



Supplement of

Wildfires heat the middle troposphere over the Himalayas and Tibetan Plateau during the peak of fire season

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Table S1. Details of the study locations, including latitude, longitude, altitude, observational period, instrument used, and observed elements.

AERONET Sites	Latitude	Longitude	Altitude (m)	Period	Instruments	Observational Elements
Nam Co, Tibetan Plateau	30.8°N	91.0°E	4725	2011-2024	CE318-T	AOD (500nm)/Radiative Forcing
QOMS, Himalayas	28.4°N	86.9°E	4294	2011-2024	CE318-T	AOD (500nm)/Radiative Forcing
Pokhara, Himalayas	28.2°N	84.0°E	800	2011-2024	CE318-T	AOD (500nm)/Radiative Forcing
MWR Sites						
QOMS, Himalayas	28.4°N	86.9°E	4294	2021-2022	MWP967KV	Temperature profiles
Naqu, Tibetan Plateau	31.4°N	91.9°E	4471	2021-2022	MWP967KV	Temperature profiles
SETS, Tibetan Plateau	29.8°N	94.4°E	3328	2021-2022	MWP967KV	Temperature profiles
NADOR, Tibetan Plateau	33.4°N	79.7°N	4270	2021-2022	MWP967KV	Temperature profiles

Table S2. Mean values of extinction, SSA, and asymmetry at wavelengths of 0.44 μm , 0.675 μm , 0.87 μm , and 1.02 μm for April at QOMS.

Date	Extinction [0.44 μm]	Extinction [0.675 μm]	Extinction [0.87 μm]	Extinction [1.02 μm]	SSA [0.44 μm]	SSA [0.675 μm]	SSA [0.87 μm]	SSA [1.02 μm]	Asymmetry [0.44 μm]	Asymmetry [0.675 μm]	Asymmetry [0.87 μm]	Asymmetry [1.02 μm]
2021/4/6	0.74	0.39	0.24	0.18	0.89	0.88	0.86	0.84	0.69	0.61	0.56	0.54
2021/4/6	0.74	0.38	0.24	0.18	0.88	0.88	0.86	0.84	0.68	0.61	0.56	0.54
2021/4/7	0.57	0.31	0.20	0.15	0.87	0.88	0.85	0.83	0.70	0.62	0.57	0.54
2021/4/7	0.54	0.29	0.18	0.13	0.85	0.85	0.83	0.81	0.69	0.61	0.56	0.53
2021/4/13	0.62	0.31	0.19	0.14	0.87	0.85	0.83	0.81	0.69	0.59	0.54	0.52
2021/4/13	0.57	0.28	0.18	0.13	0.87	0.87	0.86	0.84	0.69	0.59	0.55	0.53
Average	0.63	0.33	0.20	0.15	0.87	0.87	0.85	0.83	0.69	0.61	0.56	0.53
Standard Deviation	0.09	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.005	0.01	0.01	0.007

Table S3. Monthly means heating rates at Pokhara and QOMS for most months during the study period.

Pokhara						QOMS			
Year/Month	Heating Rate (K day ⁻¹)	Year/Month	Heating Rate (K day ⁻¹)	Year/Month	Heating Rate (K day ⁻¹)	Year/Month	Heating Rate (K day ⁻¹)	Year/Month	Heating Rate (K day ⁻¹)
2011/1	0.83	2014/3	0.51	2018/1	0.65	2011/1	0.15	2014/4	0.14
2011/2	0.40	2014/4	1.56	2018/2	0.93	2011/2	0.08	2014/5	0.20
2011/3	0.92	2014/5	0.66	2018/3	1.26	2011/3	0.21	2014/9	0.05
2011/4	1.83	2014/10	0.72	2018/4	1.90	2011/4	0.24	2015/2	0.19
2011/5	0.28	2014/12	0.58	2018/10	0.27	2011/5	0.18	2015/11	0.75
2011/10	0.85	2015/1	0.51	2018/11	0.40	2011/8	0.48	2016/4	0.60
2011/11	0.43	2015/2	1.45	2019/1	0.25	2011/11	0.05	2016/5	0.16
2012/1	0.80	2015/3	1.41	2019/2	0.14	2011/12	0.12	2016/8	0.07
2012/2	0.72	2015/5	1.57	2019/3	0.80	2012/2	0.16	2016/10	0.09
2012/3	1.48	2015/11	1.72	2019/4	1.41	2012/3	0.37	2017/5	0.41
2012/4	0.96	2016/1	0.91	2019/5	1.15	2012/4	0.45	2017/9	0.16
2012/5	1.59	2016/2	1.54	2019/6	0.20	2012/5	0.64	2017/10	0.13
2012/11	0.52	2016/3	2.73	2019/10	0.34	2012/9	0.38	2020/10	0.22
2012/12	0.33	2016/4	1.72	2020/1	0.45	2012/10	0.25	2021/2	0.62
2013/2	0.25	2016/11	0.69	2020/2	0.46	2012/11	0.09	2021/10	0.26
2013/3	0.62	2016/12	0.58	2020/3	0.44	2012/12	0.02	2021/11	0.52
2013/4	0.82	2017/1	0.72	2020/4	0.25	2013/4	0.05	2021/12	0.38
2013/10	0.47	2017/2	1.30	2020/10	0.45	2013/5	0.10	2022/1	0.35
2013/11	0.45	2017/3	1.07	2022/1	0.46	2013/11	0.04	2022/4	1.63
2014/1	0.58	2017/4	0.83	2022/2	0.66	2013/12	0.02	2023/1	0.84
2014/2	0.44	2017/5	0.51	2022/3	1.12	2014/3/	0.04	2023/2	1.29

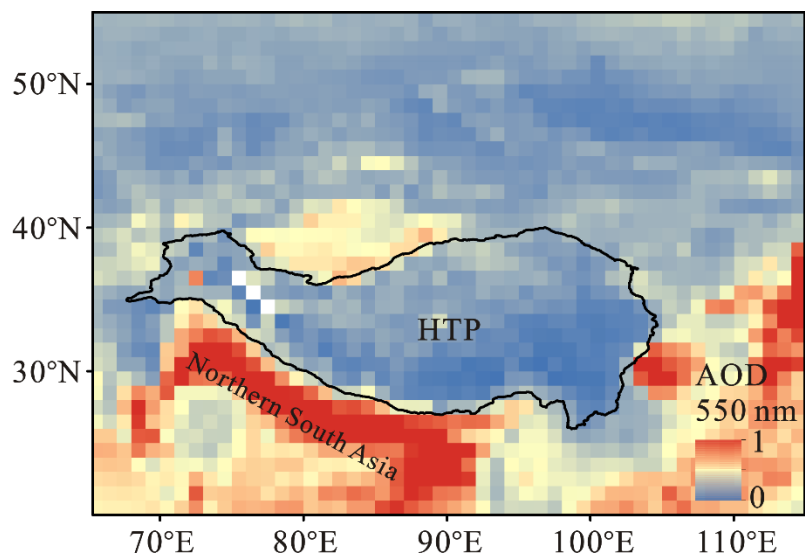


Figure S1. Annual average AOD at 550nm over the HTP region and its surrounding areas from 2011 to 2024.

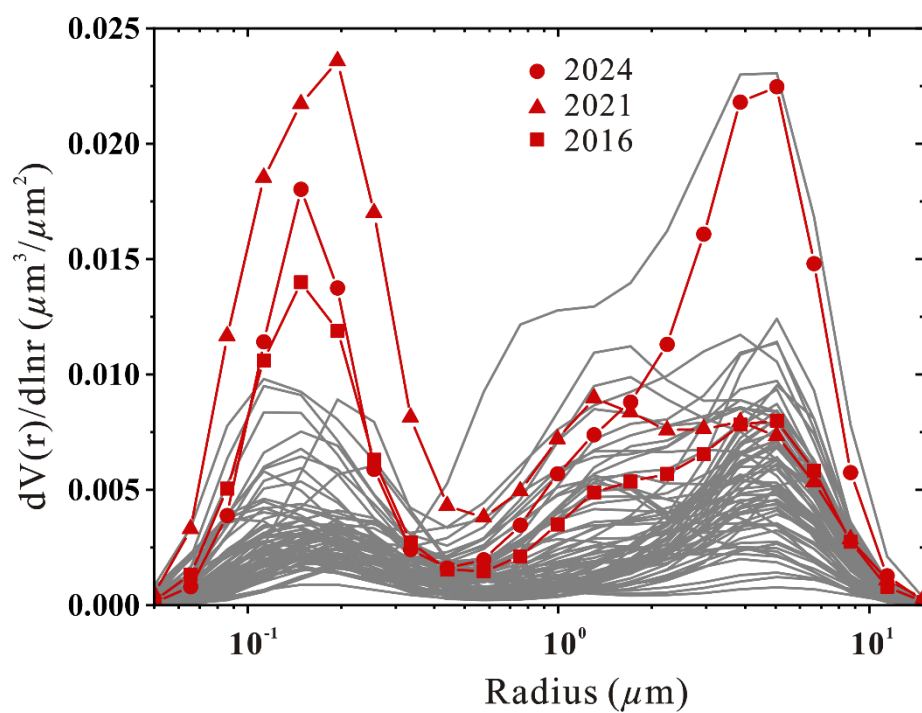


Figure S2. Averaged aerosol volume size distributions for April at QOMS from 2011 to 2024. The grey lines represent the other years.

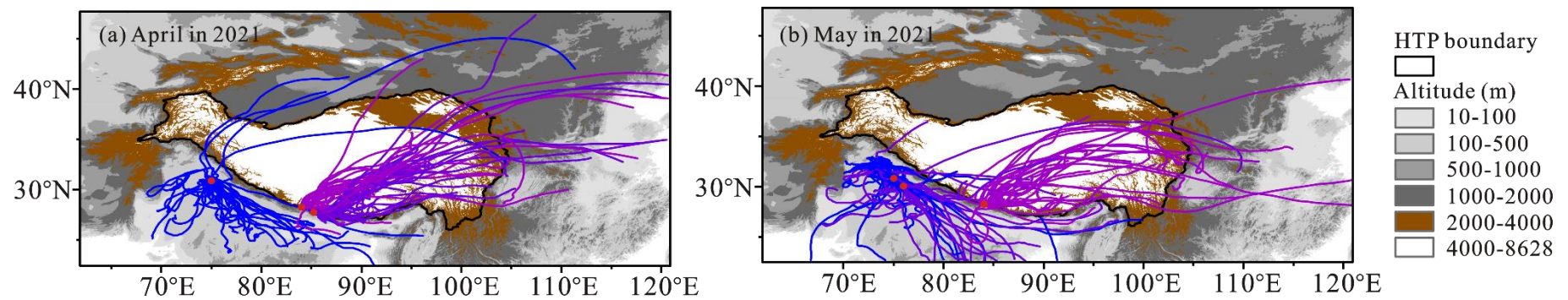


Figure S3. 72-hour forward trajectories starting from different sites located in the Himalayas and IGP above ground level 500 m in April (a) and May (b) 2021, simulated using HYSPLIT.

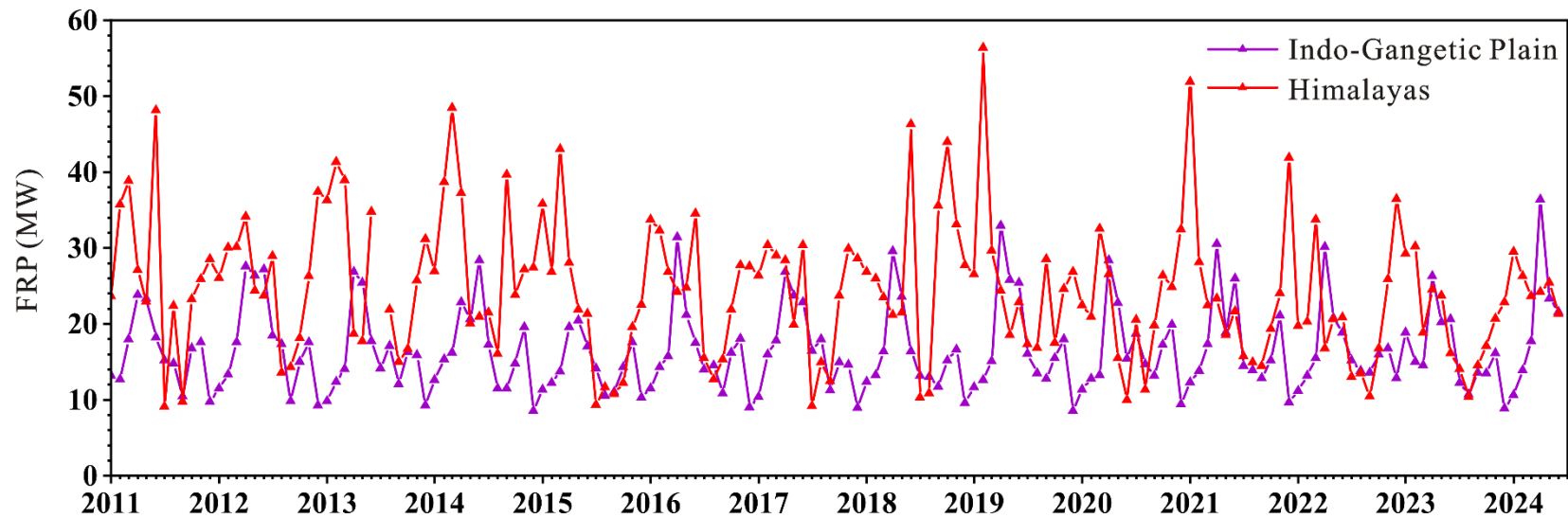


Figure S4. Temporal variations of monthly average FRP over the Himalayas and Indo-Gangetic Plain regions from 2011 to 20

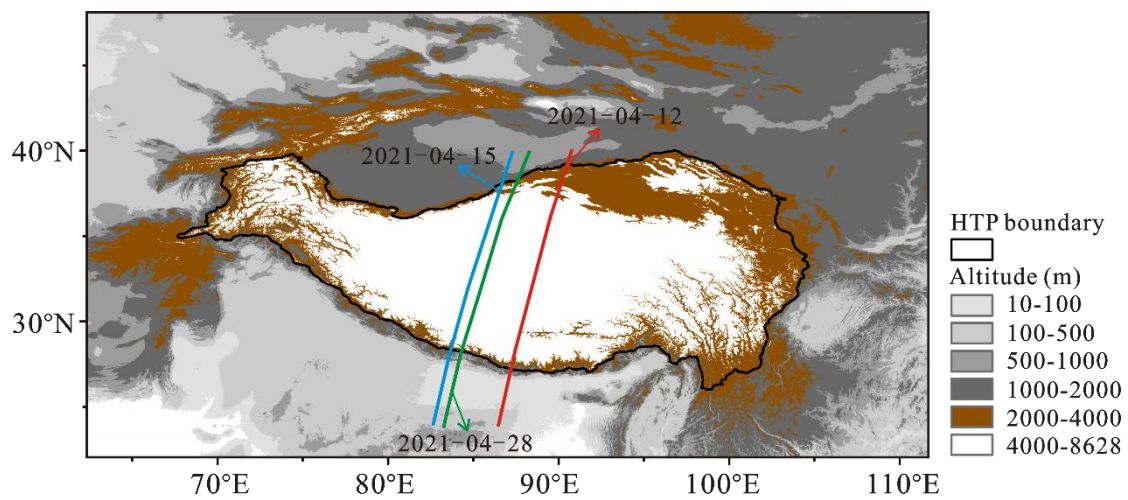


Figure S5. CALIPSO observations of aerosol and cloud layers over the HTP region on April 12, 15, and 28, 2021.

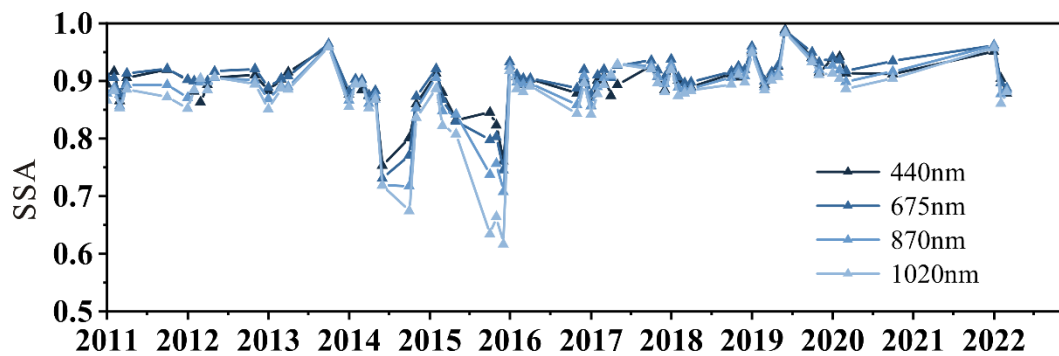


Figure S6. Monthly mean single scattering albedo (SSA) at Pokhara, Nepal, from AERONET data, covering the period from January 2011 to March 2022.