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Observed impacts of aerosol regimes on energy and carbon fluxes in the Amazon forest

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Supplementary Material

Table S1: Number of runs (half-hour periods) after applying all filtering procedures (described in section 2.2) during the dry season.

Variables	10:00 – 14:00 LT			07:00 – 17:00 LT		
	N. Clean	N. Polluted	Total	N. Clean	N. Polluted	Total
$SWin$ (Wm^{-2})	301	204	505	736	459	1195
$SWout$ (Wm^{-2})	301	204	505	736	459	1195
$LWatm$ (Wm^{-2})	301	200	501	733	453	1186
$LWterr$ (Wm^{-2})	301	204	505	735	459	1194
R_n (Wm^{-2})	301	200	501	733	453	1186
H (Wm^{-2})	197	192	389	455	389	844
LE (Wm^{-2})	183	180	363	447	386	833
FCO_2 ($\mu molm^{-2}s^{-1}$)	247	195	442	596	405	1001
G (Wm^{-2})	301	218	519	741	487	1228

Table S2: Number of runs (half-hour periods) after applying all filtering procedures (described in section 2.2) reported by year for the dry season, within the 07:00–17:00 LT time window.

Year	$SWin$		$SWout$		$LWatm$		$LWterr$		Rn		H		LE		FCO_2		G	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
2016	169	14.1	169	14.1	169	14.2	169	14.2	169	14.2	157	18.6	146	17.5	160	16.0	174	14.2
2017	180	15.1	180	15.1	180	15.2	180	15.1	180	15.2	2	0.2	2	0.2	176	17.6	191	15.6
2018	67	5.6	67	5.6	67	5.6	66	5.5	67	5.6	57	6.8	59	7.1	55	5.5	69	5.6
2019	117	9.8	117	9.8	117	9.9	117	9.8	117	9.9	70	8.3	71	8.5	67	6.7	114	9.3
2020	205	17.2	205	17.2	205	17.3	205	17.2	205	17.3	199	23.6	195	23.4	195	19.5	205	16.7
2021	167	14.0	167	14.0	158	13.3	167	14.0	158	13.3	91	10.8	90	10.8	85	8.5	160	13.0
2022	290	24.3	290	24.3	290	24.5	290	24.3	290	24.5	268	31.8	270	32.4	263	26.3	315	25.7
Total	1195	100	1195	100	1186	100	1194	100	1186	100	844	100	833	100	1001	100	1228	100

Table S3: Mann-Whitney U test results for different aerosol regime classifications. $***$ ($p < 0.001$), $**$ ($p < 0.01$), $*$ ($p < 0.05$), and ns (not significant).

Variable	N Clean	Mean Clean	SD Clean	N Polluted	Mean Polluted	SD Polluted	U Statistic	p-value	Signif.
Main Stage - Percentil 10 (AOD $\leq$ 0.13), Percentil 90 (AOD $\geq$ 0.40)									
$SWin$ (Wm^{-2})	301	836.5	165.2	204	813.5	124.4	35391	0.004	**
$SWout$ (Wm^{-2})	301	92.8	19.7	204	95.9	15.1	27859	0.077	ns
$LWatm$ (Wm^{-2})	301	431.5	10.4	200	432.1	9.4	29439	0.677	ns
$LWterr$ (Wm^{-2})	301	484.7	14.0	204	483.6	10.8	34148	0.032	*
R_n (Wm^{-2})	301	659.3	137.8	200	632.8	100.8	35671	0.000	***
H (Wm^{-2})	197	160.6	67.8	192	138.9	61.4	22611	0.001	***
LE (Wm^{-2})	183	426.7	136.8	180	417.8	146.7	17246	0.438	ns
FCO_2 ($\mu molm^{-2}s^{-1}$)	247	-12.5	8.0	195	-17.4	8.6	32125	0.000	***
G (Wm^{-2})	301	1.8	1.6	218	0.8	1.4	43719	0.000	***
Wide Stage - Percentil 15 (AOD $\leq$ 0.14), Percentil 85 (AOD $\geq$ 0.36)									
$SWin$ (Wm^{-2})	423	829.1	166.2	272	816.6	131.5	62510	0.054	ns
$SWout$ (Wm^{-2})	423	91.8	20.1	272	95.7	15.6	50534	0.007	**
$LWatm$ (Wm^{-2})	423	432.7	10.0	268	433.2	9.4	55655	0.688	ns
$LWterr$ (Wm^{-2})	423	484.1	14.5	272	484.5	11.0	59785	0.382	ns
R_n (Wm^{-2})	423	654.7	138.0	268	634.7	107.7	64197	0.003	**
H (Wm^{-2})	281	157.5	70.0	258	139.0	62.7	42045	0.001	**
LE (Wm^{-2})	265	422.3	133.9	241	419.8	145.7	32675	0.651	ns
FCO_2 ($\mu molm^{-2}s^{-1}$)	354	-12.6	8.2	263	-16.7	8.5	60056	0.000	***
G (Wm^{-2})	427	1.8	1.6	298	0.9	1.4	83989	0.000	***
Alternative Stage - Percentil 20 (AOD $\leq$ 0.16), Percentil 80 (AOD $\geq$ 0.32)									
$SWin$ (Wm^{-2})	547	822.9	172.0	372	828.2	132.4	103274	0.698	ns
$SWout$ (Wm^{-2})	547	91.1	20.4	372	96.3	15.4	85935	0.000	***
$LWatm$ (Wm^{-2})	544	433.4	9.8	366	433.6	9.5	98174	0.723	ns
$LWterr$ (Wm^{-2})	547	483.7	14.6	372	485.2	11.0	100283	0.712	ns
R_n (Wm^{-2})	544	650.5	144.8	366	644.3	112.1	105788	0.109	ns
H (Wm^{-2})	377	155.9	71.0	350	140.8	64.5	74993	0.001	**
LE (Wm^{-2})	355	416.4	135.7	331	420.4	148.0	58402	0.893	ns
FCO_2 ($\mu molm^{-2}s^{-1}$)	472	-12.7	8.3	364	-16.0	8.5	105109	0.000	***
G (Wm^{-2})	567	1.9	1.6	411	1.0	1.5	150612	0.000	***

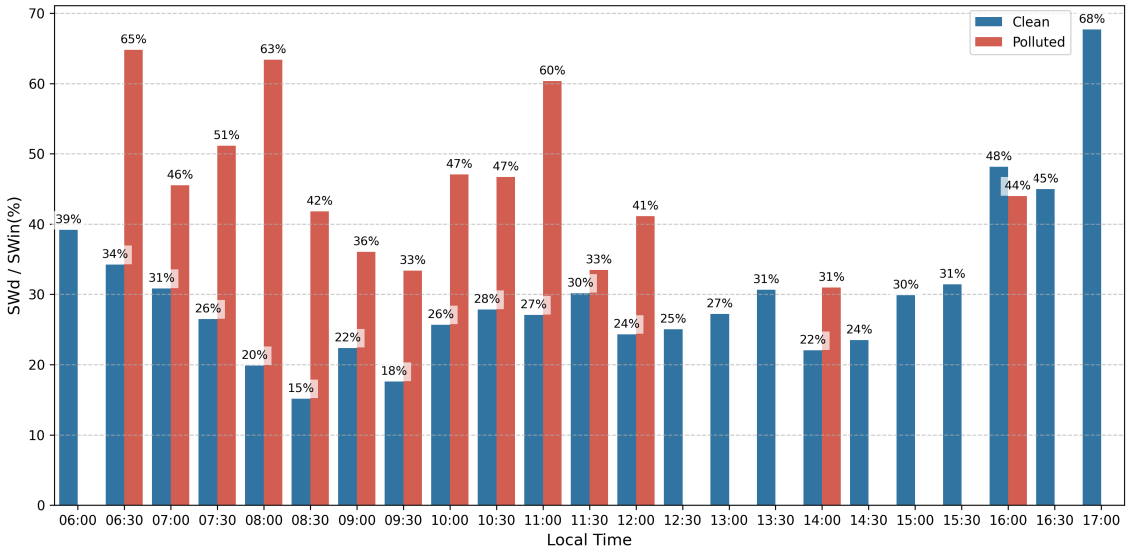

Figure S1: Diffuse radiation fraction ($F_d = SW_d/SW_{in}$) under Clean and Polluted aerosol regimes during 2021 at the ATTO site. SW_d represents diffuse radiation and SW_{in} the incoming shortwave radiation.

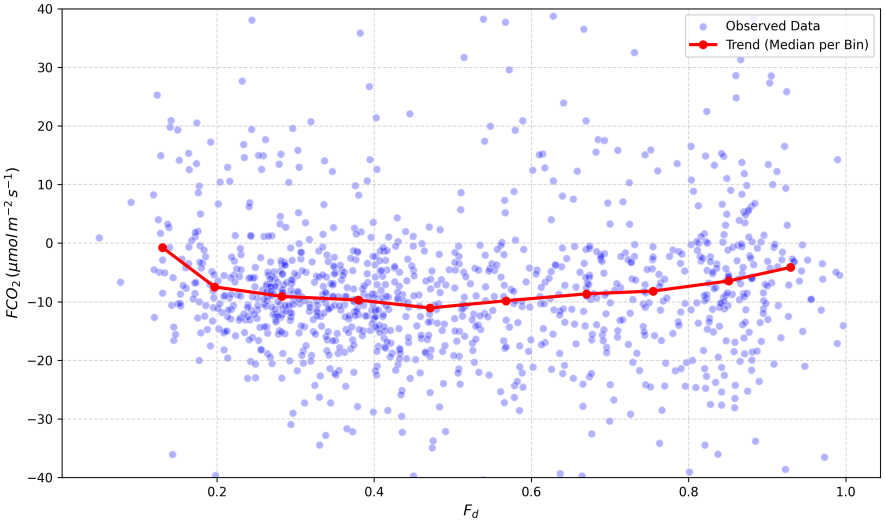

Figure S2: The relationship between CO_2 flux and diffuse radiation fraction ($F_d = SW_d/SW_{in}$) during 2021 at the ATTO site. SW_d represents diffuse radiation and SW_{in} the incoming shortwave radiation.

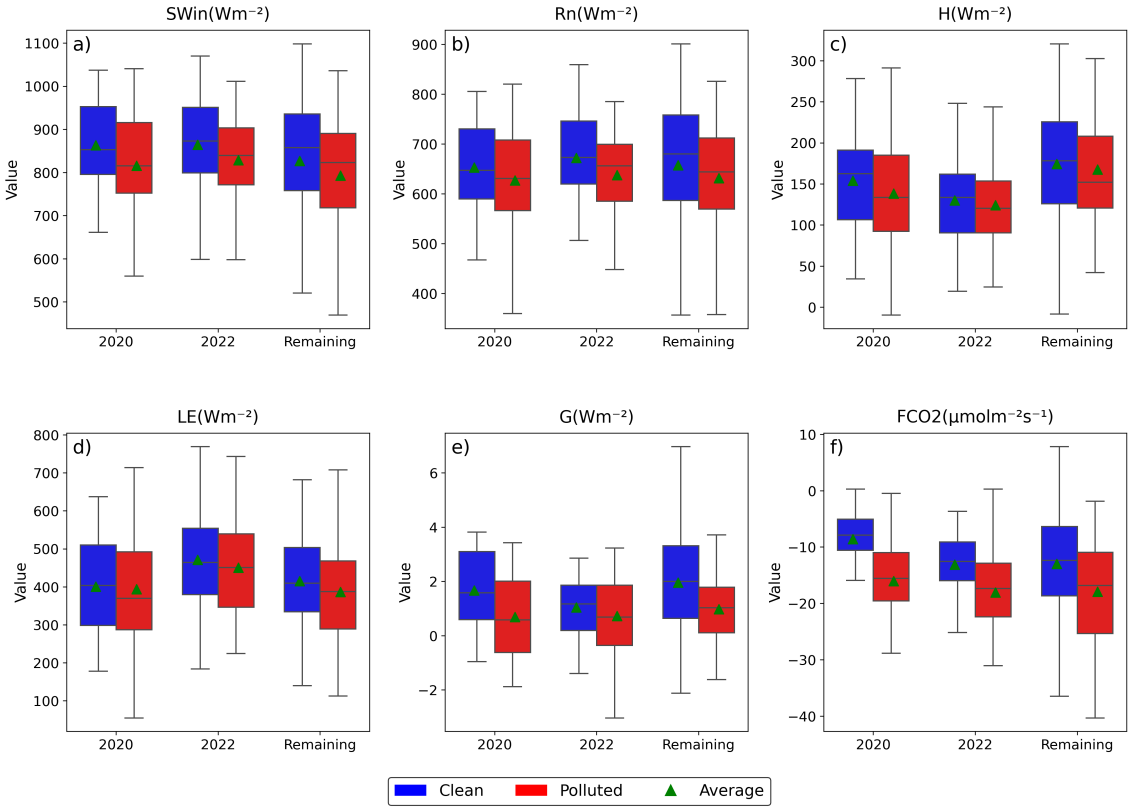

Figure S3: Box plots of a) incoming shortwave radiation (SW_{in}), b) net radiation (R_n), c) sensible heat flux (H), d) latent heat flux (LE), e) ground heat flux (G), f) CO_2 flux (FCO_2). All variables under clean (blue) and polluted (red) aerosol regimes for 2020, 2022, and the remaining years (2016, 2017, 2018, 2019 and 2021), grouped due to limited data availability. Triangles indicate the mean value.