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MDPI

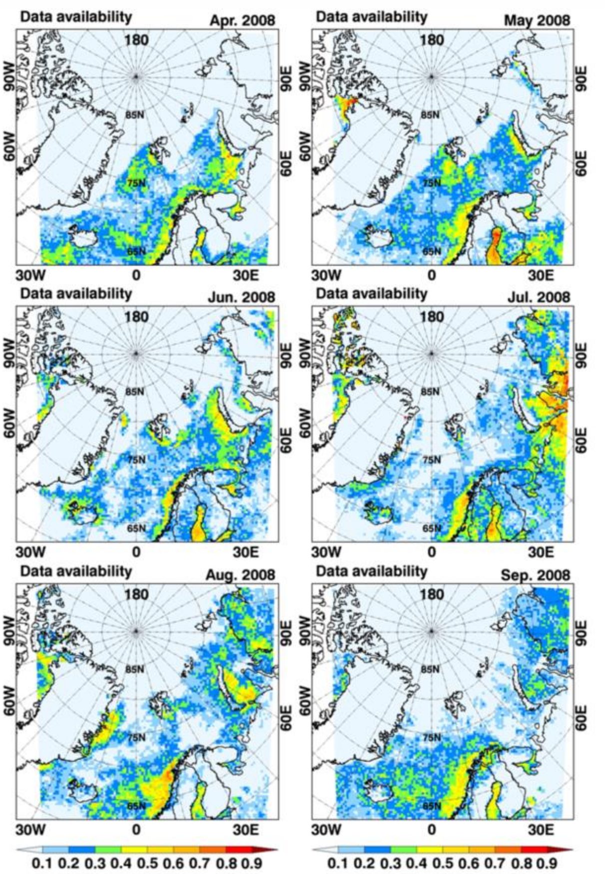


Figure S1. Spatiotemporal map of the monthly availability of the MODIS AOD product for the entire domain

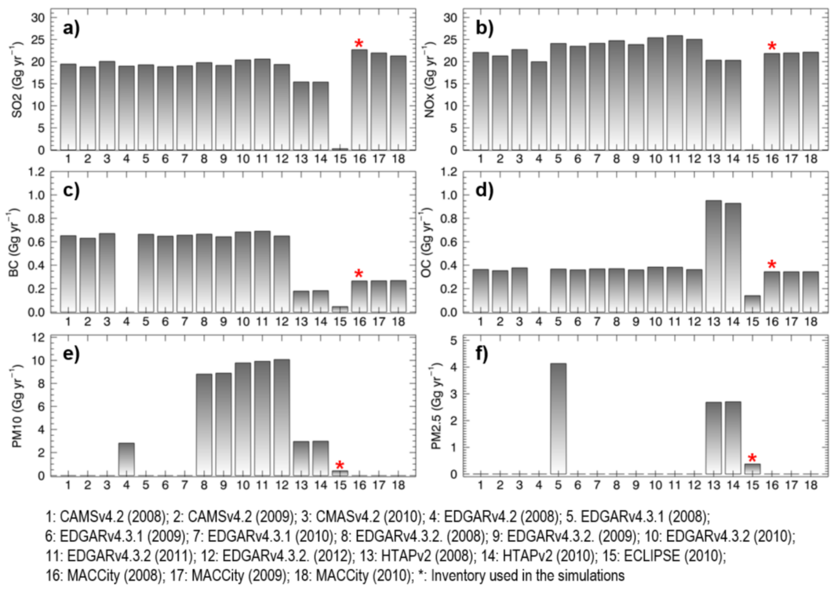


Figure S2. Annual emission fluxes of (**a**) SO_2, (**b**) NO_x, (**c**) BC, (**d**) OC, (**e**) PM_{10}, (**f**) $PM_{2.5}$ for the regions (70°N–90°N; 60°W–60°E) from the eighteen inventories

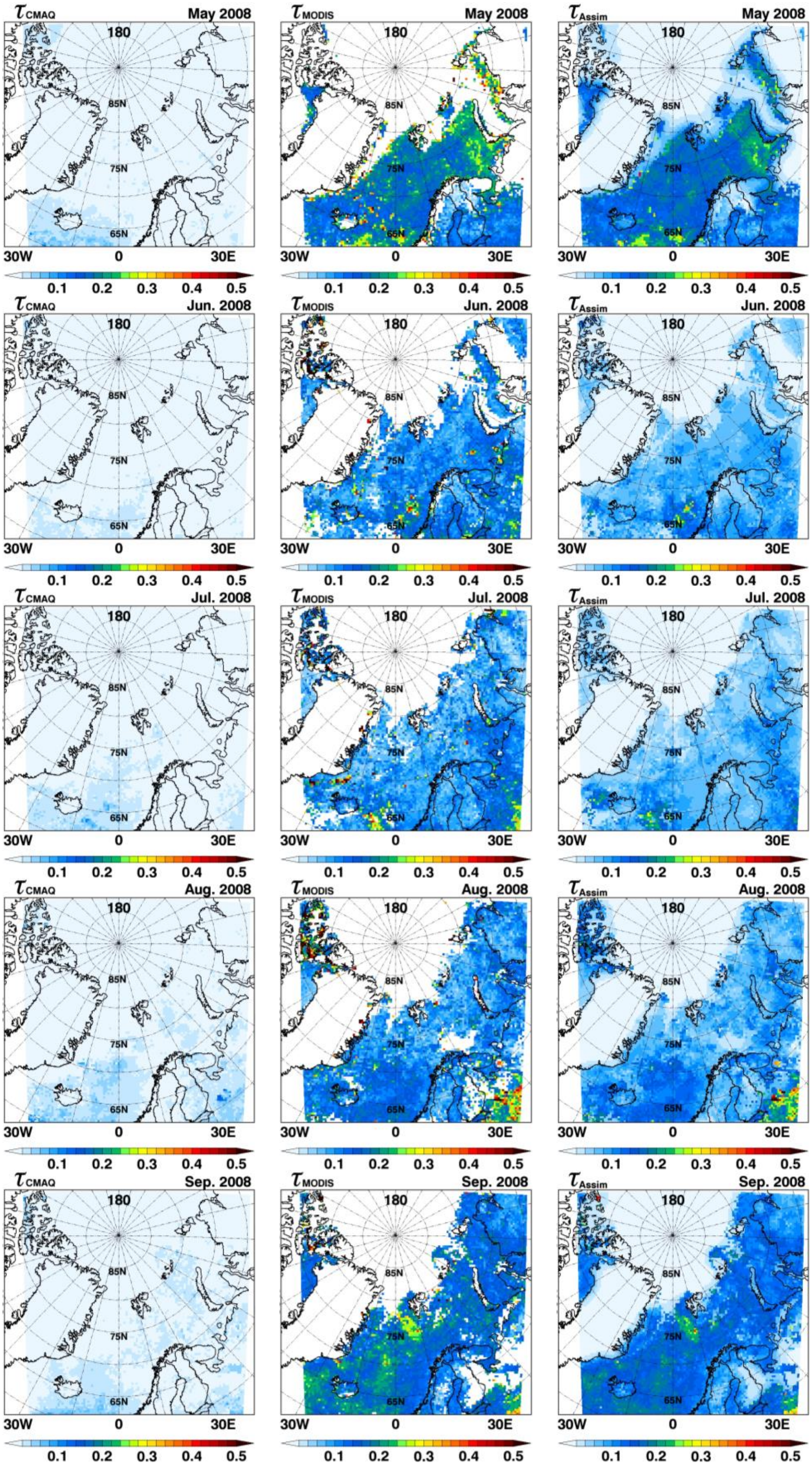
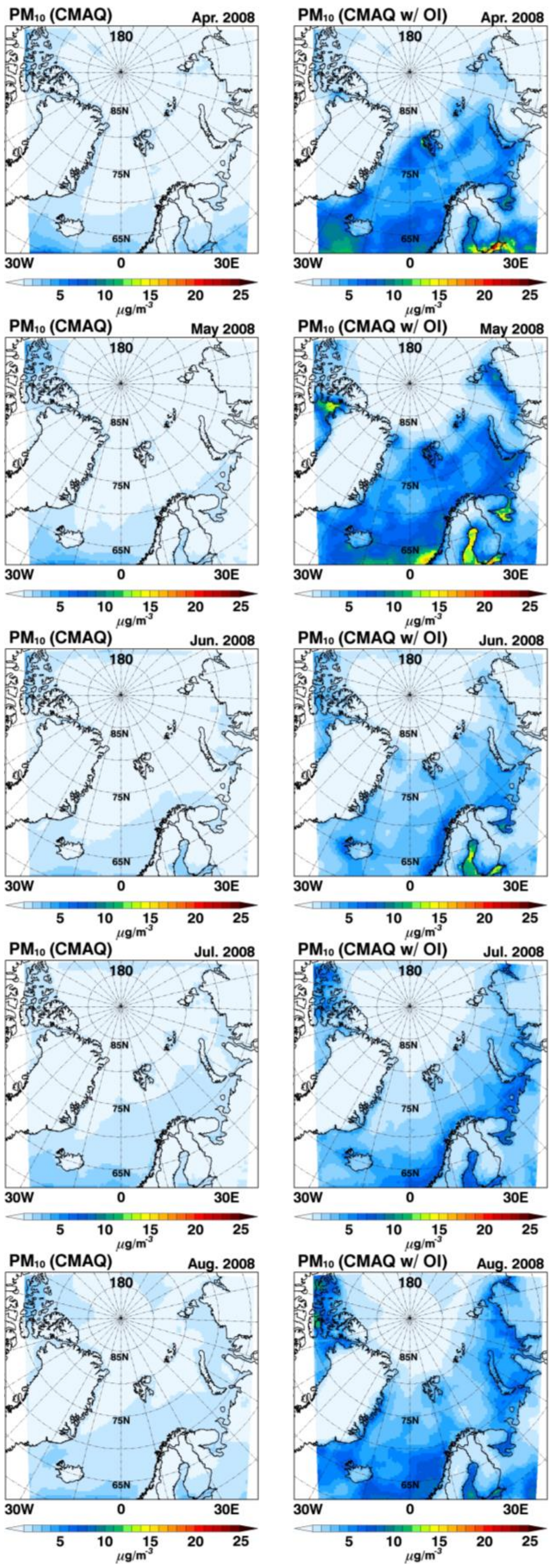
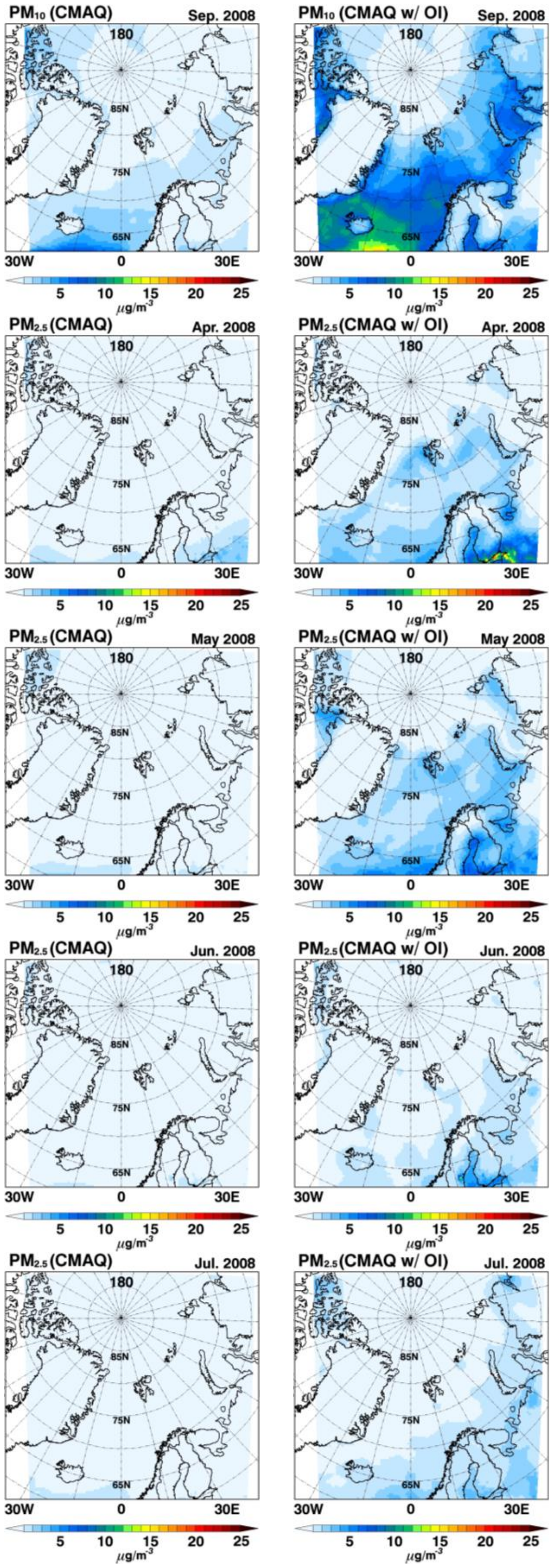


Figure S3. Spatial distributions of the CMAQ model-estimated (first column), MODIS-observed (second column), and assimilated (third column) AODs over the Arctic from April 2008 to September 2008.


PM10 (CMAQ)
Apr. 2008
PM10 (CMAQ w/ OI)
Apr. 2008
PM10 (CMAQ)
May 2008
PM10 (CMAQ w/ OI)
May 2008
PM10 (CMAQ)
Jun. 2008
PM10 (CMAQ w/ OI)
Jun. 2008
PM10 (CMAQ)
Jul. 2008
PM10 (CMAQ w/ OI)
Jul. 2008
PM10 (CMAQ)
Aug. 2008
PM10 (CMAQ w/ OI)
Aug. 2008
180
85N
75N
65N
30W
0
30E
5
10
15
20
25
μg/m-3


PM10 (CMAQ) Sep. 2008
PM10 (CMAQ w/ OI) Sep. 2008
PM2.5 (CMAQ) Apr. 2008
PM2.5 (CMAQ w/ OI) Apr. 2008
PM2.5 (CMAQ) May 2008
PM2.5 (CMAQ w/ OI) May 2008
PM2.5 (CMAQ) Jun. 2008
PM2.5 (CMAQ w/ OI) Jun. 2008
PM2.5 (CMAQ) Jul. 2008
PM2.5 (CMAQ w/ OI) Jul. 2008
180
85N
75N
65N
30W
0
30E
5 10 15 20 25
μg/m-3

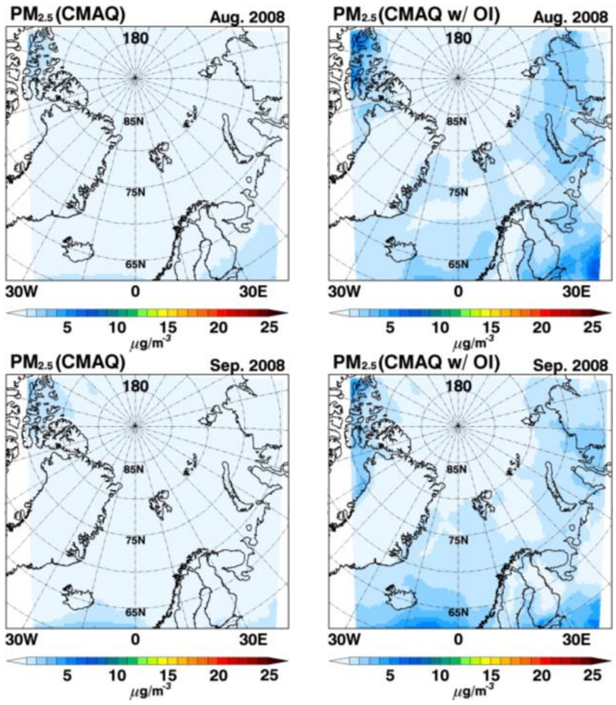


Figure S4. Spatial distributions of monthly averaged PM_{10} and $PM_{2.5}$ calculated from the CMAQ simulations and inferred from the linear relationship between PMs and assimilated AODs

Table S1. Monthly mean of PM_{10} and $PM_{2.5}$ from the CMAQ simulation and linear estimation and their relative differences over the entire domain. .

Month	Mean $PM_{10, CMAQ}$	Mean $PM_{10, CMAQ (w/ OI)}$	RD_{PM10} @	Mean $PM_{2.5, CMAQ}$	Mean $PM_{2.5, CMAQ (w/ OI)}$	$RD_{PM2.5}$ #
April	1.00 (±0.64)*	2.95 (±2.77)	168.52	0.54 (±0.39)	1.45 (±1.59)	194.59
May	0.92 (±0.58)	3.50 (±2.96)	258.12	0.47 (±0.27)	1.68 (±1.38)	281.51
June	0.84 (±0.44)	2.18 (±1.71)	154.25	0.34 (±0.18)	0.85 (±0.70)	159.55
July	0.99 (±0.52)	2.37 (±1.63)	140.80	0.44 (±0.19)	1.06 (±0.68)	140.76
August	1.10 (±0.55)	3.15 (±2.15)	173.71	0.51 (±0.27)	1.39 (±0.98)	185.26
September	1.08 (±0.84)	3.70 (±3.00)	182.75	0.46 (±0.36)	1.30 (±0.88)	241.38

* Mean (± standard deviation), unit (μg m^{-3}) .

@ Relative Differences of PM_{10} (RD_{PM10}) were calculated by following equation:.

$$RD_{PM10} = \frac{PM_{10, CMAQ(w/OI)} - PM_{10, CMAQ}}{PM_{10, CMAQ}} \times 100(\%) \tag{1}$$

Relative Differences of $PM_{2.5}$ ($RD_{PM2.5}$) were calculated by following equation:

$$RD_{PM10} = \frac{PM_{2.5, CMAQ(w/OI)} - PM_{2.5, CMAQ}}{PM_{2.5, CMAQ}} \times 100(\%) \tag{2}$$

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Table S2. The optimized free parameters obtained from the sensitivity test.

Month	f_m	f_o	ε_m	ε_o
April	3.0	0.1	0.0	0.04
May	4.0	0.1	0.0	0.05
June	4.0	0.6	0.0	0.05
July	2.0	0.3	0.0	0.04
August	4.0	0.4	0.0	0.05
September	5.0	0.4	0.0	0.01