Supplementary materials of Surprisingly high levels and activity contributions of oxygenated volatile organic compounds on the southeast of the Tibetan Plateau

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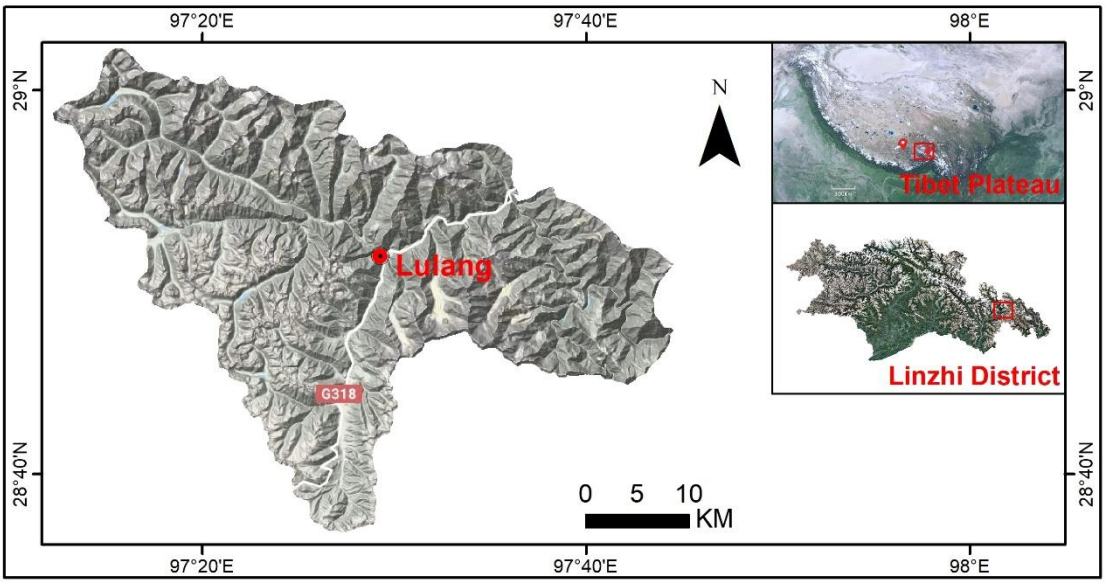
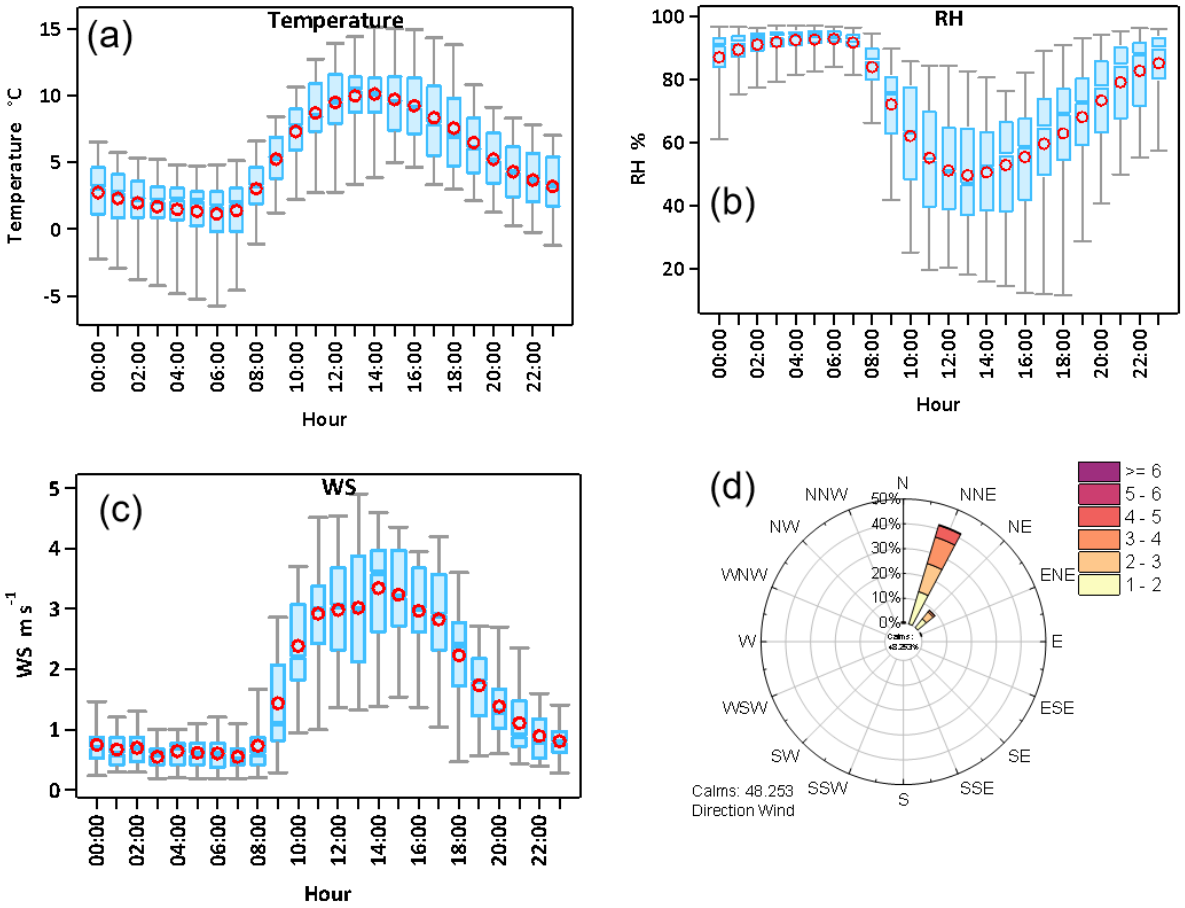
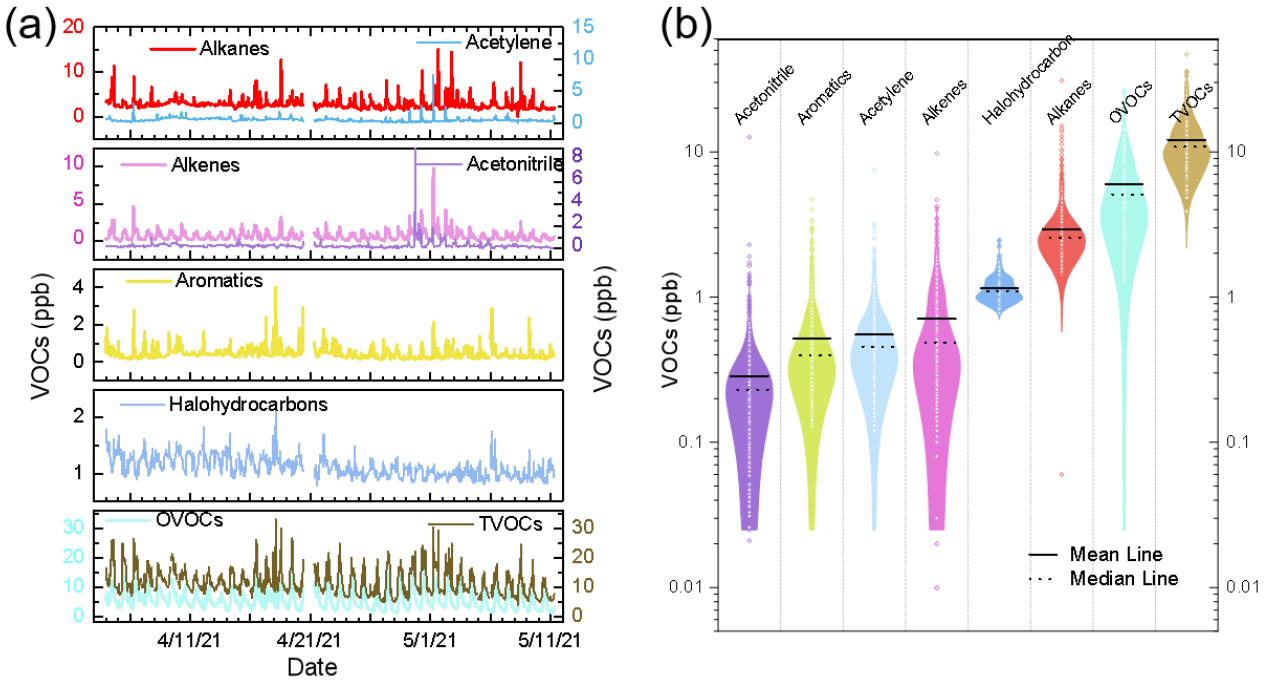


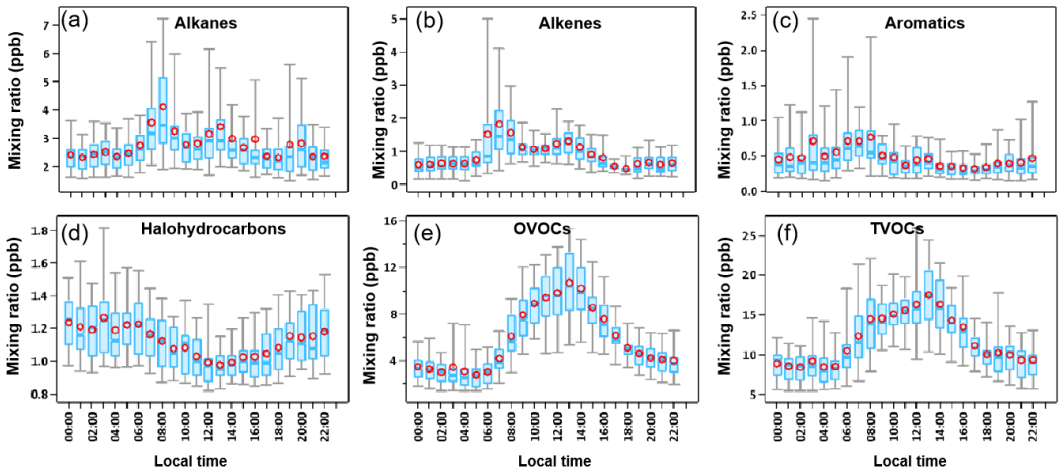
Fig. S1 The location and topography of the measurement site (reedited from map.baidu.com).



20 **Fig. S2. Diurnal variations in air temperature (a), relative humidity (b), wind speed (c), and wind speed rose chart (d) during the observation period**



24 **Fig. S3. (a) Time-series and (b) Violin distribution diagram of VOCs**



28 **Fig. S4 The diurnal variations in different VOCs**

Bar represents 25%-75% quartile, whisker represents 5% and 95% quantile, red circle indicates mean, and blue horizontal line represent the median.

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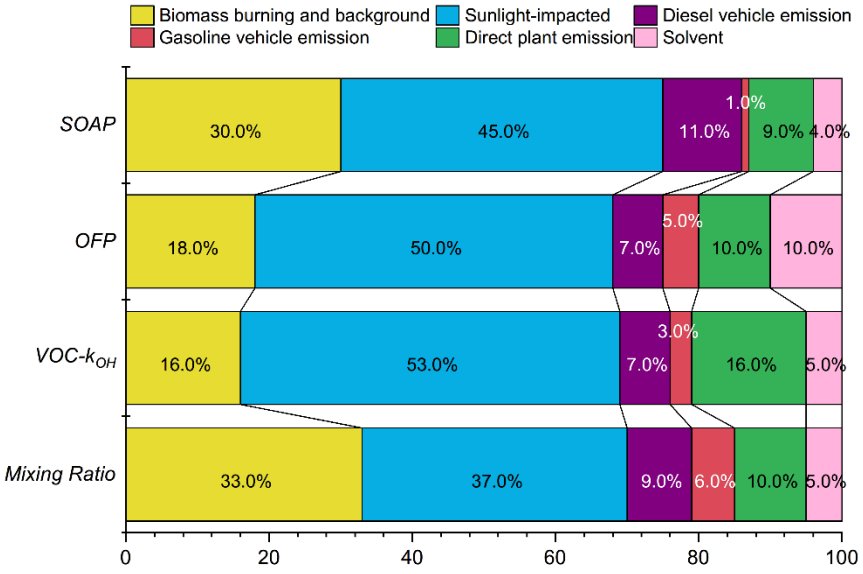

36 **Fig. S5 Contributions of six sources decomposed by PMF to mixing ratio, VOC-k_{OH}, OFP and SOAP.**

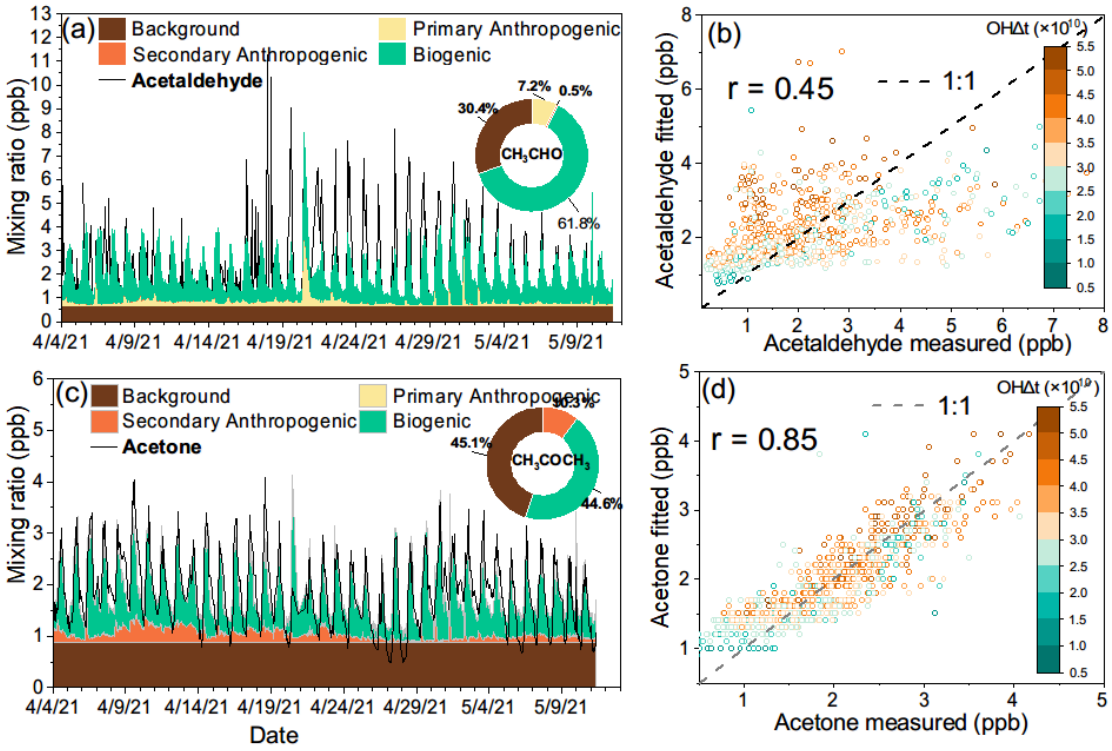

Fig. S6 The four source concentrations of acetaldehyde (a) and acetone (c) by PAP and the time series of observed concentrations. The fitted and observation scatter plots of acetaldehyde (b) and acetone (d), marked color as hydroxyl exposure

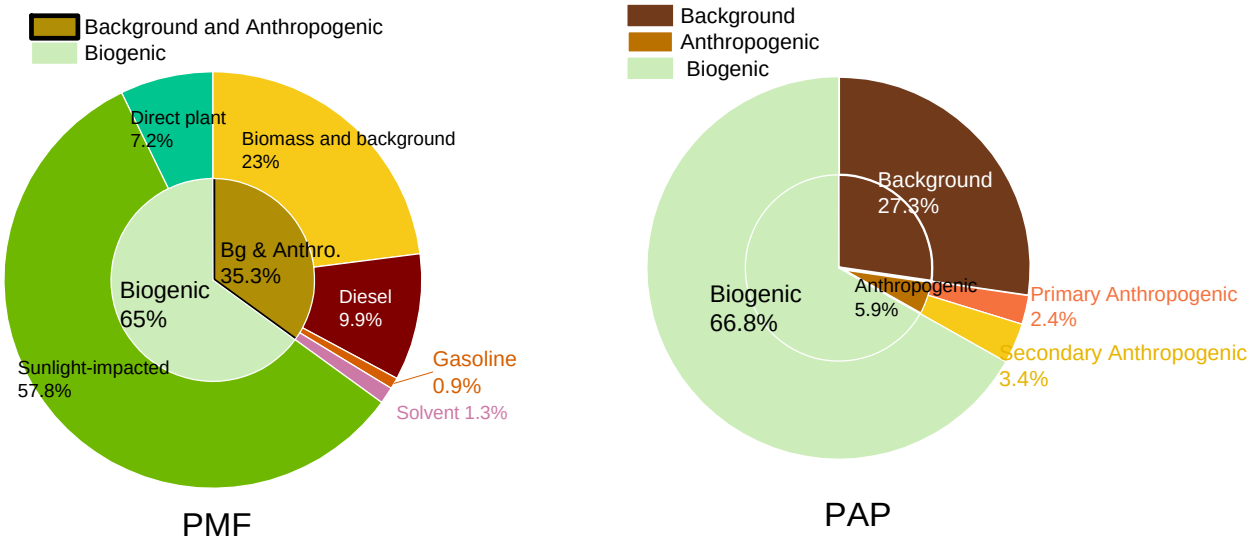

Fig. S7. Comparation of composition and contribution of biogenic source, anthropogenic sources and background of OVOCs analysed by methods of positive matrix factorization (PMF) and photochemical age-based parameterization (PAP).

Table S1 Comparison of VOCs species levels at Lulang with other sites (Unit: ppb)

Site	Sampling Period	Alkanes						Alkenes				Alkyne	Aromatics				
		Ethane	Propane	*n*-butane	*i*-butane	*n*-pentane	*i*-pentane	Ethene	Propene	Isoprene	*α*-pinene	Ethyne	Benzene	Toluene	Ethylbenzene	*m,p*-xylene	*o*-xylene
Arctic[a]	2009.03-04	2.1	0.9	0.2	0.2	0.07	0.2	-	-	-	-	0.30	0.1	0.1	0.01	-	-
Arctic [b]	Apr-Oct,2018	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
Arctic[c]	2008.08-09	0.62	0.09	0.02	-	0.01	-	-	-	-	-	0.06	0.02	-	-	-	-
Antarctic[c]	2007.12-2008.01	0.10	0.01	-	-	0.00	-	-	-	-	-	0.02	0.01	-	-	-	-
Menyua[d]	2013.9-10	-	-	-	-	-	-	-	-	-	0.06	-	0.09	0.12	0.05	0.20	0.18
WLG [e]	2003.4-5.6-8	1.50	0.28	0.07	0.06	0.02	0.06	0.13	0.03	0.01	0.01	0.39	0.09	0.18	0.02	0.12	0.05
Gongga [f]	2008-2011	-	-	0.20	-	0.22	0.47	-	-	0.40	0.10	-	0.72	0.44	0.28	0.28	0.31
Tibet [g]	2010.10	-	0.07	-	-	-	0.08	-	0.05	-	-	0.14	0.02	0.03	0.01	0.01	BDL
Jianfeng Mt.[h]	2004.4-5	0.86	0.17	0.10	0.05	0.15	0.20	0.38	0.11	0.55	0.05	0.39	0.13	0.17	0.02	0.04	BDL
Tengchong Mt.[h]	2004.4-5	1.40	0.23	0.06	0.03	0.12	0.15	0.87	0.17	0.08	0.05	0.78	0.24	0.16	0.03	0.06	0.03
Lin'an[h]	2004.4-5	2.63	1.31	0.73	0.51	0.29	0.46	1.73	0.33	0.4	0.17	2.18	0.75	2.64	0.33	0.32	0.15
Tengyue[h]	2004.4-5	2.31	0.73	0.48	0.54	0.49	1.15	4.73	0.86	0.13	0.13	4.35	1.13	1.08	0.27	0.68	0.24
Xianghe[i]	2017.11-2018.2	6.02	2.98	1.55	0.87	0.4	0.56	4.05	0.92	0.04	-	2.13	0.92	0.97	0.36	1.02	0.32
Lulang*	2021,04-05	1.52	0.41	0.23	0.19	0.08	0.27	0.40	0.13	0.02	0.09	0.56	0.13	0.05	0.03	0.16	0.10
Jungfraujoch[j]	2005 Spring	-	-	0.043	-	-	-	-	-	0.001	-	-	0.025	0.07	0.018	0.075	0.007
Mediterranean forest[k]	2019 Summer	-	-	-	-	-	-	-	-	0.42	-	-	0.04	0.13	-	-	-

a. (Hornbrook et al., 2016); b. (Pernov et al., 2021); c. (Hellen et al., 2012); d. (Zhao et al., 2020); e. (Xue et al., 2013); f. (Zhang et al., 2014); g. (Li et al., 2017); h. (Tang et al., 2009); i. (Yang et al., 2020); j (Legreid et al., 2008); k (Yáñez-Serrano et al., 2021); * This study.

Table S2 Comparison of OVOCs species levels at Lulang with other sites (Unit: ppb)

Location	Period	Methanol	Formaldehyde	Acetaldehyde	Acrolein	Methacrolein	Propanal	Acetone	MEK	MVK
Arctic[a]	2009.03-04	0.7	-	0.1	-	-	0.02	0.9	0.19	-
Pittsburgh, US[b]	2002.7-8	10.70	-	1.56	-	-	-	4.03	0.56	-
Monterrey, Mexico[c]	2012.6	-	26.10	11.60	-	-	-	7.70	5.70	-
Beijing, China[d]	2005.6-8	-	15.90	7.90	-	-	-	8.70	-	-
Beijing, China[e]	2010.6-9	-	9.43	4.02	-	-	-	2.90	0.65	-
Beijing, China[f]	2018.5-6	19.70	6.31	2.90	-	-	-	4.16	1.00	-
Shanghai, China[g]	2007.7	-	25.97	9.66	-	-	-	5.46	-	-
Hong Kong, China[h]	1999.5-8	-	4.82	1.48	-	-	-	0.29	0.10	-
Guangzhou, China[i]	2005.7	-	11.20	5.89	-	-	-	7.21	0.10	-
Shenzhen, China[f]	2018.4	6.10	1.60	1.16	-	-	-	2.31	0.63	-
Xianghe，China[j]	2017.11-2018.1	-	-	1.22	0.13	0.02	0.23	0.97	0.32	0.04
Changsha, China[k]	2015 Spring	-	6.6	2.26	-	-	-	1.91	-	-
Lulang*, China	2021.4-5	-	-	1.96	0.19	0.03	0.42	1.87	0.20	0.10
WLG, China[l]	2005.8-9	-	4.16	4.25	-	-	-	2.02	-	0.6
New Mexico Forest[m]	1997 Summer	-	2.3	1	-	0.3	-	1.2	1.3	-
Mediterranean forest[n]	2019 Summer	4.6	-	0.77	-	-	-	2.08	0.29	-

a. (Hornbrook et al., 2016); b. (Millet et al., 2005); c. (Menchaca-Torre et al., 2015); d. (Pang and Mu, 2006); e.(Wang et al., 2011); f.(Huang et al., 2020); g.(Huang et al., 2008); h. (Ho et al., 2002); i. (Lyu et al., 2010); j. (Yang et al., 2020); k. (Jiang et al., 2019); l. (Mu et al., 2007); m. (Villanueva-Fierro et al., 2004); n. (Yáñez-Serrano et al., 2021); * This study;

Table S3 OVOC sources fitting parameters by PAP

Species	ER_{OVOC}	ER_{pre}	k_{pre}	ER_{bio}	Background
	ppb [ppb Benzene] $^{-1}$		10^{-12} cm^3 molecule^{-1}s^{-1}	ppb [ppb Isoprene] $^{-1}$	ppb
Acetaldehyde	1.79	1.00	2.00	2.86	0.63
Acrolein	0.01	0.47	5.00	0.36	0.03
Propanal	0	0.01	0.17	0.95	0
Acetone	0	11.02	4.00	1.96	0.88
n-Butanal	0	0.01	1.00	0.70	0
Methyl ethyl ketone	0	0.99	3.12	0.38	0.03
2-Pentanone	0	0	0.05	0.10	0
n-Pentanal	0	0.28	0	0.72	0
3-Pentanone	0	0.11	0	0.05	0
n-Hexanal	0	0.30	0	0.95	0

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