Supplement of

Regional to global distributions, trends, and drivers of biogenic volatile organic compound emission from 2001 to 2020

Hao Wang et al.

Correspondence to: Xiaohong Liu (xiaohong.liu@tamu.edu)

Table S1: Summary of isoprene emission site observations collected from the literature (mg C $m^{-2}\cdot day^{-1}$).

Date	Location	PFTs	Emissions	References
2001/02	[25°S, 31.5°E]	EBF	1.5	(Harley et al., 2003)
2002/08/13-2002/08/31	[42.0°N,116.3°E]	Grass	6.4	(Bai et al., 2003)
2003/04/16-2003/05/05	[10.4°N, 84.0°W]	EBF	6.0	(Karl et al., 2004)
2001/08/02-2001/08/12	[61.9°N, 24.3°E]	ENF	0.6	(Spirig et al., 2004)
2002/07/08-2002/07/18	[21.9°N,101.3°E]	DBF	10.0	(Baker et al., 2005)
2002/06/06-2002/09/21	[45.5°N, 84.7°W]	DBF	26.4	(Pressley et al., 2005)
2003/07/13-2003/07/24	[50°N, 6°E]	DBF	26.9	(Spirig et al., 2005)
2004/9/14-2004/9/29	[2.6°S, 60.2°W]	EBF	20.6	(Karl et al., 2007)
2007/12/15-2007/12/19	[3°N, 102.3°E]	EBF	7.4	(Saito et al., 2008)
2006/08/01-2006/09/19	[68.3°N, 19.1°E]	Grass	2.9	(Holst et al., 2010)
2008/06/20-2008/07/20	[5.0°N, 117.8°E]	EBF	11.4	(Langford et al., 2010)
2007/06-2007/08	[42.9°N, 72.2°W]	DBF	19.4	(McKinney et al., 2011)
2008/05/30-2008/06/11	[5.2°N, 118.5°E]	EBF	42.8	(Misztal et al., 2011)
2002/06/26-2002/06/28	[43.7°N, 116.6°E]	Grass	7.0	(Bai, 2015)
2010/06/19-2010/06/30	[42.4°N, 128.1°E]	DBF	5.6	(Bai et al., 2015)
2010/09/02-2011/01/27	[2.6°S, 60.1°W]	EBF	5.1	(Alves et al., 2016)
2012/07/07-2012/07/13	[30.3°N,119.57°E]	EBF	12.4	(Bai et al., 2016)
2005/07/15-2005/08/16	[51.17°N,0.85°W]	DBF	16.8	(Langford et al., 2017)
2011/09/13-2011/10/01	[41.74°N,12.4°E]	DBF	0.7	(Langford et al., 2017)
2012/06/13-2012/07/12	[45.2°N,10.74°E]	DBF	15.0	(Langford et al., 2017)
2012/06/09-2012/06/11	[43.94°N,5.71°E]	DBF	20.8	(Langford et al., 2017)
2012/07-2012/08	[38.74°N,92.2°W]	DBF	47.3	(Zheng et al., 2017)
2013/06-2013/12	[2.6°S,60.2°W°]	EBF	50.0	(Alves et al., 2018)
2013/06/11-2013/06/26	[45.81°N,8.63°E]	DBF	27.0	(Jensen et al., 2018)

2015/05/08-2015/05/25	[39.32°N,86.42°W]	DBF	29.2	(Stoy et al., 2021)
2013/09-2014/07	[2.59°S,8.60.21°W]	EBF	17.9	(Langford et al., 2022)

Table S2. Summary of monoterpenes emission site observations collected from the literature (mg C $m^{-2}\cdot day^{-1}$).

Date	Location	PFTs	Emissions	References
2003/04/16-2003/05/05	[10.4°N, 84.0°W]	EBF	0.44	(Karl et al., 2004)
2001/08/02-2001/08/12	[61.9°N, 24.3°E]	ENF	2.12	(Spirig et al., 2004)
2003/07/13-2003/07/24	[50°N, 6°E]	DBF	8.60	(Spirig et al., 2005)
2004/9/14-2004/9/29	[2.6°S, 60.2°W]	EBF	3.20	(Karl et al., 2007)
2000/04/20-2008/05/07	[5.0°N, 117.8°E]	EBF	1.50	(Langford et al., 2010)
2008/06/20-2008/07/20	[5.0°N, 117.8°E]	EBF	2.80	(Langford et al., 2010)
2007/06-2007/08	[42.9°N, 72.2°W]	DBF	0.66	(McKinney et al., 2011)
2010/06/19-2010/06/30	[42.4°N, 128.1°E]	DBF	0.86	(Bai et al., 2015)
2010/09/02-2011/01/27	[2.6°S, 60.1°W]	EBF	4.80	(Alves et al., 2016)
2012/07/07-2012/07/13	[30.3°N,119.57°E]	EBF	0.05	(Bai et al., 2016)
2013/06/11-2013/06/26	[45.81°N,8.63°E]	DBF	0.83	(Jensen et al., 2018)

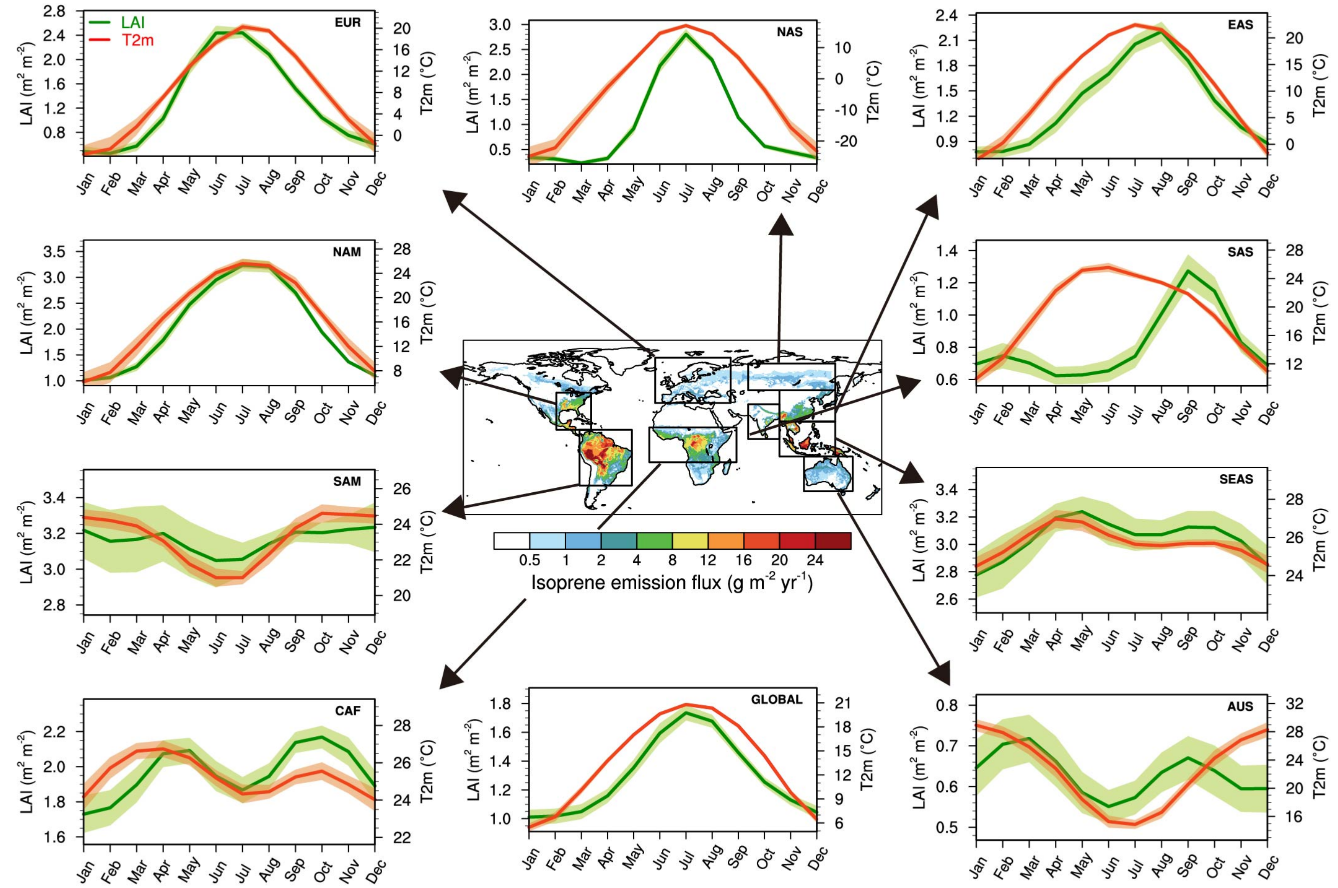

Figure S1: The seasonal variation of leaf area index (LAI) and surface 2 m temperature (T2m) for each region outlined in black on the map during 2001-2020. The shaded area represents one standard deviation. The nine regions are listed below: NAM: North America; EUR: Europe; NAS: North Asia; EAS: East Asia; SAS: South Asia; SEAS: Southeast Asia; SAM: South America; CAF: Central Africa; AUS: Australia.

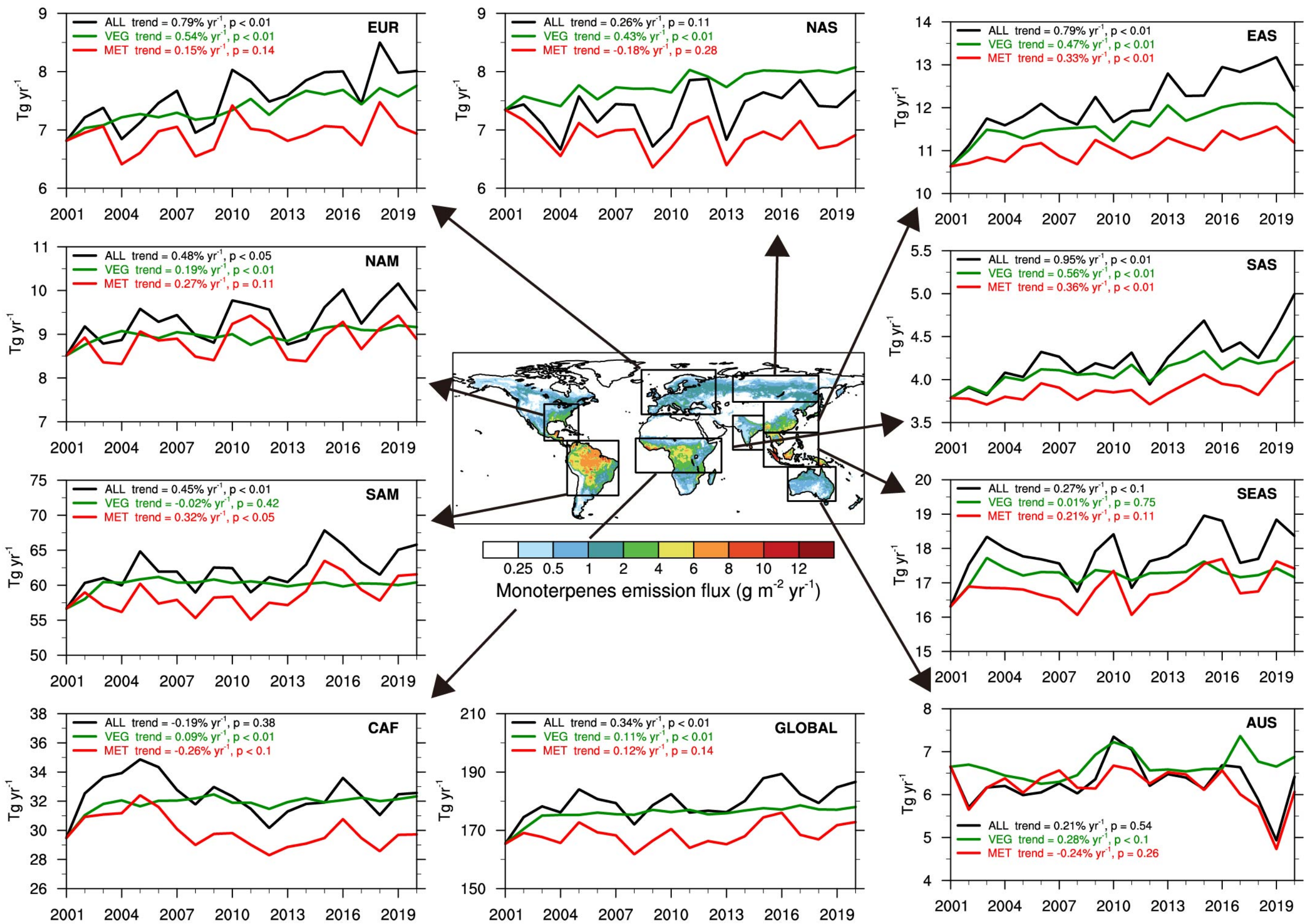

Figure S2: Interannual variation and trends in regional monoterpenes emissions for each region outlined by black rectangles on the map. Trends are expressed by the relative change in percentage (i.e., the linear change during 2001-2020 divided by the mean value). p-values denote statistically significant levels using the Mann-Kendall test. ALL represents simulated results considering interannual variability of all drivers (i.e., vegetation, meteorology), while VEG and MET represent simulated results considering only interannual variability of vegetation and meteorology, respectively.

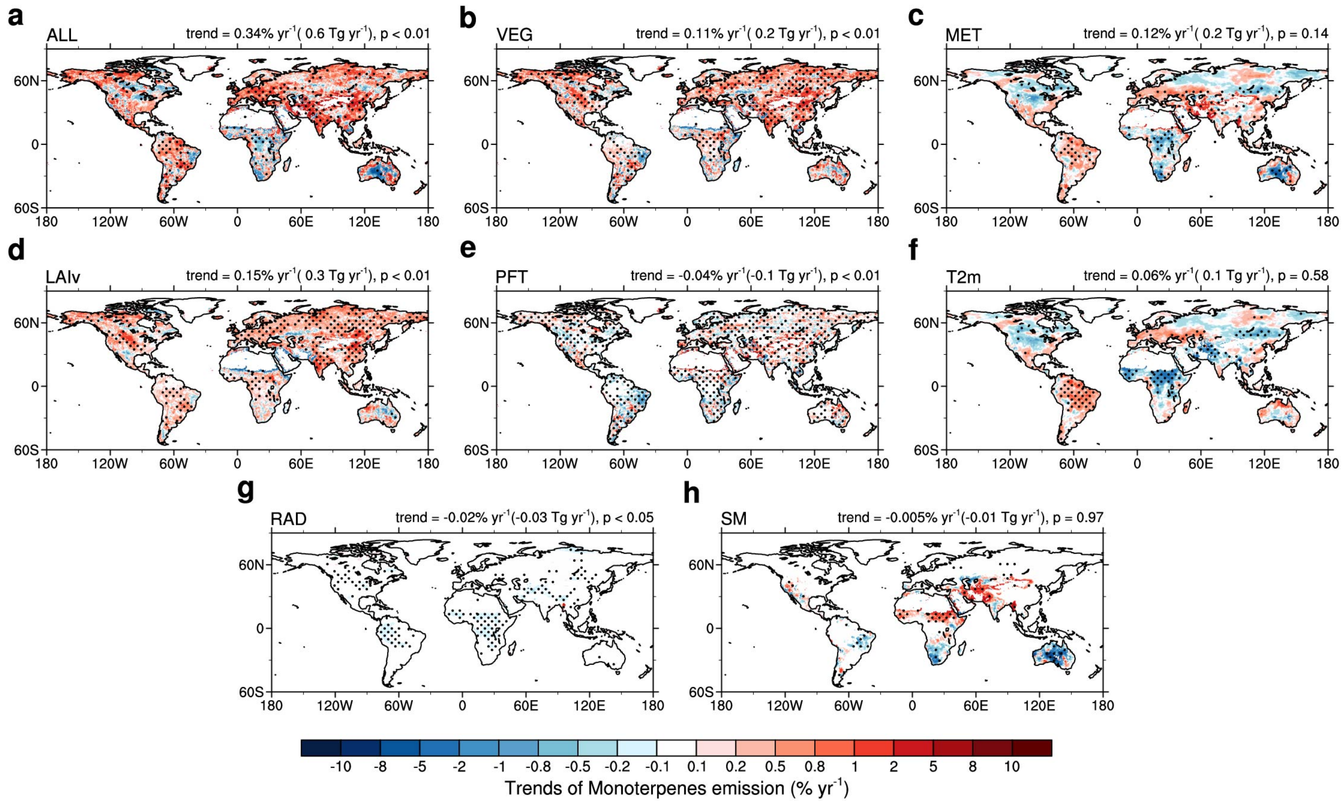

Figure S3: Spatial distribution of monoterpenes emission trends from 2001 to 2020. (a) ALL represents simulated results considering interannual variability of all drivers. (b, c) VEG and MET represent simulated trends when considering only interannual variability of vegetation and meteorology, respectively. (d, e) Contributions from individual vegetation parameters including LAIv (leaf area index of vegetation covered surfaces) and PFT (plant functional types). (f, g, and h) Contributions from individual meteorological factors including T2m (surface 2 m temperature), RAD (surface solar radiation), and SM (soil moisture). Stippling denotes regions where the trend is statistically significant ($p < 0.1$) using the Mann-Kendall test. Trends are expressed by the relative change in percentage (i.e., the linear change during 2001-2020 divided by the mean value) and absolute change. p-values represent statistically significant levels using the Mann-Kendall test.

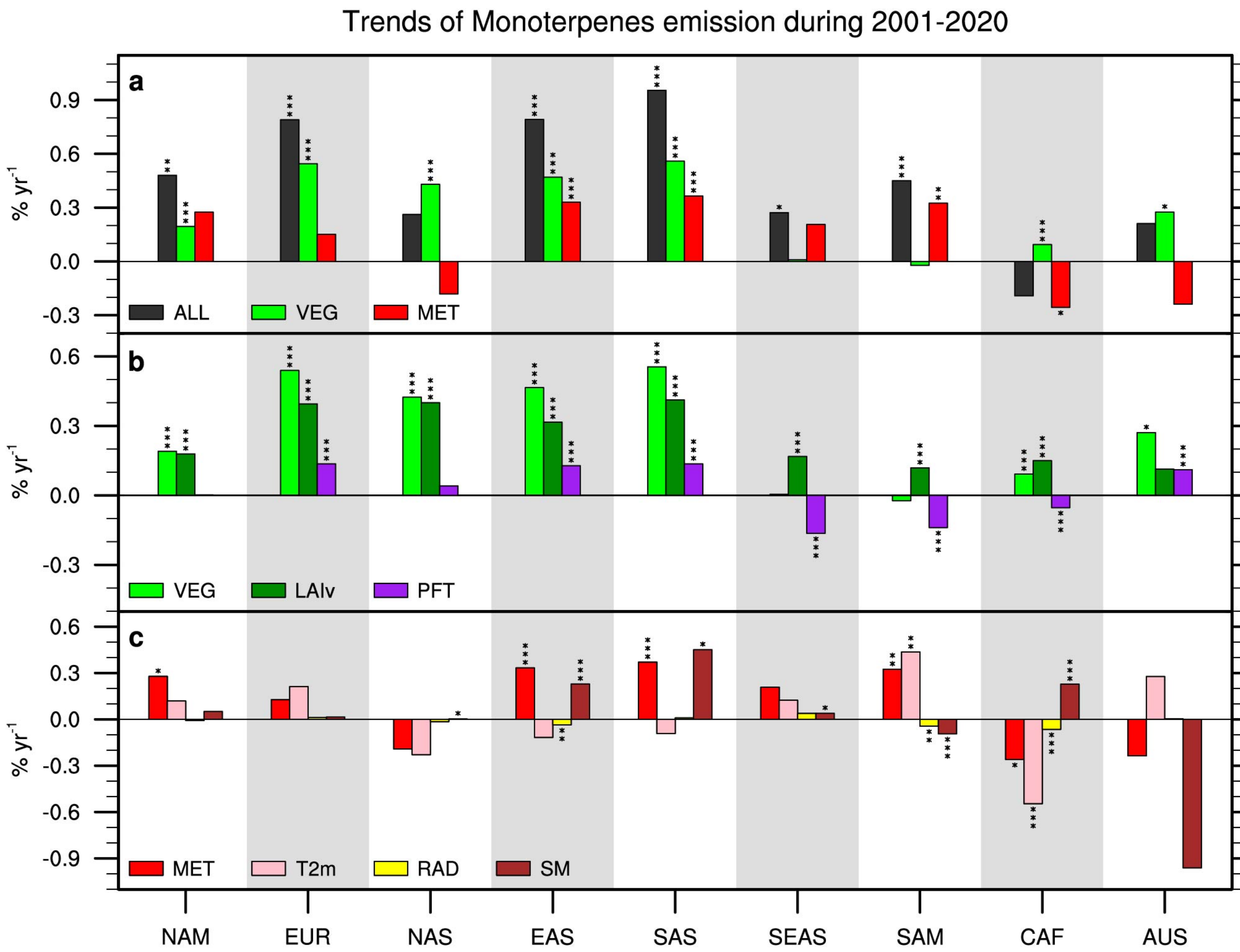

Figure S4: Trends of monoterpenes emissions and associated influencing factors from 2001–2020 in nine regions. (a) ALL represents simulated results considering interannual variability of all drivers, while VEG and MET represent simulated results considering only interannual variability of vegetation and meteorology, respectively. (b) Contributions from individual vegetation parameters including LAIv (leaf area index of vegetation covered surfaces) and PFT (plant functional types). (c) Contributions from individual meteorological factors including T2m (surface 2 m temperature), RAD (surface solar radiation), and SM (soil moisture). (d) Trends of individual influencing factors including vegetation parameters and meteorological factors. Tree, shrub, grass, and crop represent the four plant functional types (PFTs). The single, double, and triple asterisks denote 90%, 95%, and 99% confidence levels (CI) using the Mann-Kendall test, respectively.

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