



Supplement of

A global simulation of brown carbon: implications for photochemistry and direct radiative effect

D. S. Jo et al.

Correspondence to: R. J. Park (rjpark@snu.ac.kr)

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Table S1. Global biofuel consumption estimates, EFs of OC, and OC biofuel emission estimates for each biofuel category.

	Fuelwood	Crop Residues	Dung	Charcoal	Industrial	Total
Biofuel consumption ¹⁾ [Tg]	1351	495	75	39	498	2457
Known EF ²⁾ [g/kg]	1.7-7.8	3.3	1.8	1.3	0.31-3.2	2.6
OC emission (known) [Gg]		1633.5	135	50.7		6281 ³⁾
Estimated EF [g/kg]	2.97				0.91	
OC emission (estimated) [Gg]	4010.3				453.6	
Fraction of OC emission	0.638	0.260	0.021	0.008	0.072	1.000
BrC/OC within category	0.653	0.946	0.000	0.000	0.000	
BrC/Biofuel	0.417	0.246	0.000	0.000	0.000	0.663

1) From Fernandes et al. (2007)

2) From Bond et al. (2004)

3) From GEOS-Chem biofuel OC inventory (carbon_200909) by Bond et al. (2007)

Table S2. BC emission ratios between 2007 and 2000 for each region and month. Regions used in this table are defined by the ACCMIP inventory.

Region	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Canada	0.60	1.04	0.86	0.79	0.59	0.43	0.24	0.12	0.24	0.41	0.64	0.83	1.01
USA	0.56	0.97	0.80	0.74	0.55	0.40	0.22	0.11	0.23	0.39	0.60	0.78	0.94
Mexico	0.95	1.63	1.35	1.25	0.94	0.69	0.39	0.22	0.40	0.66	1.02	1.30	1.58
Rest_Central_America	1.02	1.61	1.35	1.28	1.01	0.79	0.52	0.36	0.52	0.76	1.08	1.33	1.58
Brazil	1.01	0.39	0.51	0.79	1.04	1.36	1.50	1.57	1.41	1.22	1.04	0.78	0.57
Venezuela	1.02	1.38	1.19	1.19	1.01	0.90	0.71	0.59	0.69	0.85	1.07	1.23	1.39
Argentina	1.01	0.21	0.38	0.72	1.05	1.44	1.64	1.75	1.54	1.29	1.03	0.70	0.41
Rest_South_America	1.01	0.61	0.66	0.88	1.03	1.26	1.32	1.35	1.25	1.14	1.04	0.88	0.75
Nothren_Africa	1.09	1.89	1.56	1.45	1.08	0.78	0.43	0.22	0.44	0.75	1.17	1.51	1.84
Western_Africa	1.39	1.64	1.46	1.53	1.39	1.34	1.16	1.04	1.12	1.25	1.46	1.57	1.70
Eastern_Africa	1.16	1.27	1.15	1.24	1.16	1.16	1.04	0.96	1.00	1.08	1.21	1.27	1.33
Rest_Southern_Africa	1.21	0.61	0.71	1.00	1.23	1.55	1.67	1.73	1.58	1.40	1.24	0.99	0.79
South_Africa	2.04	0.41	0.77	1.45	2.10	2.90	3.30	3.52	3.10	2.60	2.07	1.40	0.83
France	0.87	1.50	1.24	1.15	0.85	0.62	0.34	0.18	0.35	0.60	0.93	1.20	1.46
Germany	0.87	1.51	1.24	1.15	0.86	0.62	0.34	0.18	0.35	0.60	0.93	1.20	1.46
Italy	0.86	1.48	1.22	1.13	0.84	0.61	0.34	0.17	0.35	0.59	0.91	1.18	1.44
United_Kingdom	0.85	1.48	1.22	1.13	0.84	0.61	0.34	0.17	0.35	0.59	0.91	1.18	1.43
Rest_Western_Europe	0.89	1.54	1.27	1.18	0.88	0.63	0.35	0.18	0.36	0.61	0.95	1.23	1.49
Rest_Central_Europe	0.97	1.67	1.38	1.28	0.95	0.69	0.38	0.20	0.39	0.67	1.03	1.33	1.62

Baltic_States	0.72	1.24	1.02	0.95	0.71	0.51	0.28	0.15	0.29	0.49	0.77	0.99	1.21
Turkey	0.85	1.47	1.21	1.12	0.84	0.60	0.33	0.17	0.35	0.59	0.91	1.17	1.43
Ukraine	0.60	1.04	0.86	0.80	0.59	0.43	0.24	0.12	0.25	0.42	0.64	0.83	1.01
Asia-Stan	0.64	1.11	0.92	0.85	0.63	0.46	0.25	0.13	0.26	0.44	0.69	0.89	1.08
Russia	0.69	1.20	0.99	0.92	0.68	0.49	0.27	0.14	0.28	0.48	0.74	0.96	1.16
Middle_East	3.41	5.87	4.85	4.50	3.36	2.44	1.36	0.72	1.41	2.36	3.64	4.69	5.70
zIndia	1.10	1.85	1.53	1.43	1.09	0.81	0.48	0.28	0.49	0.78	1.17	1.49	1.80
Rest_South_Asia	1.11	1.87	1.55	1.45	1.09	0.81	0.48	0.28	0.49	0.78	1.18	1.51	1.82
South_Korea	0.97	1.67	1.38	1.28	0.95	0.69	0.38	0.20	0.39	0.67	1.03	1.33	1.62
North_Korea	1.06	1.84	1.52	1.41	1.05	0.76	0.42	0.22	0.43	0.73	1.14	1.47	1.79
China	1.12	1.94	1.60	1.48	1.10	0.80	0.44	0.23	0.46	0.77	1.20	1.55	1.88
Taiwan	1.22	2.10	1.74	1.61	1.20	0.87	0.48	0.25	0.49	0.84	1.30	1.68	2.04
Thailand	1.07	1.64	1.38	1.33	1.06	0.86	0.59	0.42	0.59	0.82	1.13	1.38	1.62
Rest_Southeastern_Asia	1.03	1.60	1.35	1.29	1.02	0.82	0.56	0.40	0.56	0.79	1.10	1.34	1.58
Indonesia	0.97	0.75	0.75	0.91	0.98	1.12	1.12	1.12	1.07	1.02	1.00	0.91	0.85
Japan	0.54	0.93	0.76	0.71	0.53	0.38	0.21	0.11	0.22	0.37	0.57	0.74	0.90
Australia	0.71	0.15	0.27	0.51	0.74	1.01	1.15	1.23	1.09	0.91	0.73	0.49	0.29
New_Zealand	0.67	0.14	0.26	0.48	0.70	0.96	1.09	1.16	1.03	0.86	0.68	0.46	0.27
Rest_Oceania	1.06	0.40	0.53	0.83	1.09	1.43	1.58	1.66	1.49	1.29	1.09	0.81	0.58

Table S3. Same as Table S2 but for OC emission ratios.

Region	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Canada	0.86	1.48	1.22	1.13	0.84	0.61	0.34	0.17	0.35	0.59	0.91	1.18	1.44
USA	0.82	1.41	1.16	1.08	0.80	0.58	0.32	0.17	0.33	0.56	0.87	1.12	1.37
Mexico	1.14	1.94	1.61	1.49	1.12	0.82	0.47	0.26	0.48	0.79	1.21	1.56	1.89
Rest_Central_America	1.05	1.63	1.37	1.31	1.04	0.84	0.57	0.40	0.57	0.80	1.11	1.36	1.60
Brazil	1.12	0.43	0.56	0.87	1.15	1.50	1.66	1.74	1.56	1.35	1.14	0.86	0.62
Venezuela	1.63	2.21	1.91	1.91	1.63	1.45	1.14	0.95	1.11	1.36	1.72	1.97	2.22
Argentina	1.20	0.24	0.46	0.86	1.24	1.71	1.95	2.08	1.83	1.54	1.22	0.83	0.49
Rest_South_America	1.06	0.64	0.69	0.92	1.08	1.31	1.37	1.40	1.30	1.19	1.09	0.92	0.78
Nothren_Africa	1.09	1.89	1.56	1.45	1.08	0.78	0.43	0.22	0.45	0.75	1.17	1.51	1.84
Western_Africa	1.28	1.51	1.34	1.41	1.29	1.25	1.08	0.97	1.04	1.16	1.35	1.45	1.56
Eastern_Africa	1.10	1.23	1.11	1.19	1.11	1.10	0.98	0.91	0.95	1.02	1.15	1.21	1.28
Rest_Southern_Africa	1.15	0.58	0.68	0.96	1.18	1.47	1.58	1.64	1.50	1.33	1.18	0.95	0.76
South_Africa	2.38	0.49	0.90	1.69	2.46	3.39	3.86	4.12	3.63	3.04	2.42	1.64	0.97
France	0.76	1.31	1.08	1.00	0.75	0.54	0.30	0.15	0.31	0.52	0.81	1.04	1.27
Germany	0.75	1.30	1.07	0.99	0.74	0.54	0.30	0.15	0.31	0.52	0.80	1.04	1.26
Italy	0.75	1.29	1.07	0.99	0.73	0.53	0.29	0.15	0.30	0.51	0.80	1.03	1.25
United_Kingdom	0.73	1.26	1.04	0.96	0.72	0.52	0.29	0.15	0.30	0.50	0.78	1.00	1.22
Rest_Western_Europe	0.80	1.39	1.15	1.06	0.79	0.57	0.32	0.16	0.33	0.55	0.86	1.11	1.35
Rest_Central_Europe	0.83	1.43	1.18	1.10	0.82	0.59	0.33	0.17	0.34	0.57	0.89	1.14	1.39
Baltic_States	0.81	1.39	1.15	1.07	0.79	0.57	0.32	0.16	0.33	0.56	0.86	1.11	1.35

Turkey	0.79	1.37	1.13	1.05	0.78	0.56	0.31	0.16	0.32	0.55	0.85	1.09	1.33
Ukraine	0.75	1.30	1.07	0.99	0.74	0.53	0.29	0.15	0.30	0.52	0.80	1.03	1.26
Asia-Stan	0.76	1.32	1.09	1.01	0.75	0.54	0.30	0.16	0.31	0.52	0.81	1.05	1.28
Russia	0.80	1.38	1.14	1.06	0.79	0.57	0.31	0.16	0.32	0.55	0.85	1.10	1.34
Middle_East	3.39	5.85	4.83	4.48	3.34	2.43	1.36	0.72	1.40	2.35	3.63	4.67	5.68
India	1.11	1.86	1.54	1.44	1.09	0.82	0.48	0.28	0.49	0.79	1.18	1.50	1.81
Rest_South_Asia	1.11	1.87	1.55	1.44	1.09	0.81	0.47	0.27	0.48	0.78	1.18	1.51	1.82
South_Korea	1.24	2.14	1.77	1.64	1.22	0.88	0.49	0.25	0.50	0.85	1.32	1.71	2.08
North_Korea	0.99	1.71	1.41	1.31	0.97	0.70	0.39	0.20	0.40	0.68	1.06	1.36	1.66
China	0.99	1.72	1.42	1.31	0.98	0.71	0.39	0.20	0.40	0.68	1.06	1.37	1.66
Taiwan	7.20	12.46	10.29	9.53	7.09	5.13	2.83	1.47	2.93	4.96	7.70	9.93	12.10
Thailand	1.21	1.86	1.57	1.50	1.20	0.97	0.66	0.48	0.66	0.92	1.28	1.56	1.83
Rest_Southeastern_Asia	1.02	1.58	1.33	1.27	1.01	0.81	0.55	0.39	0.55	0.77	1.08	1.32	1.56
Indonesia	1.00	0.77	0.77	0.94	1.01	1.15	1.16	1.15	1.10	1.05	1.03	0.94	0.88
Japan	0.53	0.92	0.76	0.70	0.52	0.38	0.21	0.11	0.22	0.37	0.57	0.73	0.89
Australia	0.79	0.17	0.30	0.57	0.82	1.12	1.28	1.36	1.20	1.01	0.80	0.55	0.33
New_Zealand	0.77	0.16	0.29	0.55	0.80	1.10	1.25	1.33	1.18	0.99	0.78	0.53	0.31
Rest_Oceania	1.36	0.53	0.69	1.07	1.40	1.82	2.01	2.10	1.89	1.64	1.39	1.05	0.76
