

Supplementary Materials for

New Inventories of Global Carbon Dioxide Emissions through Biomass Burning
in 2001–2020

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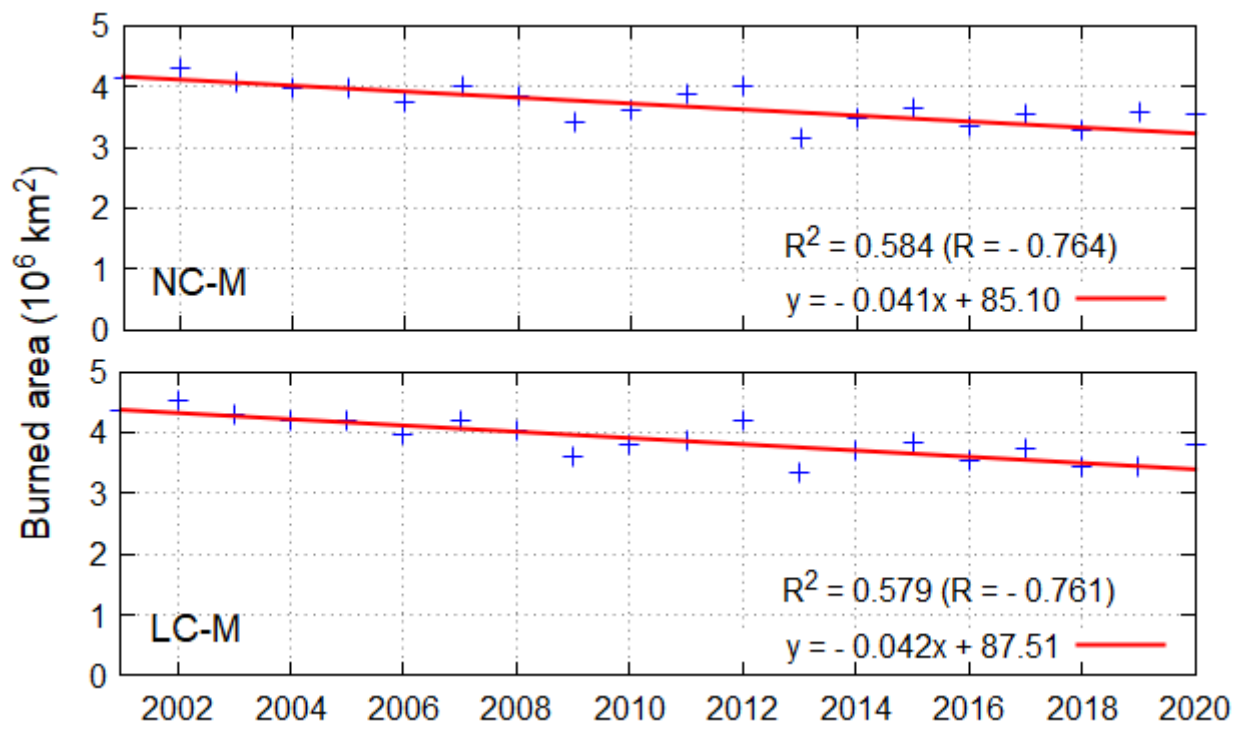


Figure S1. Global burned area trend for two fire distribution maps (NC-M and LC-M). R^2 is the coefficient of determination. R is the correlation coefficient.

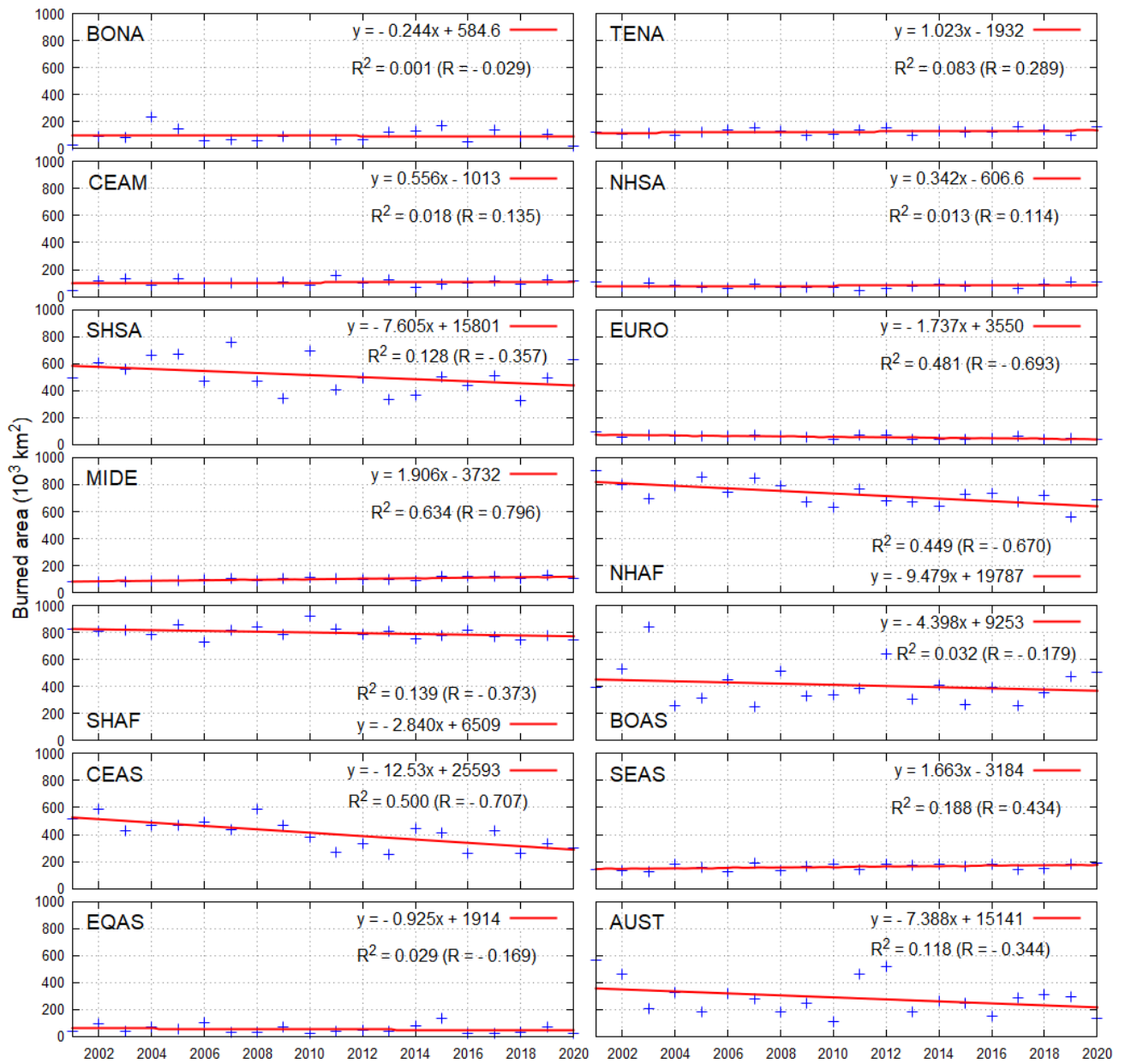


Figure S2. Regional burned area trend for LC-M. R^2 is the coefficient of determination. R is the correlation coefficient.

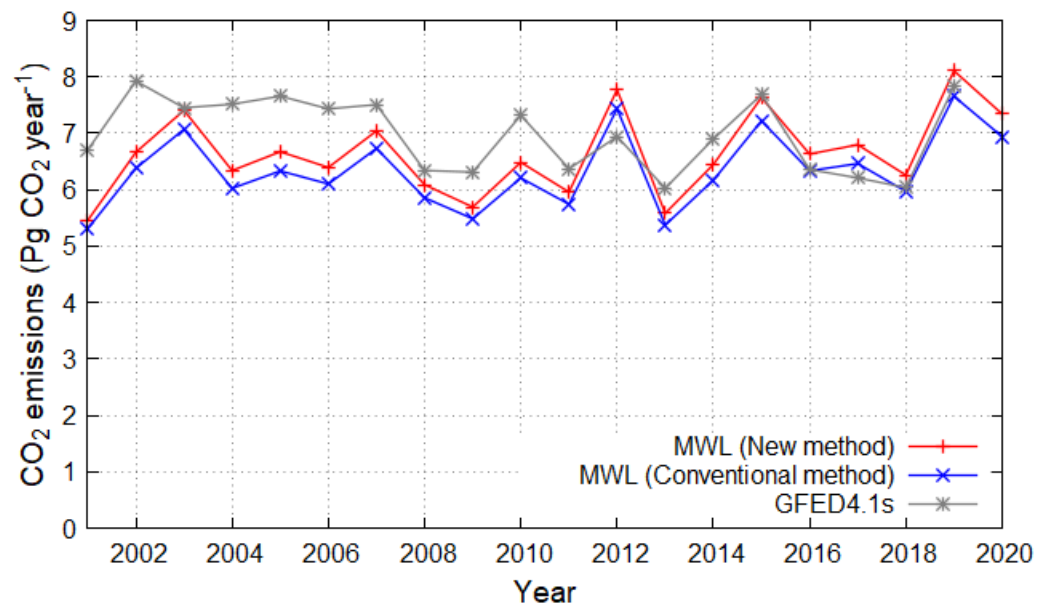


Figure S3. Comparison of the annual estimated CO₂ emissions for MWL inventory using new and conventional methods based on GFED4.1s. The inputs of MWL are MCD12Q1 for LCC, GEOCARBON for AGB, and LC-M for FD.

Table S1. Abbreviation list.

Abbreviation	Description
CO ₂	Carbon dioxide
CO	Carbon monoxide
CH ₄	Methane
GFED	The Global Fire Emissions Database
CASA	Carnegie Ames Stanford Approach
GFAS	The Global Fire Assimilation System
FRP	Fire radiative power
FINN	The Fire Inventory from the National Center for Atmospheric Research
GICC	Global Inventory for Chemistry-Climate studies
G-G	The GICC-GFED4 Inventory
MODIS	Moderate Resolution Imaging Spectroradiometer
GLC2000	The Global Land Cover 2000 Project
EM	CO ₂ emission from fires (g CO ₂)
BA	Burned area (m ²)
BD	Biomass density (kg m ⁻²)
Agb	Biomass density (kg m ⁻²) from above-ground biomass map
BE	Burning efficiency (0 to 1)
EF	Emission factor of dry matter (g CO ₂ kg ⁻¹)
ESA	The European Space Agency
FD	Fire distribution
LCC	Land cover classification
AGB	Above-ground biomass
HC-M	Fire distribution map with 80% to 100% confidence level
NC-M	Fire distribution map with 30% to 100% confidence level
LC-M	Fire distribution map with 0% to 100% confidence level
MWN	Inventory was created from MCD12Q1, GEOCARBON, and NC-M
MWL	Inventory was created from MCD12Q1, GEOCARBON, and LC-M
MEN	Inventory was created from MCD12Q1, Globbiomass, and NC-M
MEL	Inventory was created from MCD12Q1, Globbiomass, and LC-M
GWN	Inventory was created from GLC2000, GEOCARBON, and NC-M
GWL	Inventory was created from GLC2000, GEOCARBON, and LC-M
GEN	Inventory was created from GLC2000, Globbiomass, and NC-M
GEL	Inventory was created from GLC2000, Globbiomass, and LC-M

BONA	Boreal North America
TENA	Temperate North America
CEAM	Central America
NHSA	Northern Hemisphere South America
SHSA	Southern Hemisphere South America
EURO	Europe
MIDE	Middle East
NHAF	Northern Hemisphere Africa
SHAF	Southern Hemisphere Africa
BOAS	Boreal Asia
CEAS	Central Asia
SEAS	Southeast Asia
EQAS	Equatorial Asia
AUST	Australia and New Zealand

Table S2. Burning efficiency (BE) and emission factors (EF) for forest (F) and non-forest (NF) in GLC2000 and MCD12Q1 from Mievilte et al. (2010) [25] and Shi et al. (2015) [26]. The characters in parentheses following the NF category represent shrub (S), cropland (C), and others (O) classification categories for the evaluation.

Land cover categories				BE	EF (g CO ₂ kg ⁻¹)
GLC2000		MCD12Q1			
F/NF	Type	F/NF	Type		
F	Tree Cover, broadleaved, evergreen	F	Evergreen Broadleaf Forests	0.25	1580
F	Tree Cover, broadleaved, deciduous, closed	F	Deciduous Broadleaf Forests	0.25	1569
F	Tree Cover, broadleaved, deciduous, open		-	0.4	1613
F	Tree Cover, needle-leaved, evergreen	F	Evergreen Needleleaf Forests	0.25	1569
F	Tree Cover, needle-leaved, deciduous	F	Deciduous Needleleaf Forests	0.25	1569
F	Tree Cover, mixed leaf type	F	Mixed Forests	0.25	1569
NF(O)	Tree Cover, regularly flooded, fresh water	NF(O)	Permanent Wetlands	0	0
NF(O)	Tree Cover, regularly flooded, saline water		-	0	0
F	Mosaic: Tree Cover, Other natural vegetation	F	Savannas, Woody Savannas	0.35	1591
NF(O)	Tree Cover, burned		-	0	0
NF(S)	Shrub Cover, closed-open, evergreen	NF(S)	Open, Close Shrublands	0.9	1613
NF(S)	Shrub Cover, closed-open, deciduous		-	0.4	1613
NF(S)	Herbaceous Cover, closed-open		-	0.9	1613
NF(S)	Sparse herbaceous or sparse shrub cover		-	0.6	1567
NF(O)	Regularly flooded shrub and/or herbaceous cover		-	0	0
NF(C)	Cultivated and managed areas		-	0.6	1515
NF(C)	Mosaic: Cropland, Tree Cover, Other natural vegetation	NF(C)	Cropland, Natural Vegetation Mosaics	0.8	1594
NF(C)	Mosaic: Cropland, Shrub and/or grass cover	NF(C)	Grasslands	0.75	1580
NF(O)	Bare Areas	NF(O)	Barren	0	0
NF(O)	Water Bodies	NF(O)	Water Bodies	0	0
NF(O)	Snow and Ice	NF(O)	Permanent Snow and Ice	0	0
NF(O)	Artificial surfaces and associated areas	NF(O)	Urban and Built-up Lands	0	0
NF(O)	No data		-	0	0

Table S3. Emission factors (EF) for CO based on MCD12Q1 from van der Werf et al. (2017) [6].

[illegible]

[illegible]

Table S5. Averages of annual CO emissions for the CO inventories of the United States Environmental Protection Agency and our eight results in temperate North America from 2001 to 2020.

Inventory	Average (Tg CO year⁻¹)	1 standard deviation (Tg CO year⁻¹)
EPA	12.9	3.86
MWN	15.8	4.73
MWL	16.5	4.90
MEN	24.8	4.97
MEL	25.9	5.15
GWN	10.0	3.31
GWL	10.5	3.45
GEN	17.9	3.67
GEL	18.7	3.83
Average of our eight inventories	17.5	4.19

Table S6. Comparison of the average biomass density for the collected categories in each combination of LCC and AGB maps. The collected categories, which are “Forest” and “Non-forest” (Shrub, Cropland), are classified in Table S2.

Category		Average biomass density (kg m ⁻²)			
		MCD12Q1		GLC2000	
		GEOCARBON	Globbiomass	GEOCARBON	Globbiomass
Forest		7.22	10.5	7.51	9.07
Non-forest	Shrub	0.32	0.23	0.09	0.52
	Cropland	0.69	0.86	0.17	2.36