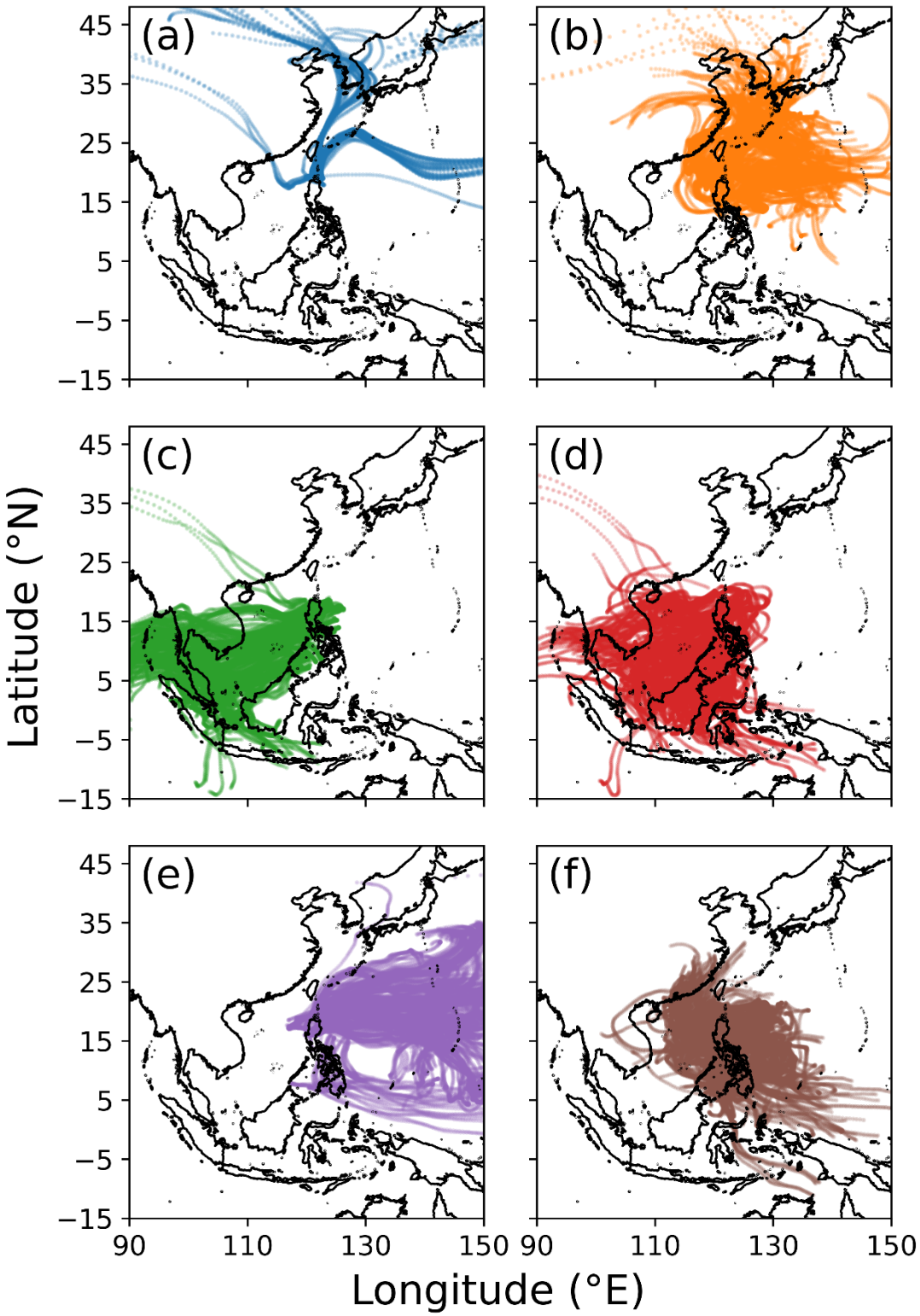


Figure S3: Trajectories clustered using K-means clustering.

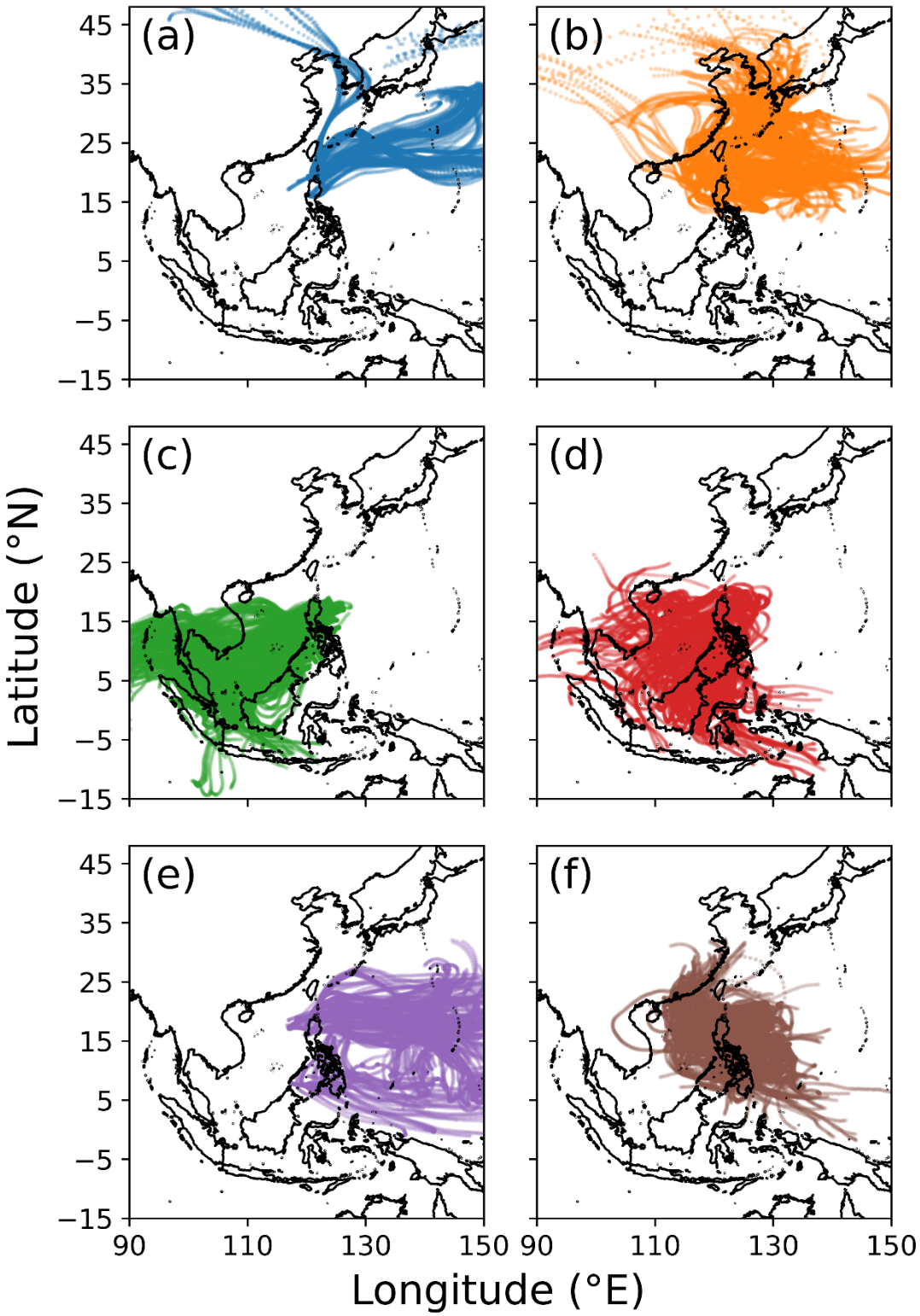


Figure S4: Same as Fig. S3 but using Ward-linkage clustering.

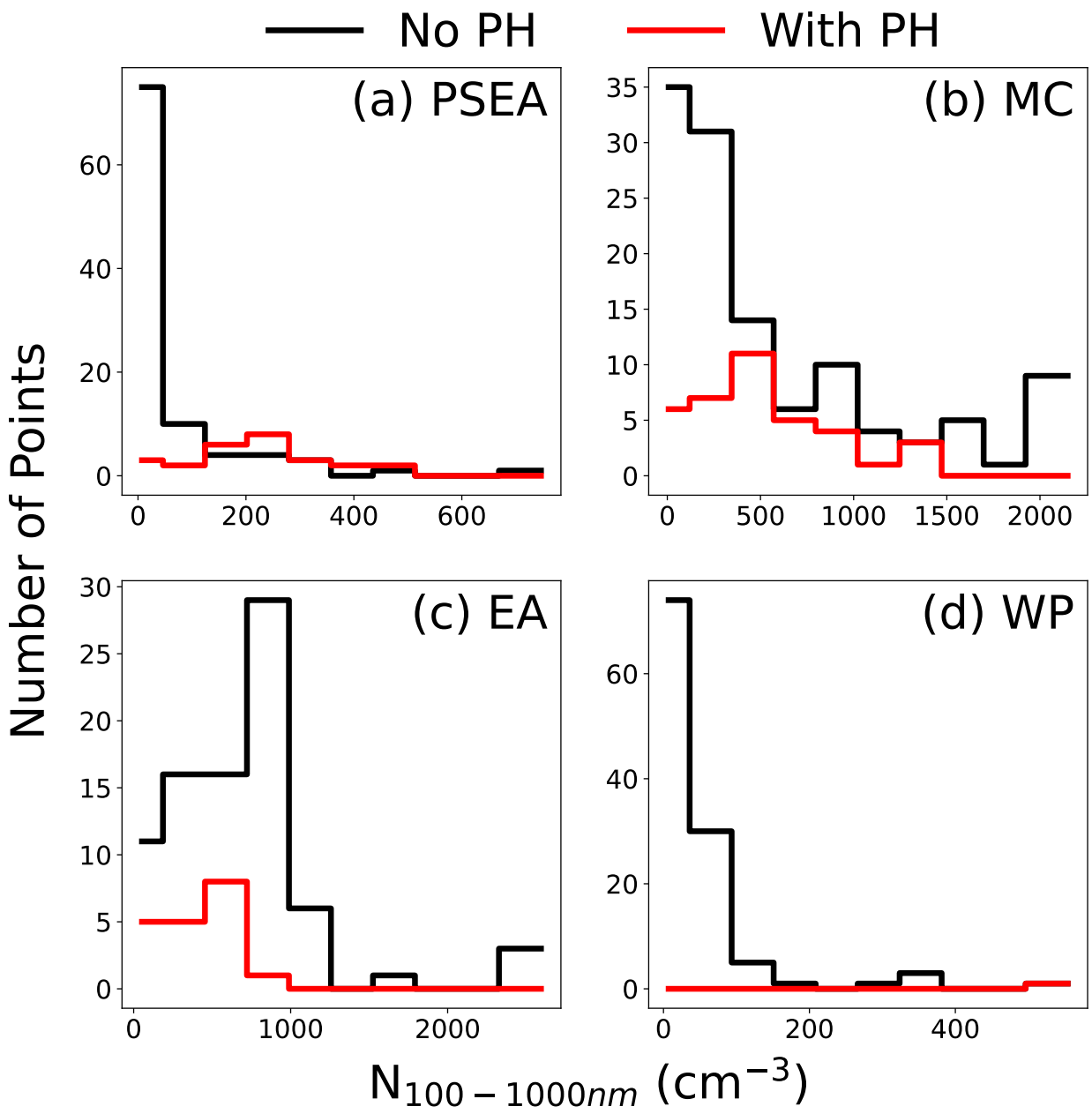


Figure S5: Histograms of integrated particle number concentration for diameters between 100 nm to 1000 nm ($N_{100\text{-}1000nm}$; cm^{-3}) for (a) Peninsular Southeast Asia (PSEA), (b) Maritime Continent (MC), (c) East Asia (EA), and (d) West Pacific (WP) to show the effect of the Philippine (PH) filter for local emissions. Note that "No PH" (black) refers to transported air considered unaffected by Philippine emissions (e.g., MC only), while "With PH" (red) refers to transported air mixed with Philippine air (e.g., air classified into both MC and PH).

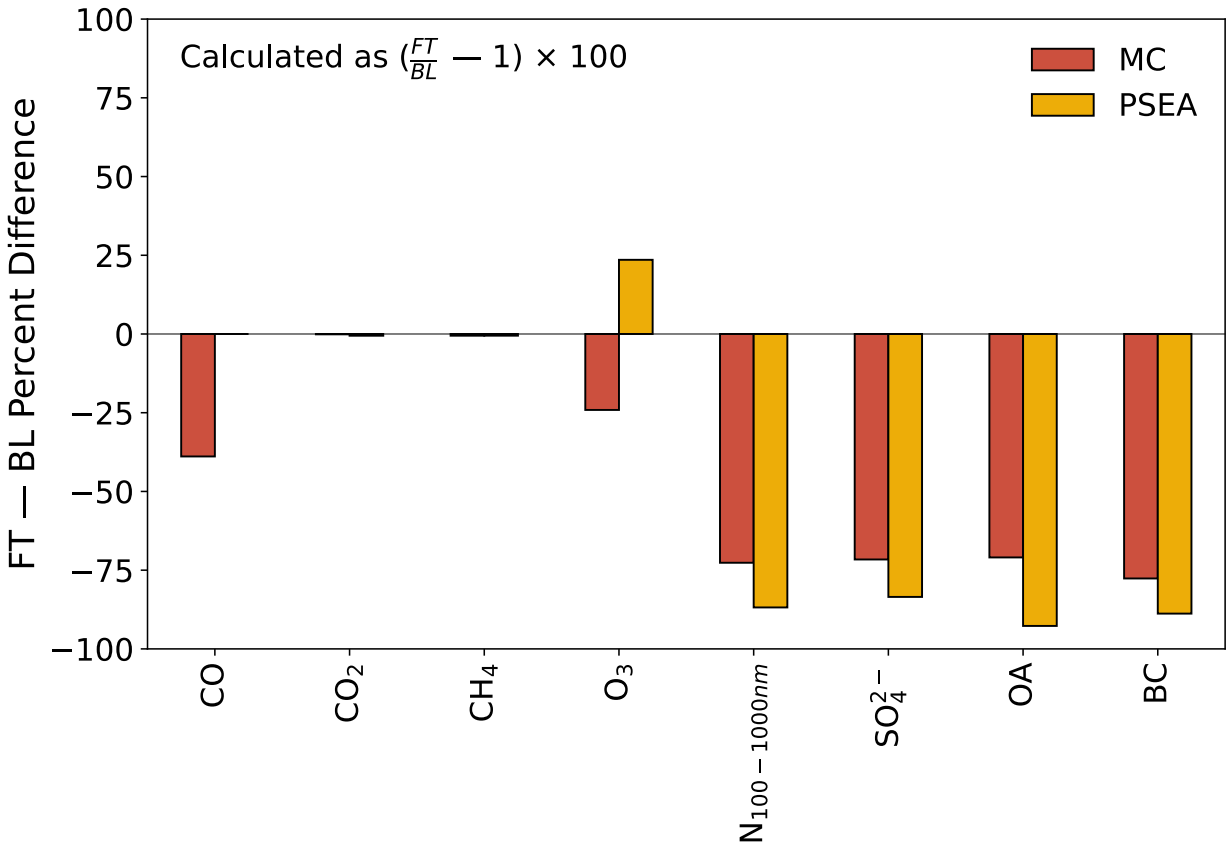


Figure S6: Percent differences between free troposphere (FT; > 2 km) and boundary layer (BL; < 2 km) concentrations for selected species in air from the Maritime Continent (MC) and Peninsular Southeast Asia (PSEA). Species along the x-axis are arranged with trace gas (aerosol) species on the left (right).

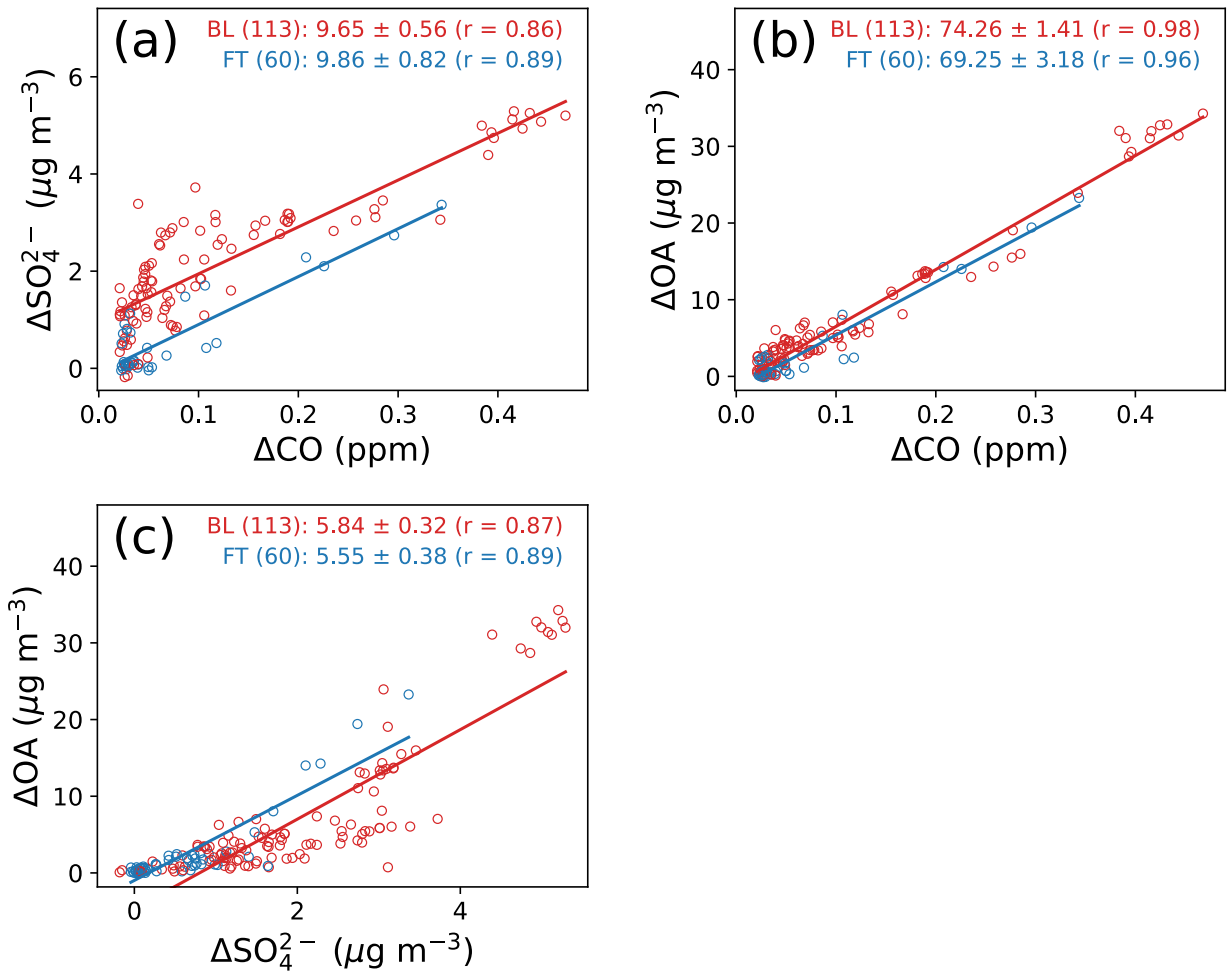
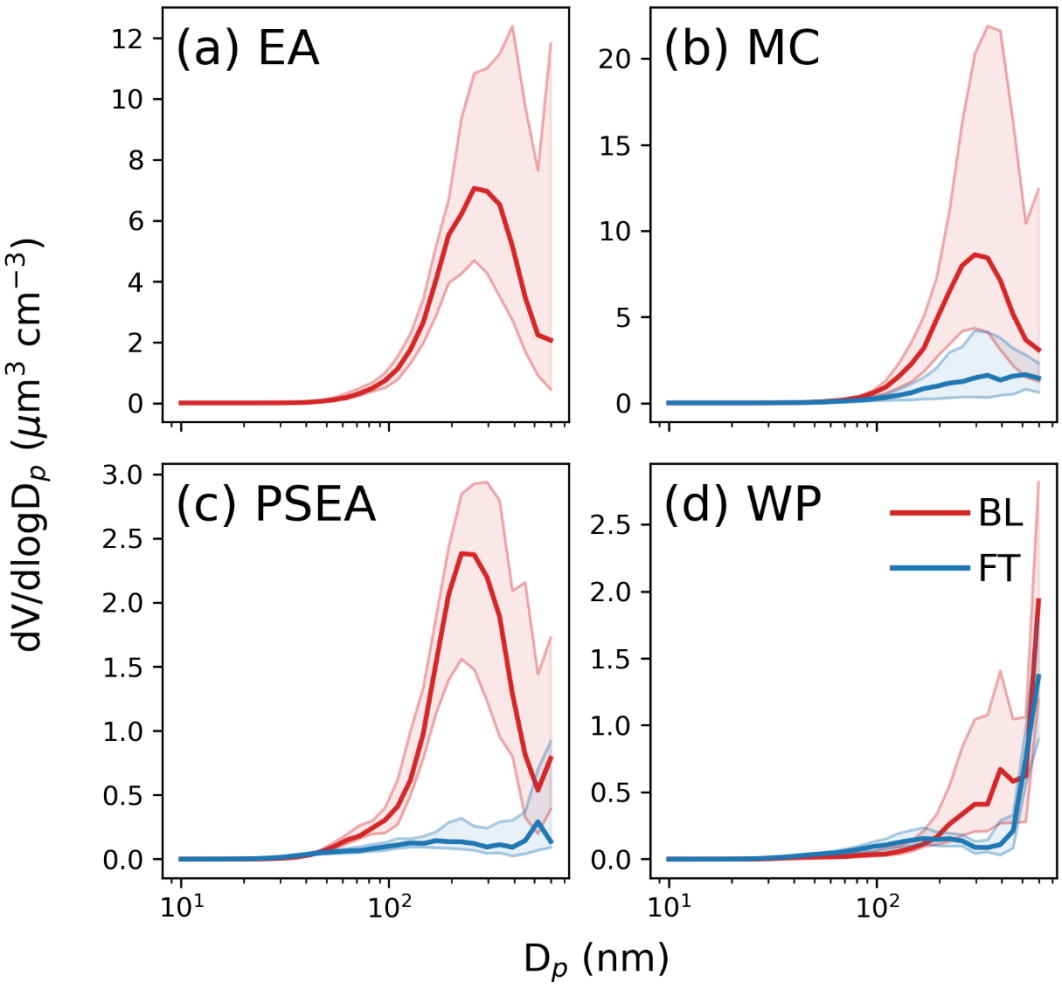


Figure S7: Same as Figure 7 but for (a) $\Delta SO_4^{2-}/\Delta CO$, (b) $\Delta OA/\Delta CO$, and (c) $\Delta OA/\Delta SO_4^{2-}$ for the Maritime Continent (MC) resolved by boundary layer (BL; < 2 km) and free troposphere (FT; > 2 km) sampling. In addition to annotations described in Figure 7, we also included the number of data points used to compute the linear regression statistics.



74

75 **Figure S8: Same as Fig. 8 but for particle volume. Note that y-axes vary between panels.**