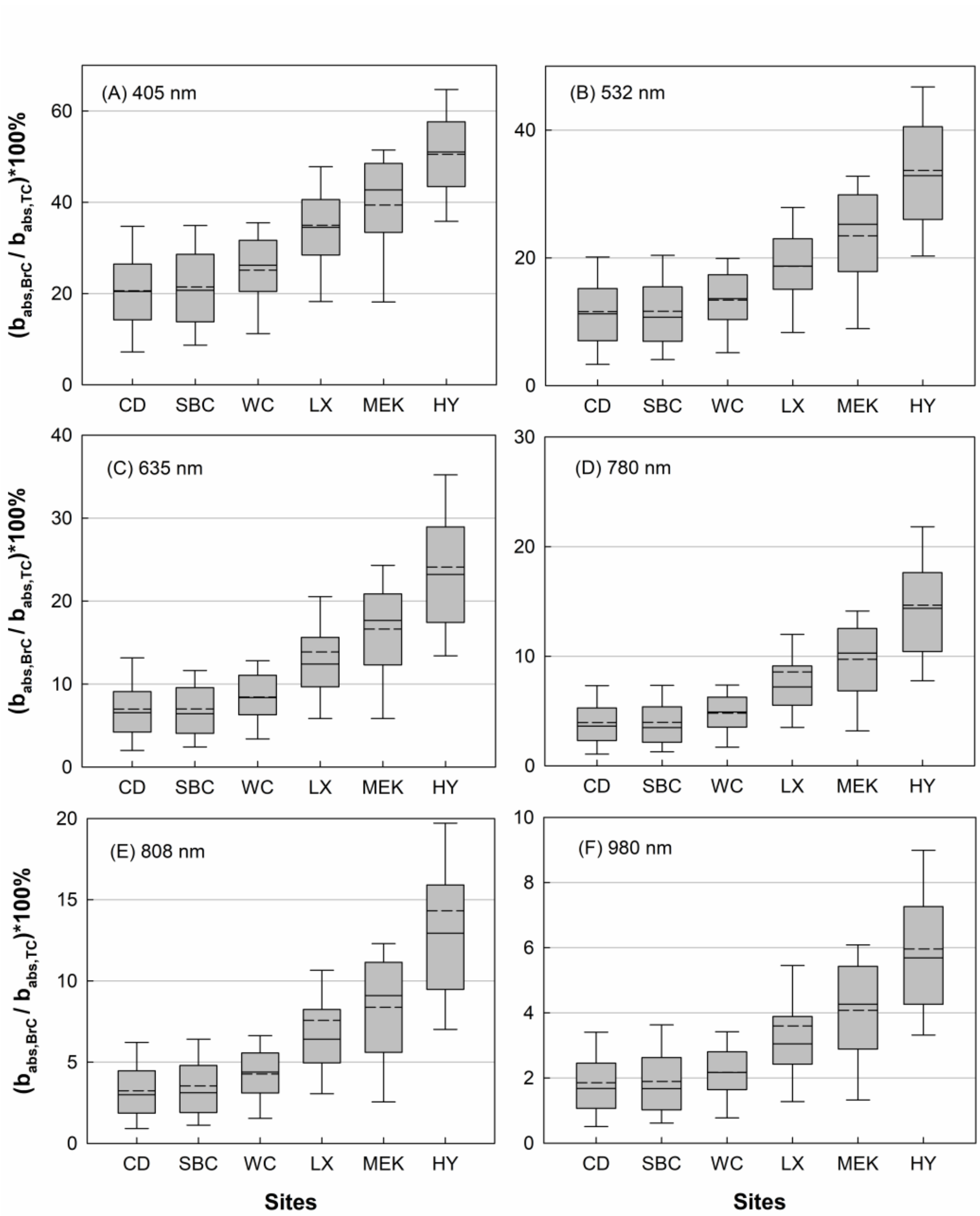

Figure S1: Box plots of light absorption coefficients (b_{abs}) of BrC accounting for TC at varying wavelength (A–F) and atmospheric pressure and air density (G) during the measurement campaign from Chengdu (CD) and Sanbacun (SBC) inside SCB to Wenchuan (WC), Lixian (LX), Maerkang (MEK) and Hongyuan (HY) over TP with increasing altitudes from 500 m to 3500 m. The solid and dotted lines inside the box denote the median and mean values; the two whiskers and the top and bottom of the box denote the 5th and 95th and the 75th and 25th percentiles.

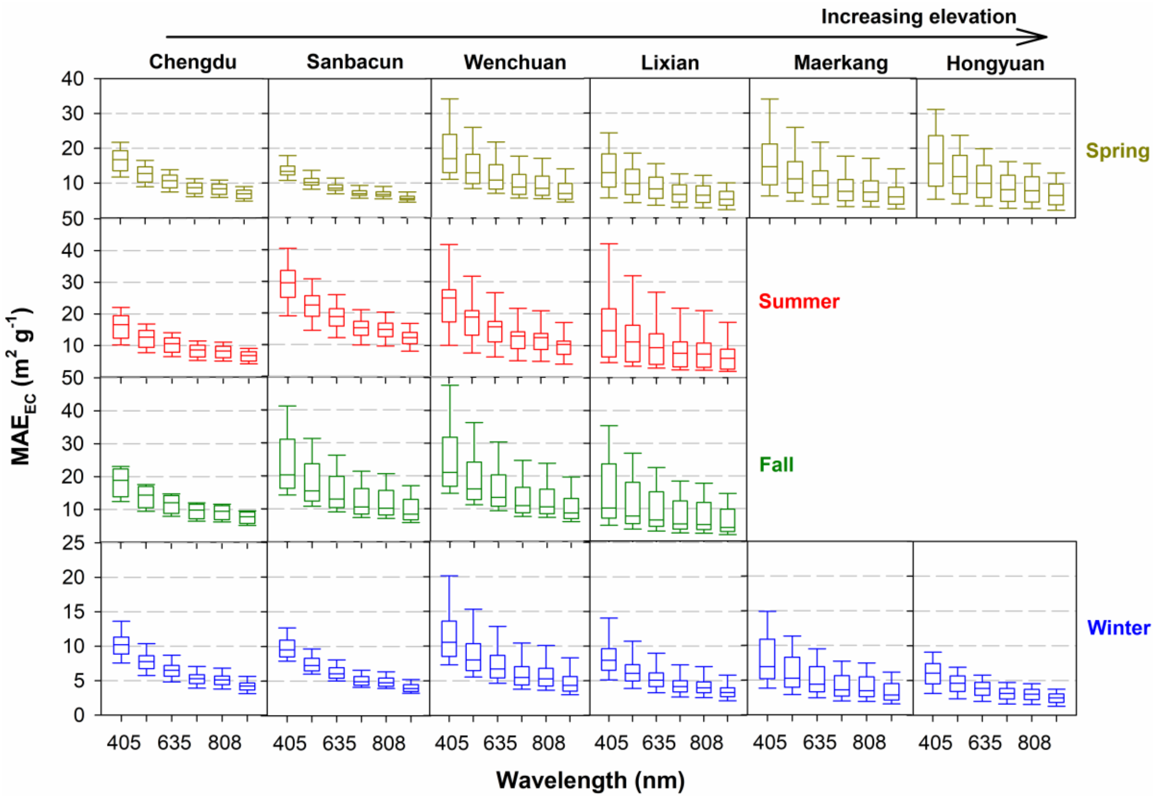

Figure S2: Box plots of spectral mass absorption efficiency (MAE) of EC in each season from Chengdu inside SCB to Hongyuan over the TP with increasing elevation from 0.5 to 3.5 km. The lines inside the box denote the median values; the two whiskers and the top and bottom of the box denote the 5th and 95th and the 75th and 25th percentiles.

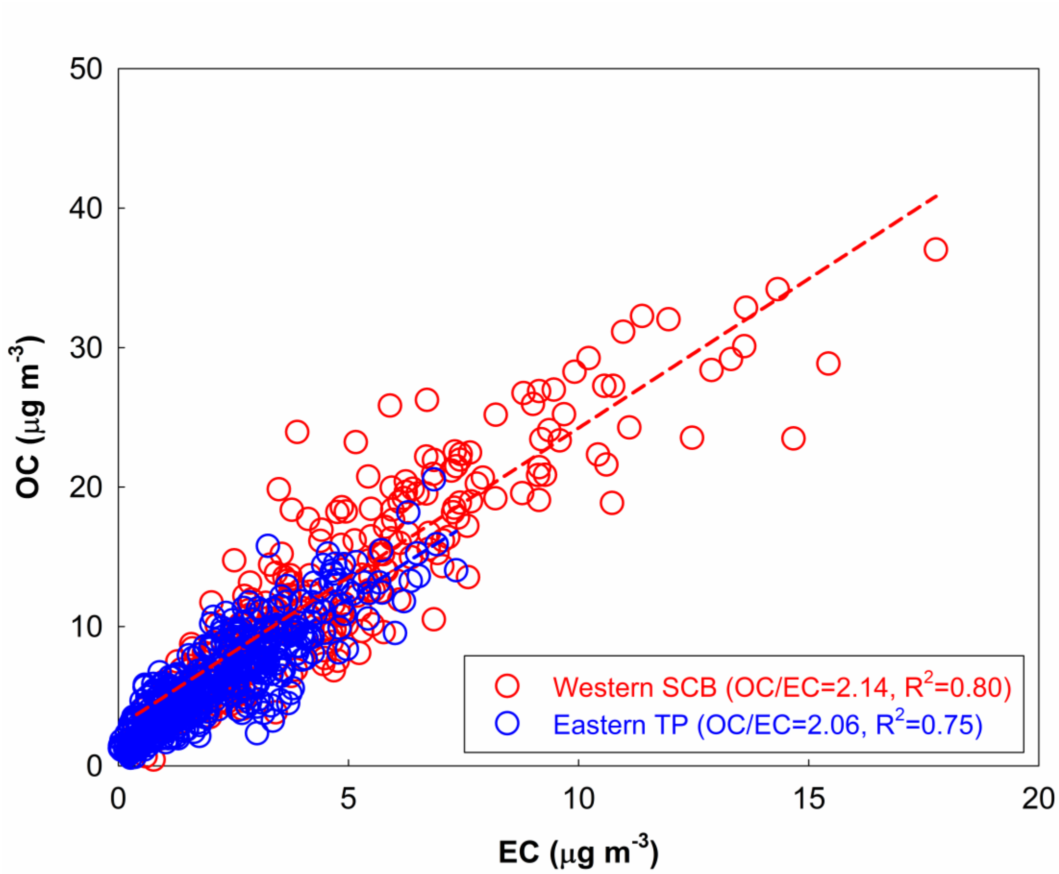

Figure S3: OC vs. EC concentrations inside Sichuan Basin (Chengdu, Sanbacun) and that over Tibetan Plateau (Wenchuan, Lixian, Maerkang, and Hongyuan) during the measurement campaign. The OC/EC ratio was obtained by fitting the relationships between OC and EC concentrations.

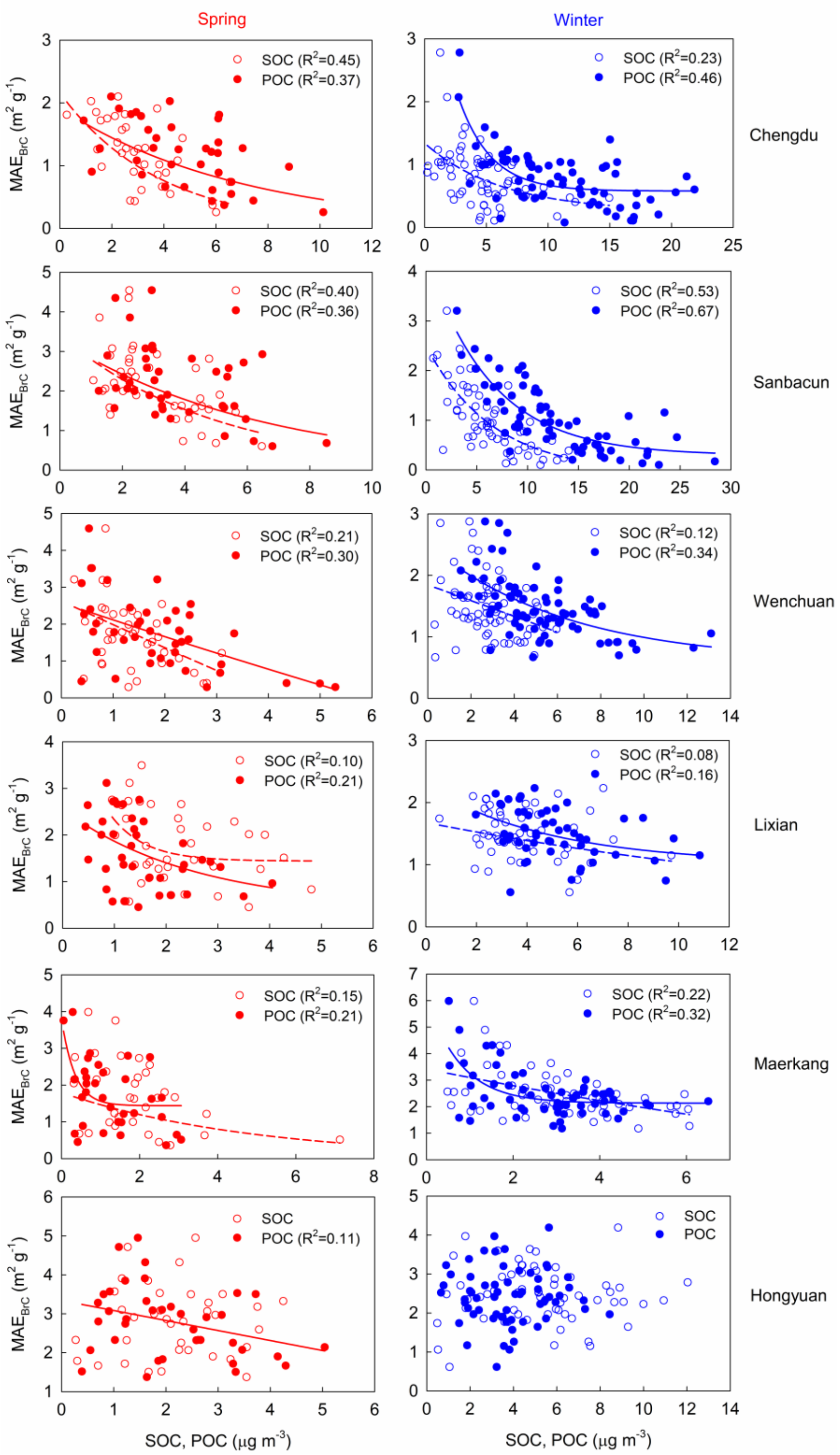

Figure S4: Variations of BrC mass absorption efficiency (MAE_{BrC}) at 405 nm as primary and secondary OC (POC and SOC) concentrations at the six sites in spring and winter during the measurement campaign. The relationships passed the significance level of 0.01.

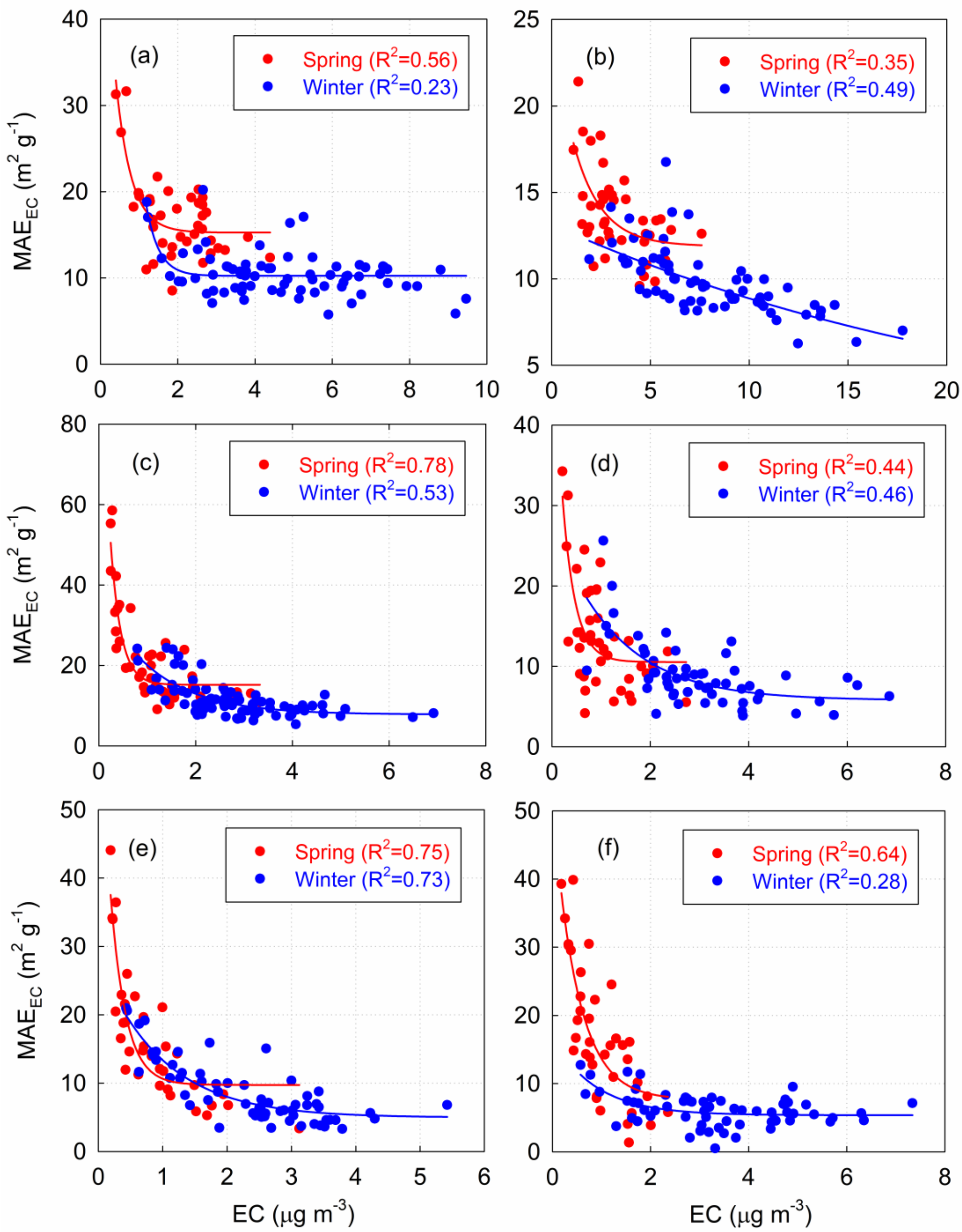

Figure S5: Variations of EC mass absorption efficiency (MAE_{EC}) at 405 nm as EC concentrations in spring and winter at (a) Chengdu, (b) Sanbacun, (c) Wenchuan, (d) Lixian, (e) Maerkang and (f) Hongyuan) during the measurement campaign. The relationships passed the significance level of 0.01 at all sites.

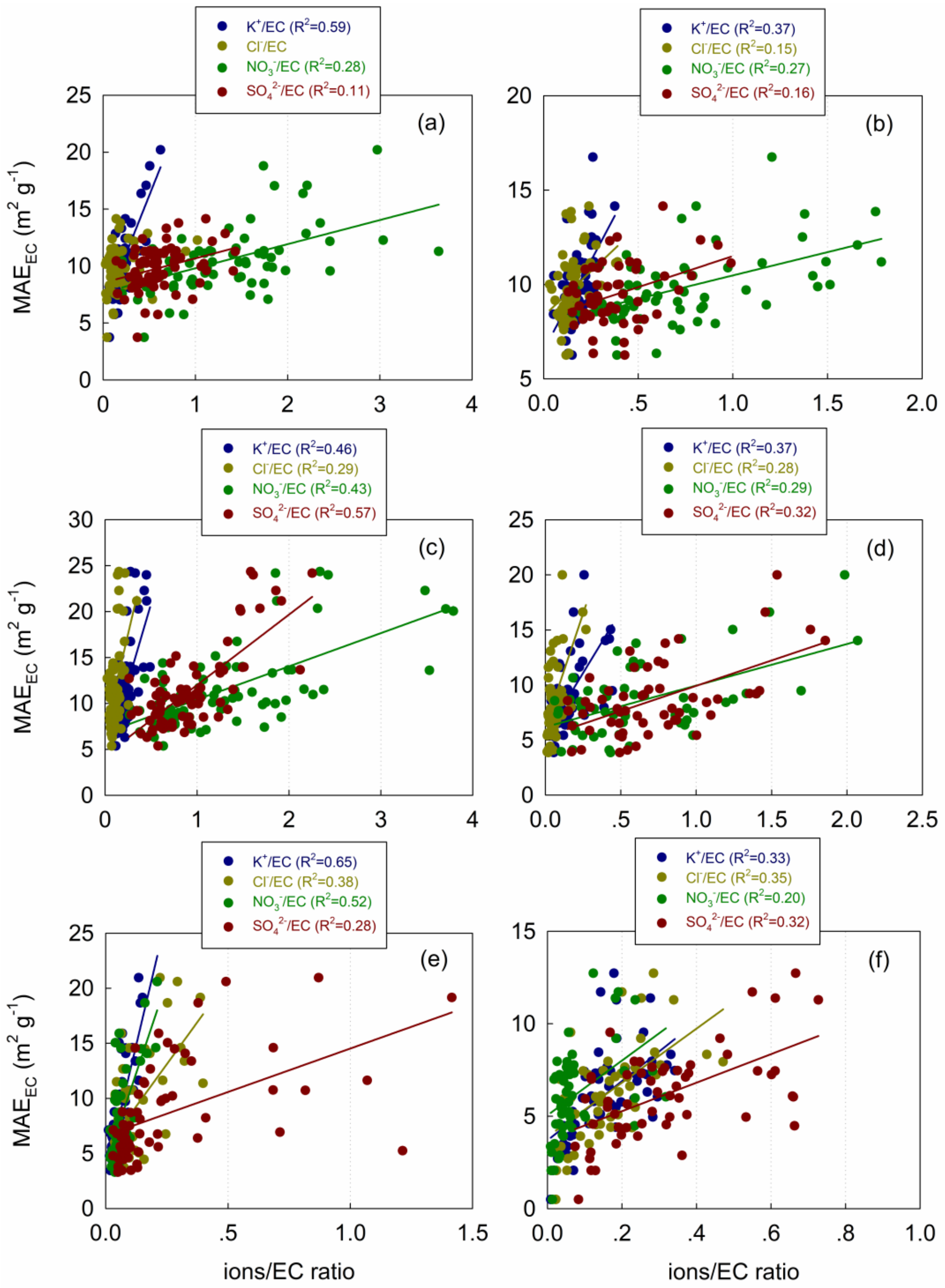

Figure S6: Variations of spring and winter EC mass absorption efficiency (MAE_{EC}) at 405 nm as the ratios of water-soluble ions (K^+, Cl^-, SO_4^{2-}, and NO_3^-) to EC concentrations at (a) Chengdu, (b) Sanbacun, (c) Wenchuan, (d) Lixian, (e) Maerkang and (f) Hongyuan) during the measurement campaign. The relationships passed the significance level of 0.01.

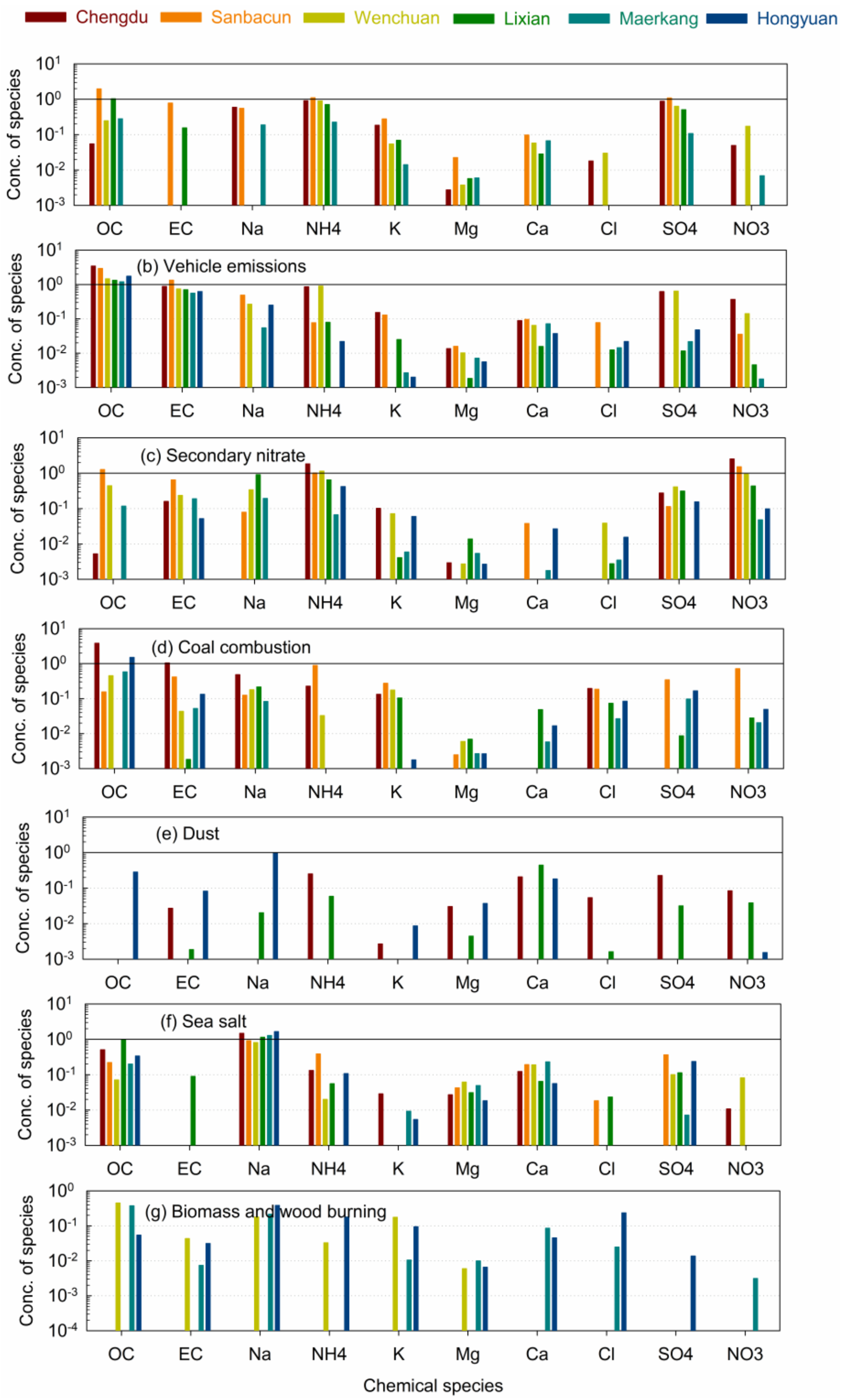

Figure S7: Mass concentrations of species for each source at each site apportioned by PMF model in spring during the campaign. The vertical axes are showed on logarithmic scale to better distinguish the concentrations of chemical species among the sampling sites.

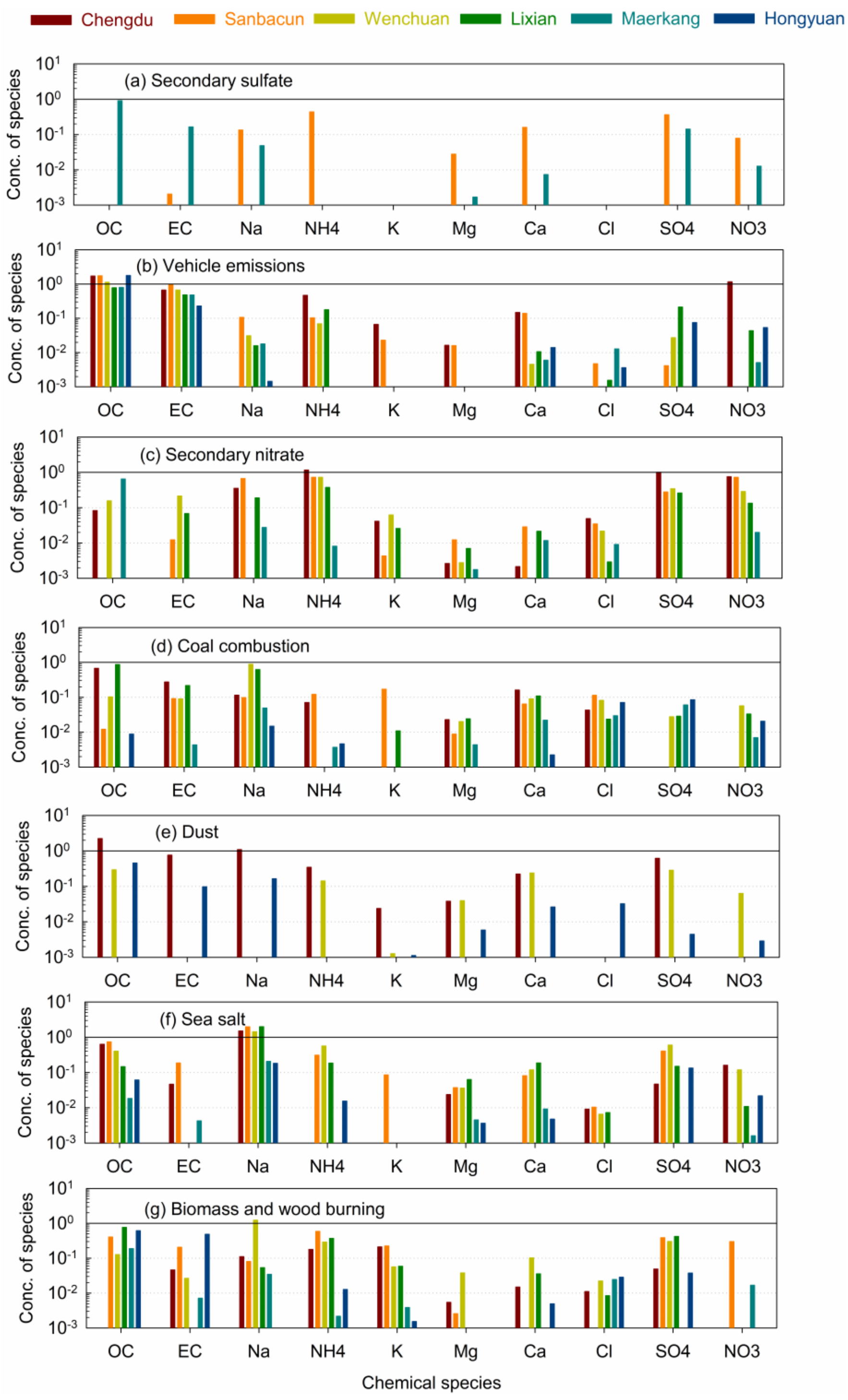

Figure S8: Mass concentrations of species for each source at each site apportioned by PMF model in summer during the campaign. The vertical axes are showed on logarithmic scale to better distinguish the concentrations of chemical species among the sampling sites.

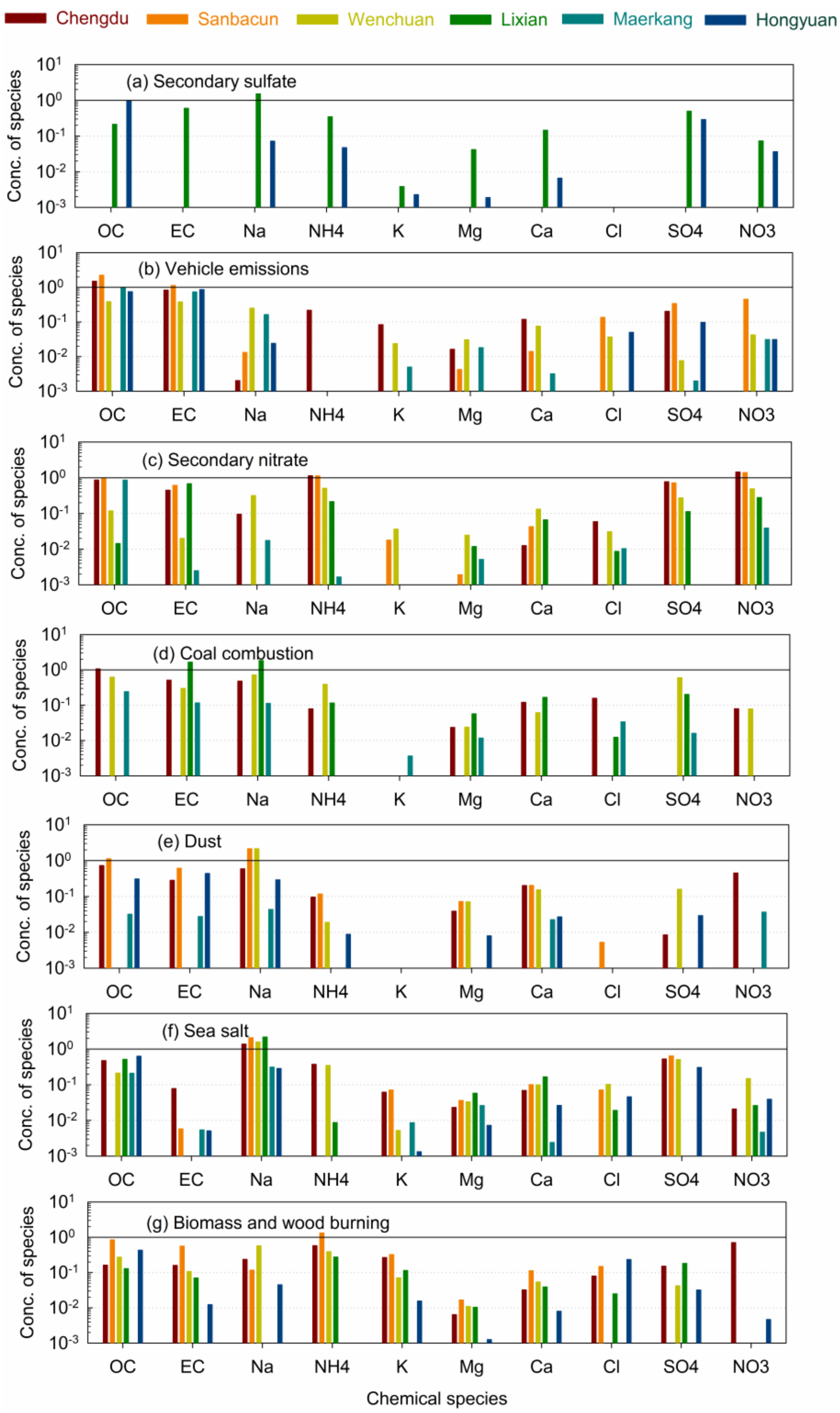

Figure S9: Mass concentrations of species for each source at each site apportioned by PMF model in fall during the campaign. The vertical axes are showed on logarithmic scale to better distinguish the concentrations of chemical species among the sampling sites.

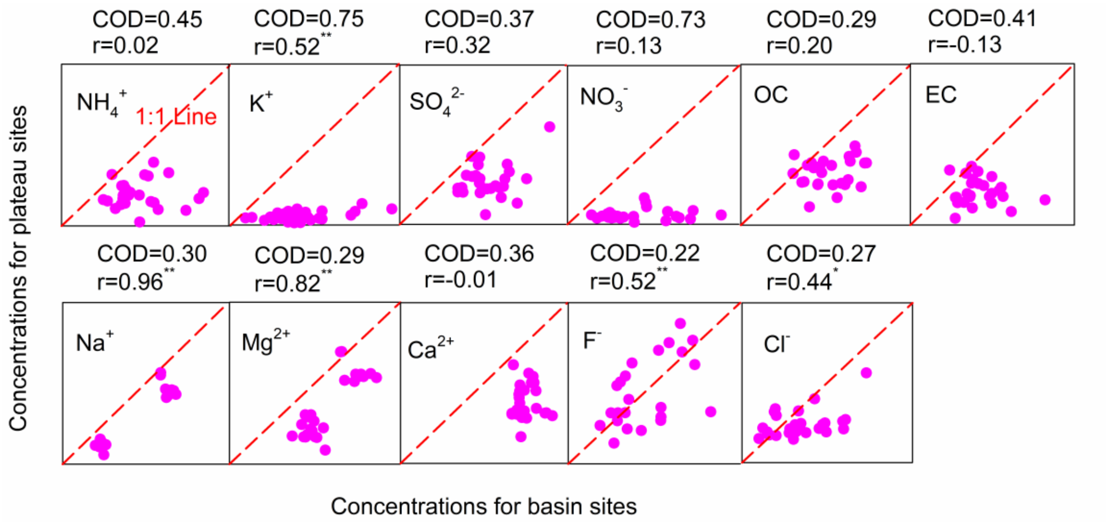

Figure S10: Relationships of summer PM_1 chemical species concentrations between basin (horizontal axes, including Chengdu and Sanbacun) and plateau sites (vertical axes, including Wenchuan, Lixian, Maerkang and Hongyuan). The correlation coefficients (r) with an asterisk and two asterisk superscripts pass the significance level of 0.05 and 0.01, respectively.

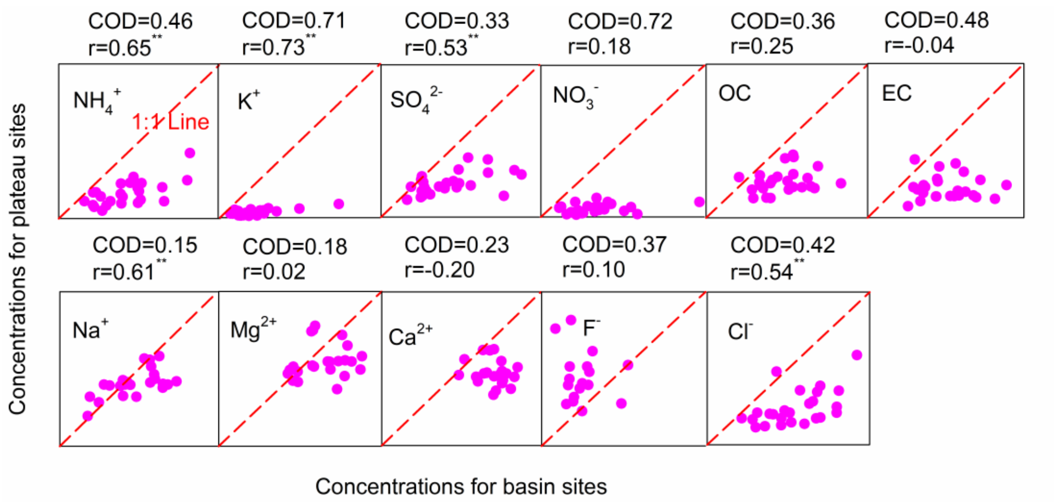

Figure S11: Relationships of fall PM_1 chemical species concentrations between basin (horizontal axes, including Chengdu and Sanbacun) and plateau sites (vertical axes, including Wenchuan, Lixian, Maerkang and Hongyuan). The correlation coefficients (r) with an asterisk and two asterisk superscripts pass the significance level of 0.05 and 0.01, respectively.

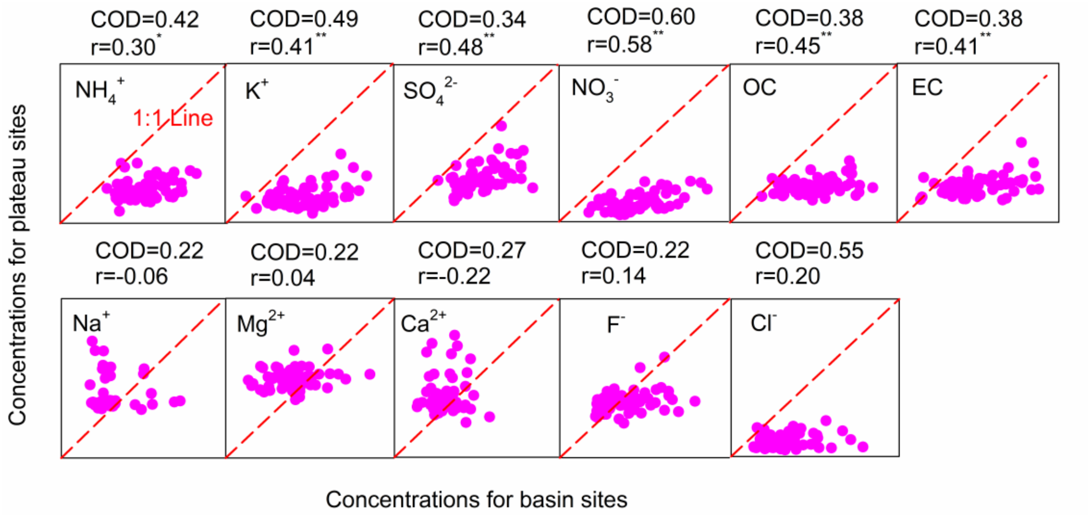

Figure S12: Relationships of winter PM_1 chemical species concentrations between basin (horizontal axes, including Chengdu and Sanbacun) and plateau sites (vertical axes, including Wenchuan, Lixian, Maerkang and Hongyuan). The correlation coefficients (r) with an asterisk and two asterisk superscripts pass the significance level of 0.05 and 0.01, respectively.

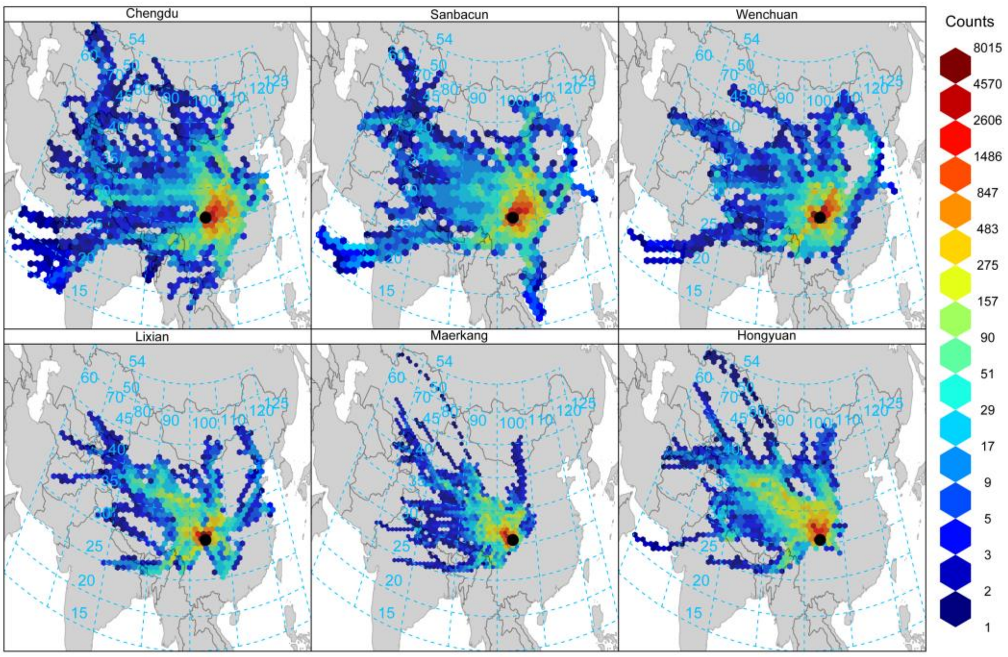

Figure S13: Gridded back trajectory frequencies with hexagonal binning in spring at the six sites from west Sichuan Basin to Tibetan Plateau. The map is a pure reproduction of Google Maps with added the trajectory frequencies. Copyright © Google Maps.

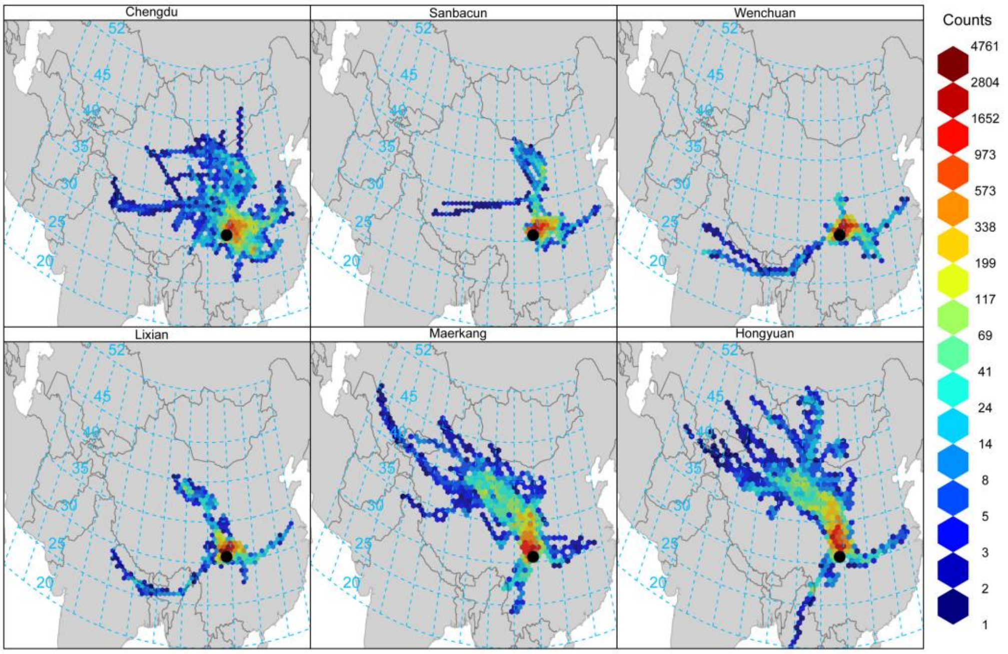

Figure S14: Gridded back trajectory frequencies with hexagonal binning in summer at the six sites from west Sichuan Basin to Tibetan Plateau. The map is a pure reproduction of Google Maps with added the trajectory frequencies. Copyright © Google Maps.

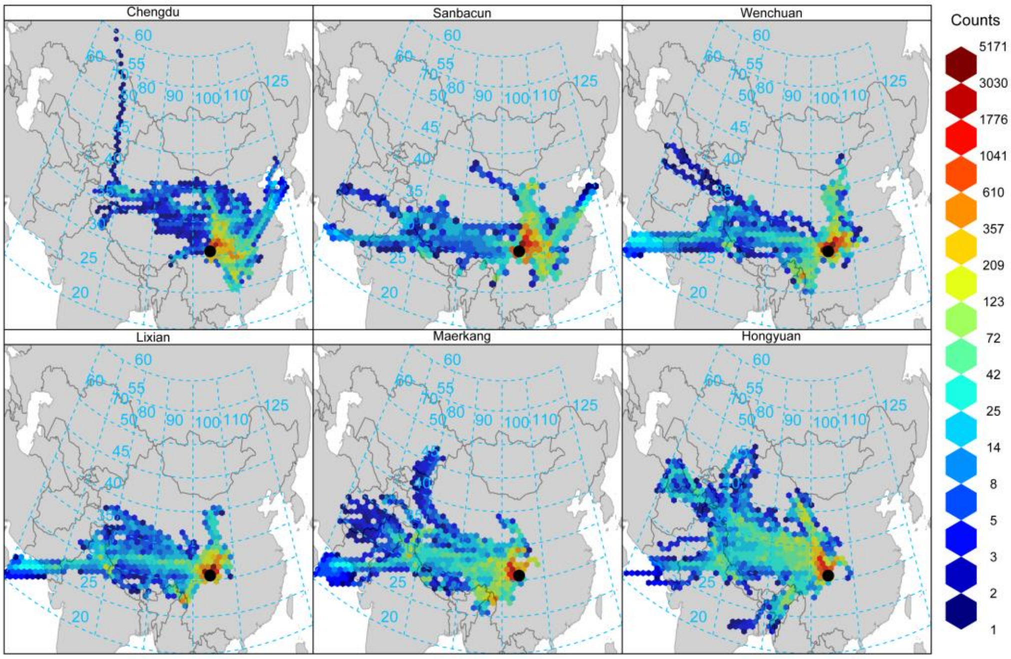

Figure S15: Gridded back trajectory frequencies with hexagonal binning in fall at the six sites from west Sichuan Basin to Tibetan Plateau. The map is a pure reproduction of Google Maps with added the trajectory frequencies. Copyright © Google Maps.

Table S1. OC and EC concentrations (μg m^{-3}) and mass absorption efficiency (MAE, m^2 g^{-1}) of EC and BrC over Tibetan Plateau and the surrounding regions. TSP is the abbreviation of Total Suspended Particulate.

Region	Site	Size fraction	period	OC	EC	MAE_{EC}	MAE_{BrC}	Reference
Tibetan Plateau (TP)	Hongyuan	PM_1	Dec 2018–May 2019	8.4	3.0	4.3	2.5	This work
	Nam Co	TSP	Dec 2014–Feb 2015	1.9	0.2	—	4.5	Wu et al. (2018)
	Lulang	TSP	Dec 2015–Feb 2016	2.1	0.8	—	0.8	Zhu et al. (2018)
	Lhasa	$PM_{2.5}$	May 2013–Mar 2014	3.3	2.2	7.2	0.7	Li et al. (2016)
Sichuan Basin (SCB)	Chengdu	PM_1	Dec 2018–Feb 2019	15.0	4.7	6.7	0.8	This work
	Chengdu	$PM_{2.5}$	Dec 2012–Feb 2013	20.1	4.7	—	—	Chen et al. (2014)
	Chongqing	$PM_{2.5}$	Dec 2016–Jan 2017	—	—	—	0.7	Peng et al. (2020a)
	Chongqing	$PM_{2.5}$	Dec 2012–Feb 2013	18.3	4.3	—	—	Chen et al. (2014)
	Neijiang	$PM_{2.5}$	Dec 2012–Feb 2013	20.1	4.7	—	—	Chen et al. (2014)
	Three Gorges Reservoir	$PM_{2.5}$	Dec 2015–Jan 2016	—	—	11.9	0.8	Peng et al. (2020b)
Indo-Gangetic Plain (IGP)	New Delhi	PM_{10}	Oct 2010–Mar 2011	—	—	—	1.6	Kirillova et al. (2014)
	Patiala	$PM_{2.5}$	Oct–Nov 2011	71.5	6.9	3.9	1.3	Srinivas et al. (2016)
	Kathmandu	TSP	Apr 2013–Jan 2018	34.8	9.9	7.0	1.4	Chen et al. (2020)
	Kanpur	PM_1	Nov 2014–Feb 2015	—	6.1	6.7	1.6	Choudhary et al. (2018)