Supplementary of: Implementation of MEGAN v3.2 in SURFEX v9.0: A new framework for global biogenic emission simulations

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1 Implementation of MEGAN v3.2 in SURFEX v9.0

Table S1. MEGAN v3.2 biogenic emission classes and emission factors ($(\mathrm{nmol\,m^{-2}\,s^{-1}})$) for each k PFT (see Table 1 for the description of n PFT).

Compound class	$\varepsilon_{15,i}$	$\varepsilon_{5,i}$	$\varepsilon_{17,i}$	$\varepsilon_{6,i}$	$\varepsilon_{14,i}$	$\varepsilon_{13,i}$	$\varepsilon_{4,i}$	$\varepsilon_{16,i}$	$^{a}\varepsilon_{19,i}$	$^{b}\varepsilon_{19,i}$	$^{c}\varepsilon_{19,i}$	$\varepsilon_{18,i}$	$\varepsilon_{10,i}$	$\varepsilon_{11,i}$	$\varepsilon_{7-8,i}$
$ISOP$	0.80	4.00	3.00*	6.00	6.00	6.00	6.00	14.00	4.00	6.00	6.00	2.20	1.10	0.30	0.05
MBO	0.30	0.10	3.00*	3.00*	3.00*	3.00*	3.00*	3.00*	3.00*	3.00*	3.00*	3.00*	3.00*	3.00*	3.00*
MT_{PINE}	0.50	0.50	0.50	0.30	0.30	0.30	0.30	0.30	0.40	0.40	0.40	0.05	0.05	0.08	0.05
MT_{ACYC}	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.06	0.06	0.10	0.10
MT_{CAMP}	0.20	0.20	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.03	0.03	0.05	0.03
MT_{SABI}	0.35	0.35	0.35	0.18	0.18	0.18	0.18	0.18	0.20	0.20	0.20	0.06	0.06	0.08	0.06
MT_{AROM}	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
NO	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.50	0.50	0.50	0.50
SQT_{HR}	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01
SQT_{LR}	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01
$MEOH$	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	0.80	0.80	0.80	0.80
$ACTO$	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.20	0.20	0.20	0.20
$ETOH$	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.35	0.35	0.35	0.35
$ACID$	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.10	0.10	0.10
$LVOC$	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.00	1.00	1.00	1.00
$OXPROD$	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
$STRESS$	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
$OTHER$	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
CO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

*Values in units of $10^{-3}\,\mathrm{nmol\,m^{-2}\,s^{-1}}$

^{a}Tropical shrub, ^{b}Temperate shrub, ^{c}Boreal shrub

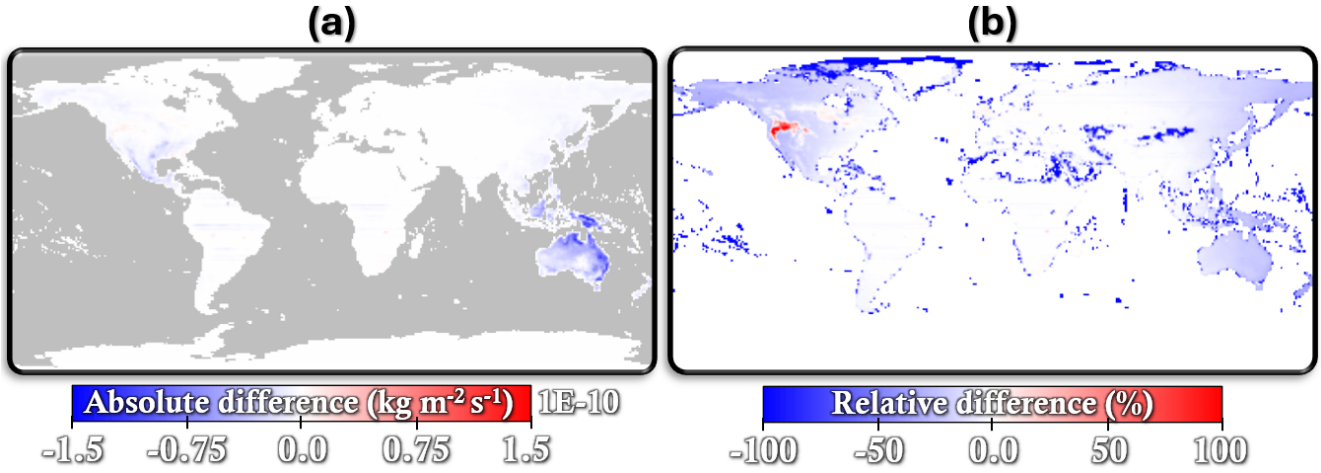


Figure S1. (a) Absolute and (b) relative differences between simulations performed using SURFEX v8.1 and SURFEX v9.0 (Baseline simulation) using the ERA5 meteorological forcing.

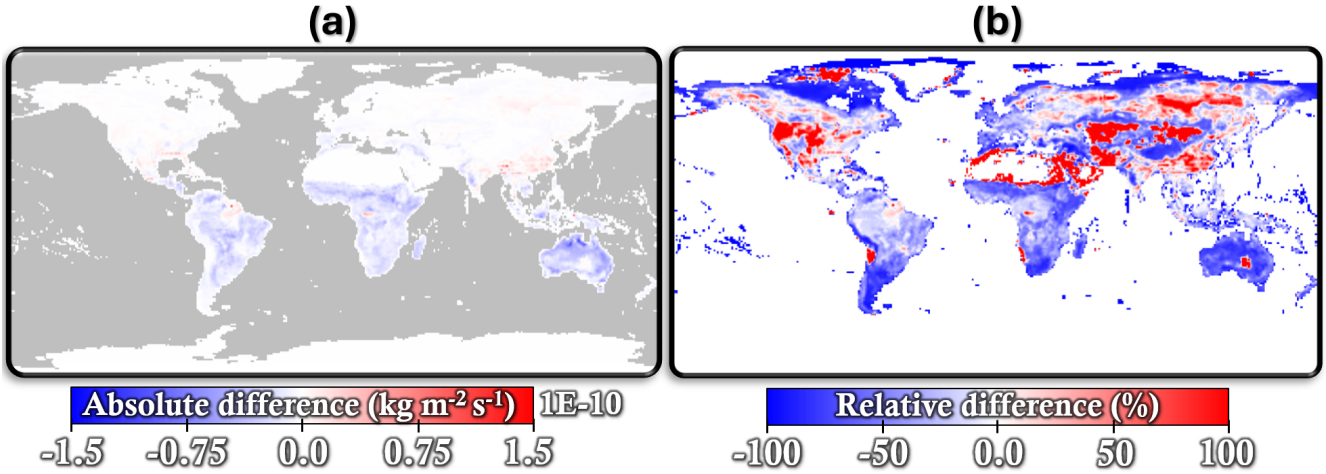


Figure S2. (a) Absolute and (b) relative differences between simulation R1 and the Baseline simulation modeled using ERA5 forcing.

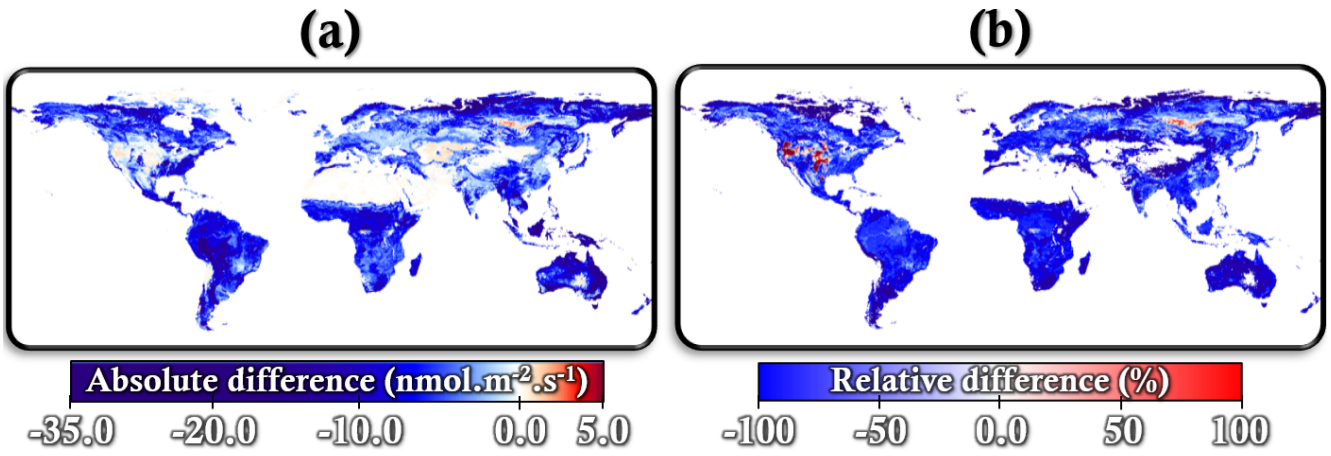


Figure S3. (a) Absolute and (b) relative differences between the new gridded isoprene emission factor (ε_{ISOP}^{map}) dataset (MEGAN v3.2) and the MEGAN v2.1 one.

Table S2. Regional isoprene emission totals and spatial statistics comparing R1 and R2 annual simulations for 2019 using the ERA5 meteorological forcing.

Region	R1 ($\mathrm{Tg\,yr^{-1}}$)	R2 ($\mathrm{Tg\,yr^{-1}}$)	NMB (%)	Pearson r
Global	317.60	236.70	-25.50	0.96
Northern Hemisphere	165.70	124.00	-25.20	0.96
Southern Hemisphere	151.90	112.80	-25.80	0.96
North America	32.00	21.90	-31.60	0.92
South America	117.20	97.80	-16.60	0.96
Europe	6.20	3.90	-37.80	0.82
North Africa	2.30	0.30	-85.70	0.69
East Africa	59.80	41.90	-29.90	0.94
South Africa	8.50	3.30	-60.80	0.78
Russia	12.30	9.50	-22.90	0.96
Southeast Asia	62.20	53.50	-14.00	0.98
Australia	17.30	4.70	-73.10	0.78

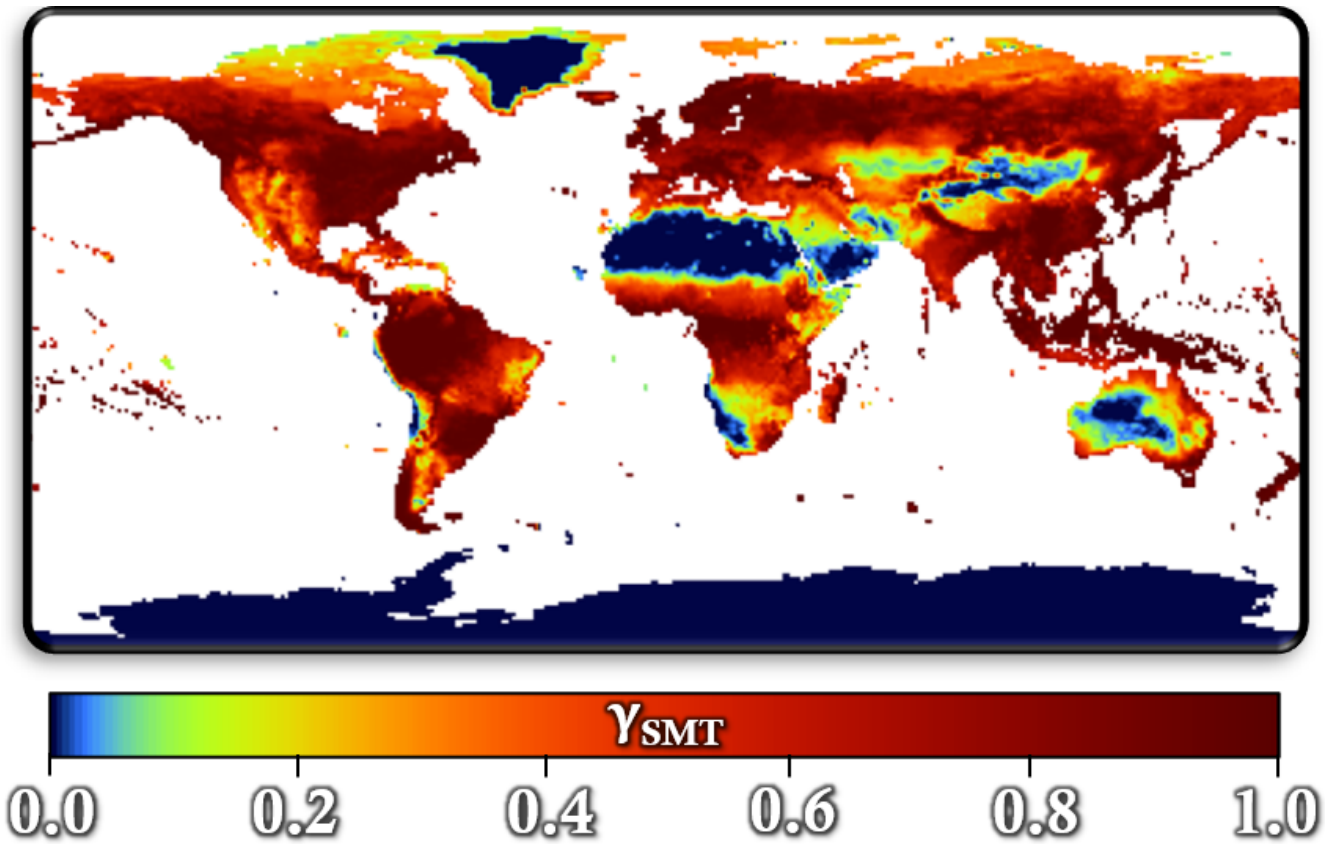


Figure S4. Spatial distribution of annual mean γ_{SMT} (dimensionless) simulated over 2019 using the R2 simulation, i.e., with γ_{SMT} turned on, conducted with the ERA5 forcing.

Table S3. Seasonal isoprene emission totals of R1 and R2 annual simulations for 2019 using the ERA5 meteorological forcing.

Season	R1 ($\mathrm{Tg\,yr^{-1}}$)	R2 ($\mathrm{Tg\,yr^{-1}}$)	NMB (%)
Boreal Winter	69.42	53.47	-22.98
Boreal Spring	77.09	56.06	-27.28
Boreal Summer	91.03	70.22	-22.86
Boreal Autumn	79.87	56.81	-28.87

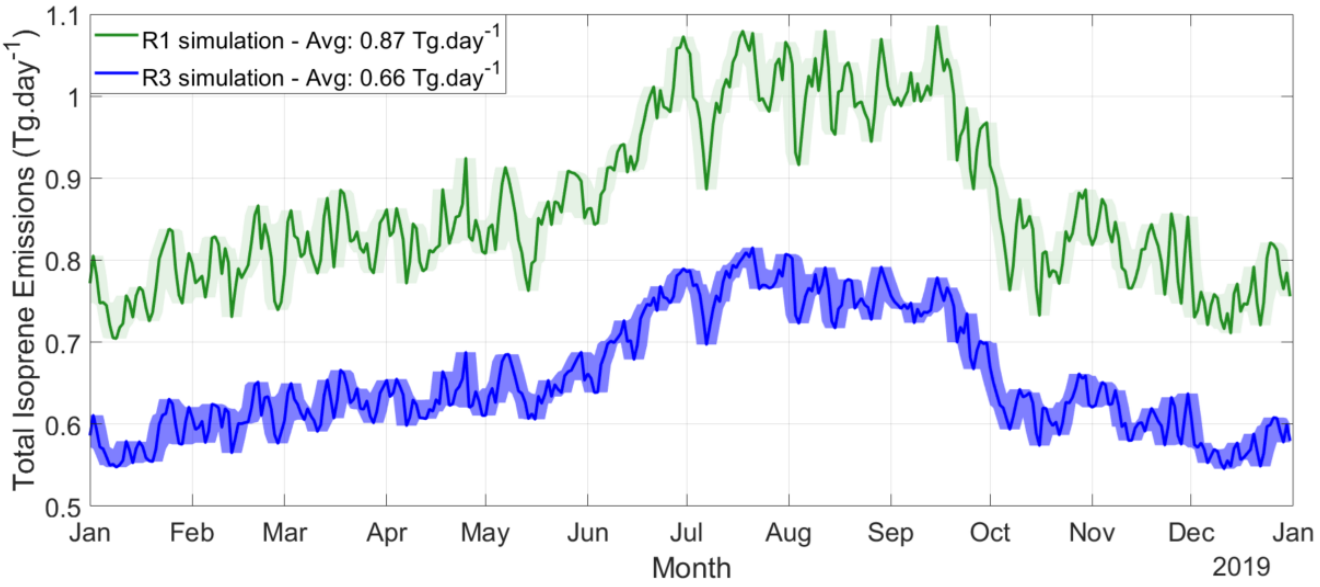


Figure S5. Time series of simulated normalized daily global isoprene emissions (in $\mathrm{Tg\,day^{-1}}$) over the year 2019, using gridded emission potential maps (R1 simulation) or PFT-dependent emission potentials (R3 simulation).

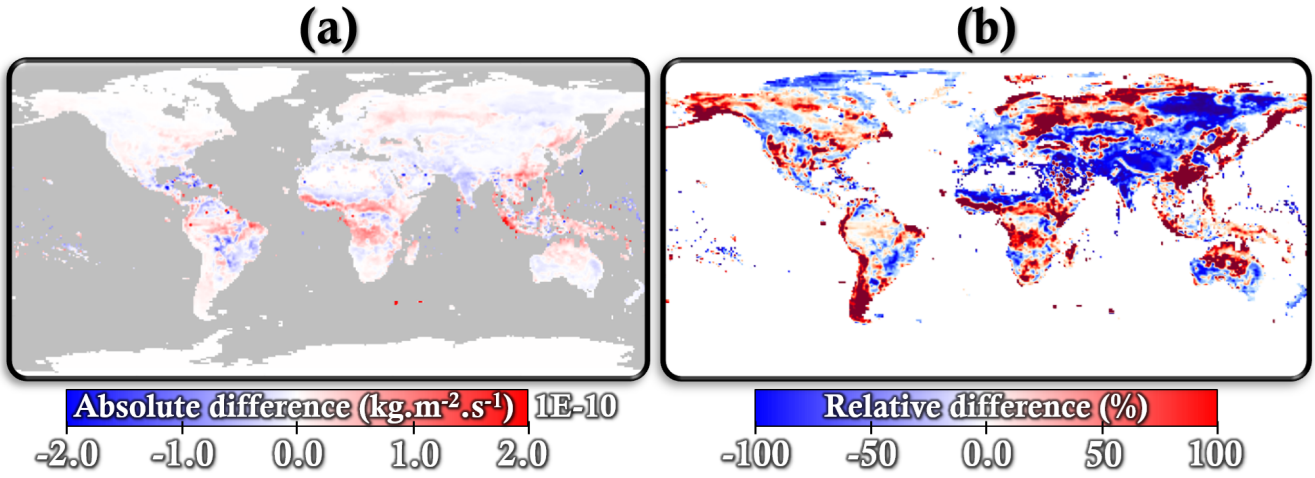


Figure S6. (a) Absolute and (b) relative differences between simulations R4 and R3 modeled using the ERA5 forcing.

Table S4. Regional isoprene emission totals and spatial statistics comparing R4 annual simulations for 2019 using the ERA5 and IFS meteorological forcings.

Region	R4/ERA5 ($\mathrm{Tg\,yr^{-1}}$)	R4/IFS ($\mathrm{Tg\,yr^{-1}}$)	NMB (%)	Pearson r
Global	261.50	290.30	+11.00	0.67
Northern Hemisphere	131.50	128.70	-2.10	0.99
Southern Hemisphere	130.00	161.6	+24.30	0.75
North America	24.30	24.40	+0.40	0.99
South America	79.40	69.10	-13.00	0.99
Europe	6.70	6.10	-9.60	0.99
North Africa	4.80	4.40	-8.70	0.99
East Africa	50.30	45.00	-10.40	0.99
South Africa	6.70	6.20	-7.80	0.99
Russia	9.90	9.70	-1.60	0.99
Southeast Asia	60.40	69.40	+14.80	0.97
Australia	12.40	15.10	+21.40	0.99