Supplementary Material for

Modelling $PM_{2.5}$ during severe atmospheric pollution episode in Lagos, Nigeria: Spatiotemporal variations, source apportionment, and meteorological influences

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Table S1. The major physics options and the schemes used in the WRF model.

Physics option	Scheme
Microphysics	Thompson scheme
Shortwave radiation	RRTMG scheme
Longwave radiation	RRTMG scheme
Surface layer	Revised MM5 Monin-Obukhov scheme
Land surface	Unified Noah land-surface scheme
Planetary boundary layer	YSU scheme
Cumulus parameterization	Grell-Freitas ensemble scheme

Table S2. Concentration range under different $PM_{2.5}$ pollution levels.

Levels	Clean	Slightly polluted	Moderately polluted	Heavily polluted	Severely polluted
Concentration ($\mu g/m^3$)	$PM_{2.5}$<35	35≤ $PM_{2.5}$<75	75≤ $PM_{2.5}$<115	115≤ $PM_{2.5}$<150	150≤ $PM_{2.5}$

Table S3. Statistical results of $PM_{2.5}$ under different pollution levels in Lagos during January 2021.

	Clean (2 days)		Slight (12 days)		Moderate (10 days)		Heavy (5 days)		Severe (2 days)	
	Obs.	Sim.	Obs.	Sim.	Obs.	Sim.	Obs.	Sim.	Obs.	Sim.
Minimum	15.7	11.9	44.3	48.8	72.5	79.1	121.7	117.4	161.8	167.3
Maximum	23.7	17.3	76.7	72.4	109.5	107.0	148.2	143.9	214.6	198.6
Mean	19.7	14.6	60.4	62.7	88.7	92.5	134.7	135.9	188.2	182.9

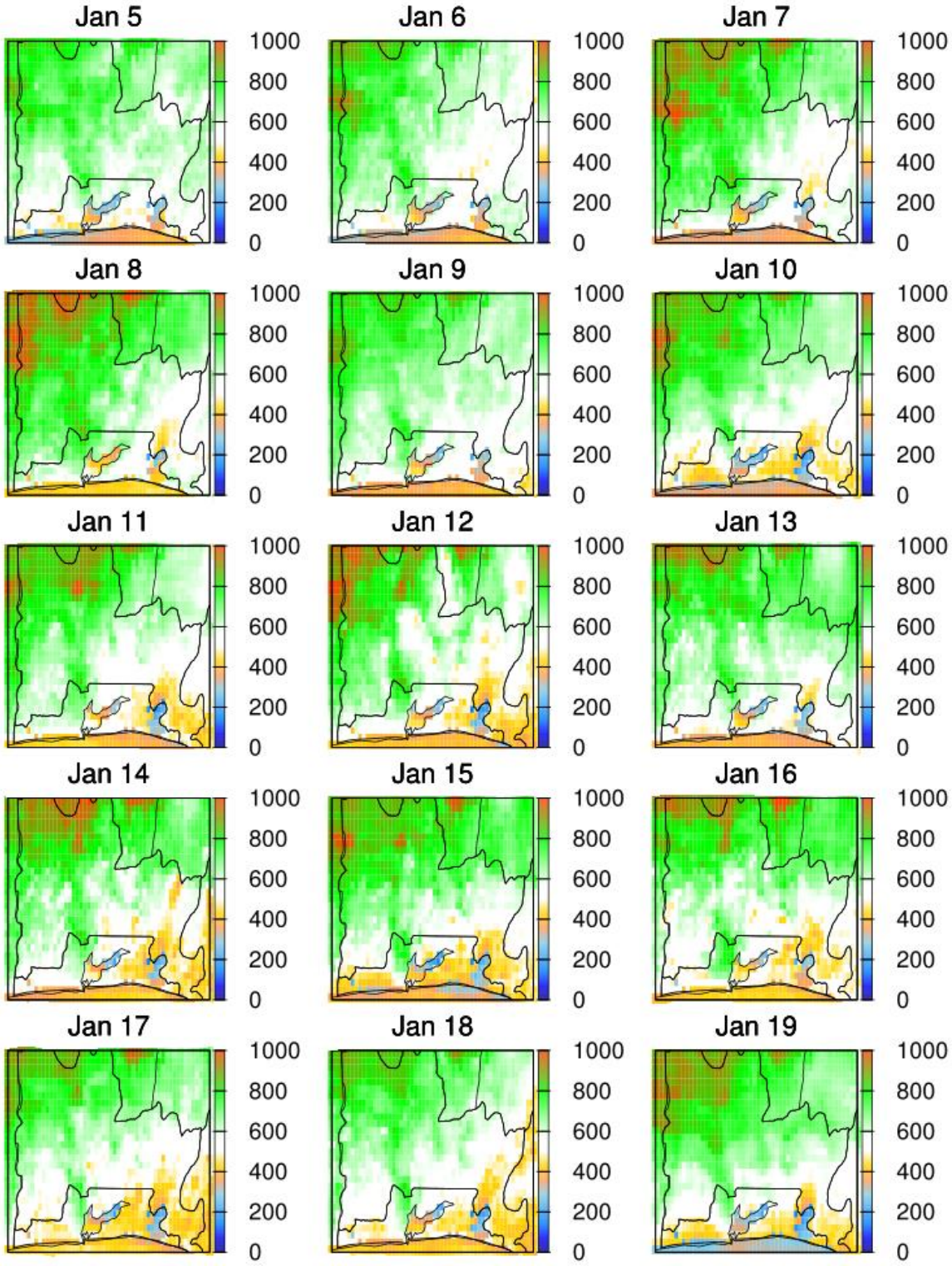

Figure S1. Spatial distributions of the predicted planetary boundary layer height (PBLH) in Lagos during the atmospheric pollution episode. Units are m.

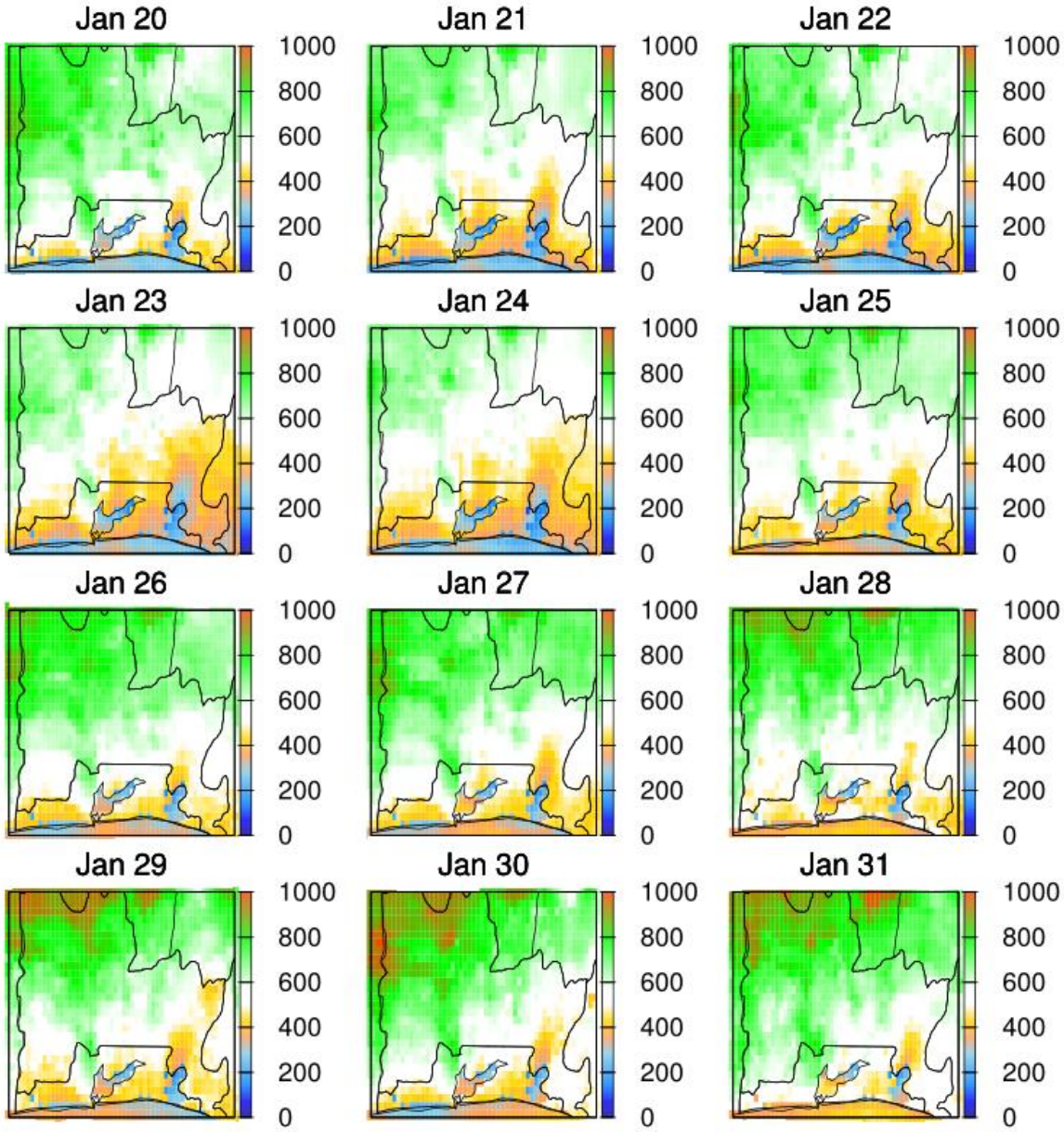

Figure S1. (continued).

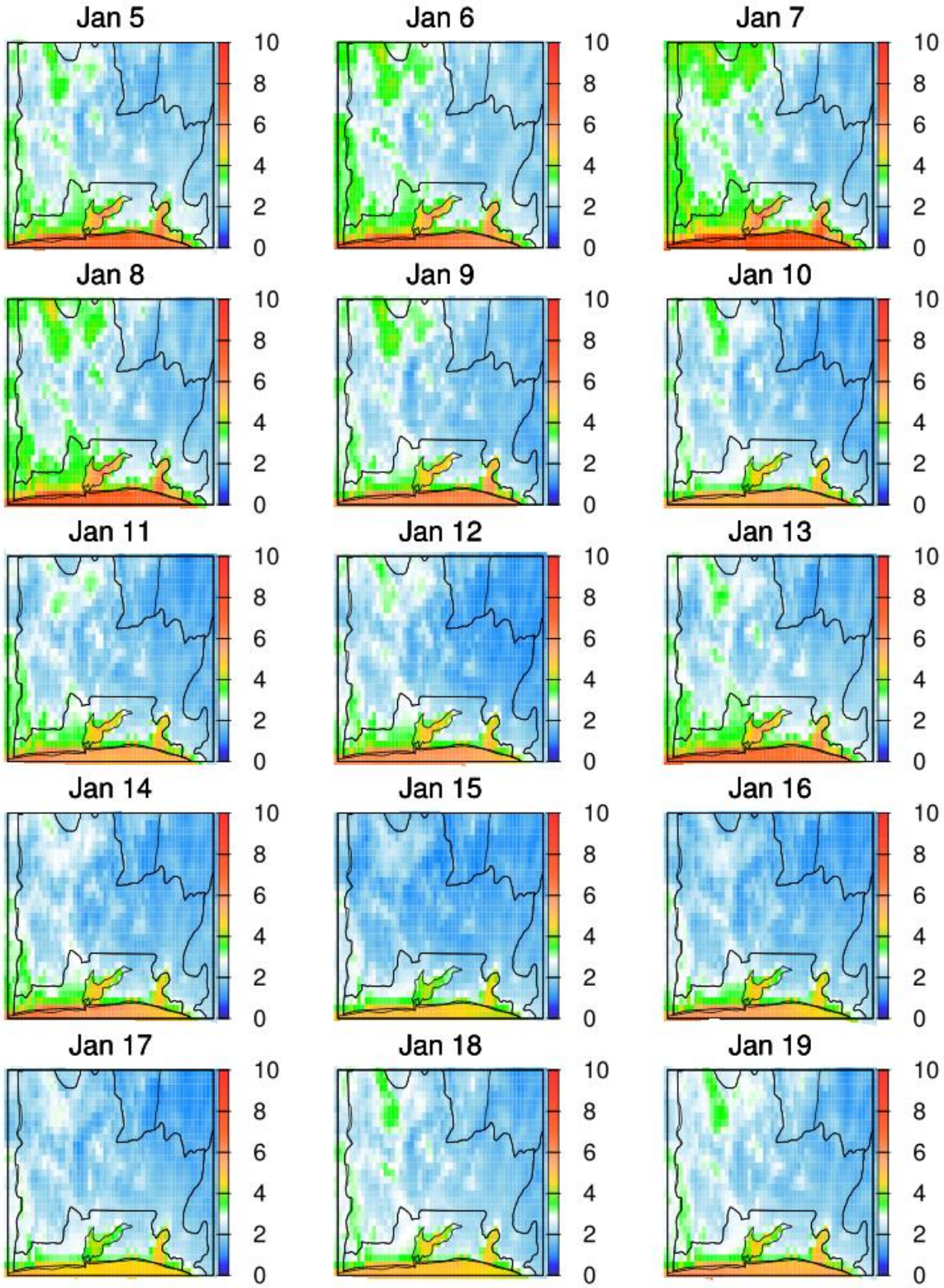

Figure S2. Spatial distributions of the predicted wind speed at 10 m (WS10) in Lagos during the atmospheric pollution episode. Units are m/s.

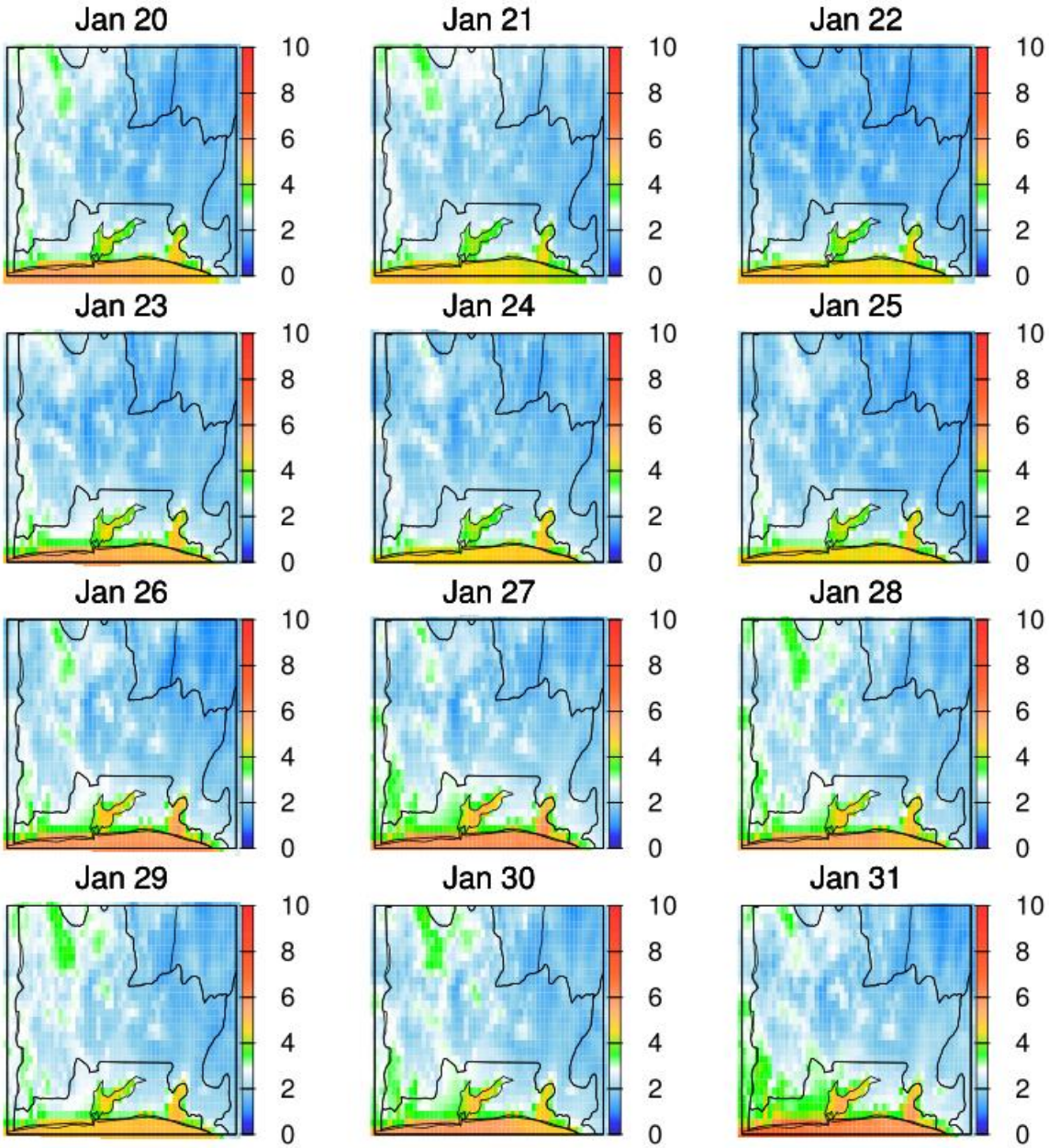

Figure S2. (continued).

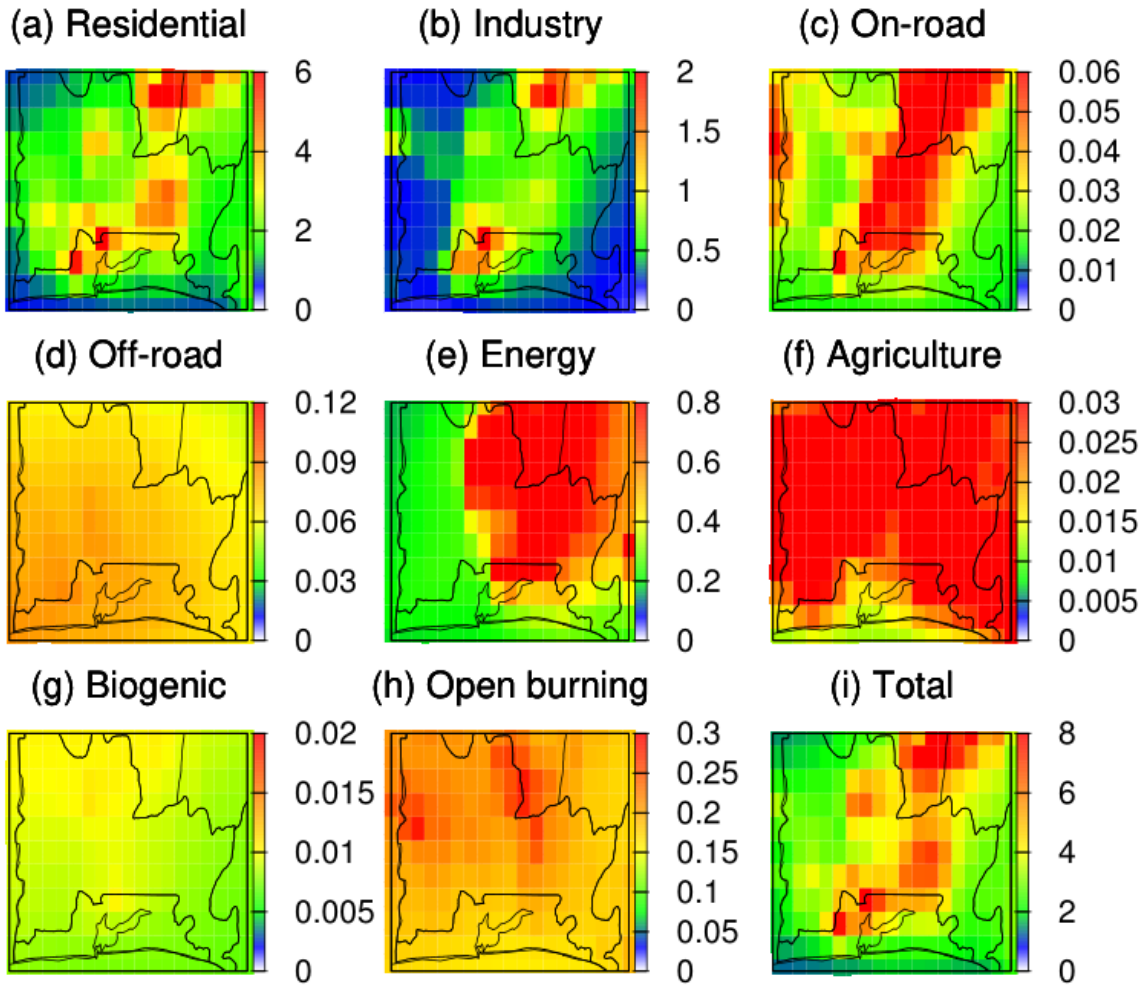

Figure S3. Source apportionment of SO_4^{2-} from (a) residential, (b) industry, (c) on-road, (d) off-road, (e) energy, (f) agriculture, (g) biogenic, and (h) open burning during the atmospheric pollution episode. Units are $\mu g/m^3$.

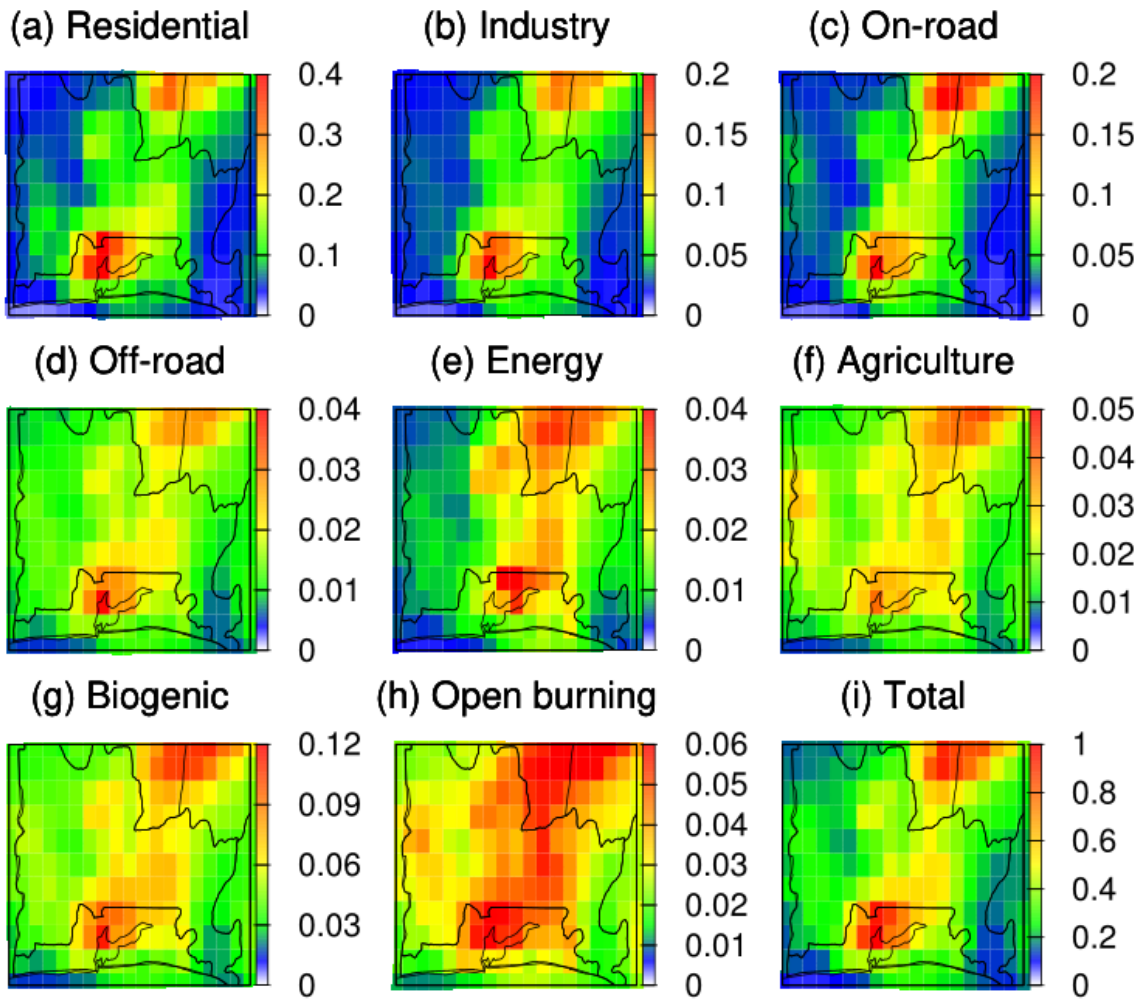

Figure S4. Source apportionment of NO_3^- from (a) residential, (b) industry, (c) on-road, (d) off-road, (e) energy, (f) agriculture, (g) biogenic, and (h) open burning during the atmospheric pollution episode. Units are $\mu g/m^3$.

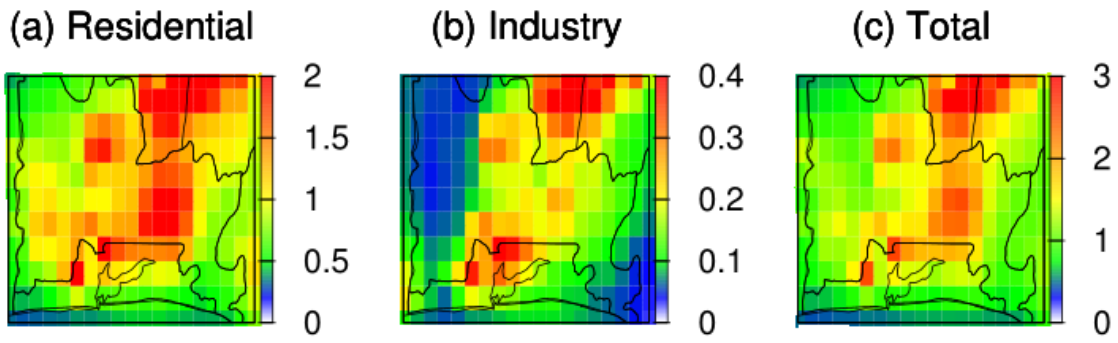

Figure S5. Source apportionment of NH_4^+ from (a) residential, (b) industry, (c) on-road, (d) off-road, (e) energy, (f) agriculture, (g) biogenic, and (h) open burning during the atmospheric pollution episode. Units are $\mu g/m^3$.

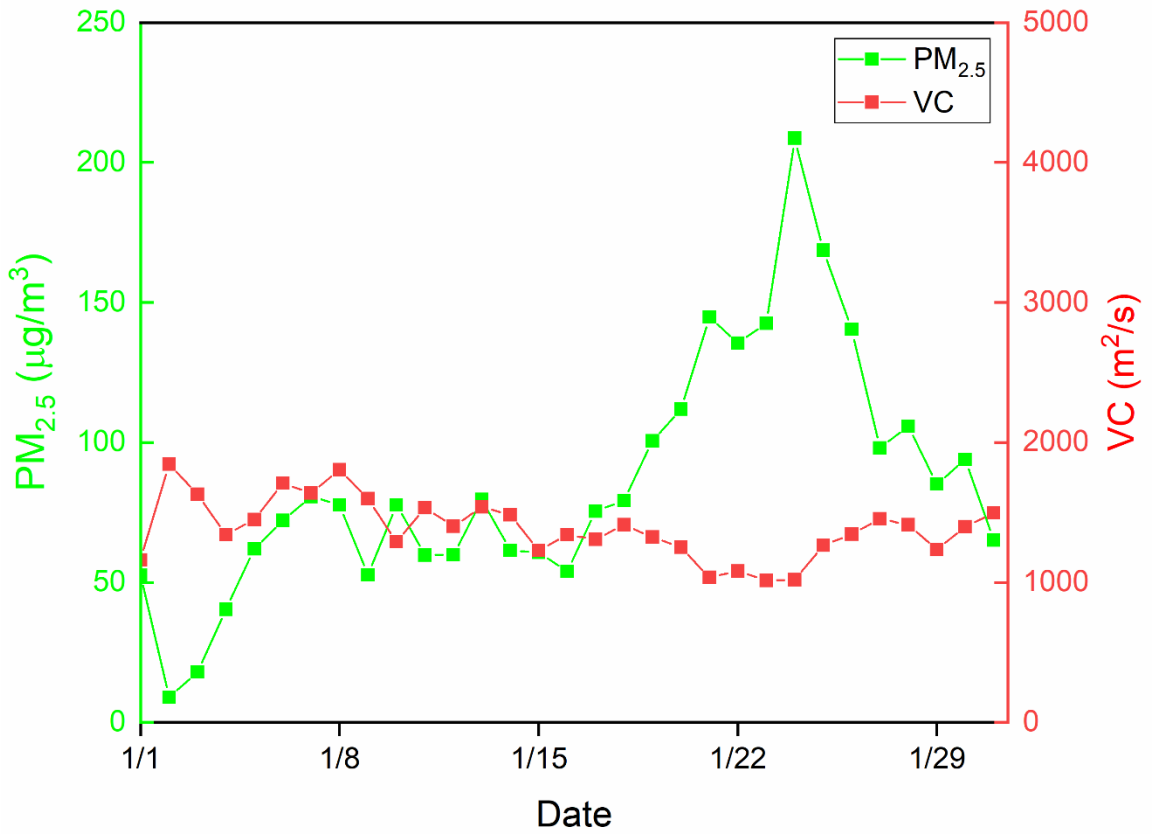

Figure S6. Temporal variations of $PM_{2.5}$ (μg/m^3) and VC (m^2/s) in Lagos during January 2021.