Supplementary Information

Analysis of Emission Files Generated by a Global Model for Air Quality Simulation in the State of Rio de Janeiro

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Meteorological validation

The validation of meteorological data was carried out according to ENVIRONN[1] and AMMM[2] for simulating meteorological variables (temperature, wind speed, and direction) over complex terrain. The statistical variables used by the authors were bias, error, and root mean square error (RMSE), which were compared to the proposed benchmarks presented in Table S1. The comparison with observed data was made by downloading data from meteorological stations of INMET (National Institute of Meteorology) located in the state of Rio de Janeiro for the simulation period (August 29 - October 1, 2018).[3]

$$\text{Bias} = \frac{1}{IJ}\sum_{J=1}^{J} \sum_{I=1}^{I}(M_J^I - O_J^I) \quad \text{(S1)}$$

$$\text{Error} = \frac{1}{IJ}\sum_{J=1}^{J} \sum_{I=1}^{I}\left|M_J^I - O_J^I\right| \quad \text{(S2)}$$

$$\text{RMSE} = \left[\frac{1}{IJ}\sum_{J=1}^{J} \sum_{I=1}^{I}(M_J^I - O_J^I)^2\right]^{1/2} \quad \text{(S3)}$$

where, M: modeled data; O: observed data; I: site; J: time.[1]

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Table S1. Monitoring stations percentage for meteorological data validation according to benchmarks

Meteorological variables	Benchmarks	Stations within the benchmarks / %
Temperature / K	Bias $\leq \pm 0.5$	69.56521739
	Error < 2.0	95.65217391
Wind speed / (m s^{-1})	Bias $\leq \pm$ 1.5	60.86956522
	RMSE $\leq$ 2.0	78.26086957
Wind direction / degree	Error $\leq$ 55	21.73913043

RMSE: root mean square error.

Hourly emissions profiles

The profile represents the percentage equally divided between emissions from light- and heavy-duty vehicles on high-traffic roads during weekday commuting hours, while on weekends the peaks shift more toward midday due to recreational outings. The residential profile, on the other hand, reflects weekdays with typical eight-hour workdays, showing peaks in the morning and in the late afternoon. The weekend residential profile represents the population remaining at home throughout the day.[4-6]

Hourly emission profile for sectors with distinct profiles for weekdays and weekends. Weekday emission profile for the transportation sector and the residential sector based on Dominutti *et al.*[5] and HTAP profiles according to Crippa *et al.*[4]

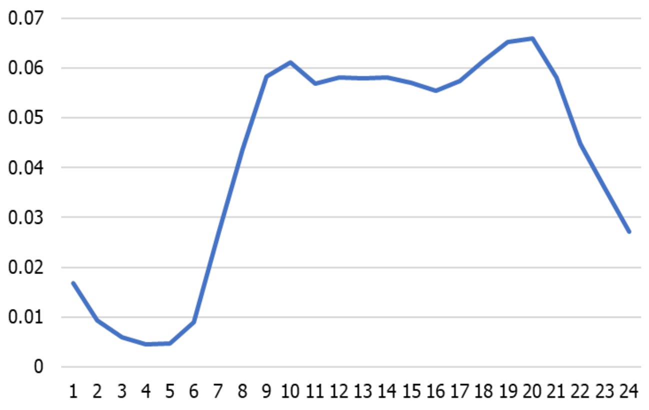

Figure S1. Weekday emission profile for the transportation sector based on the work of Dominutti *et al*.[5]

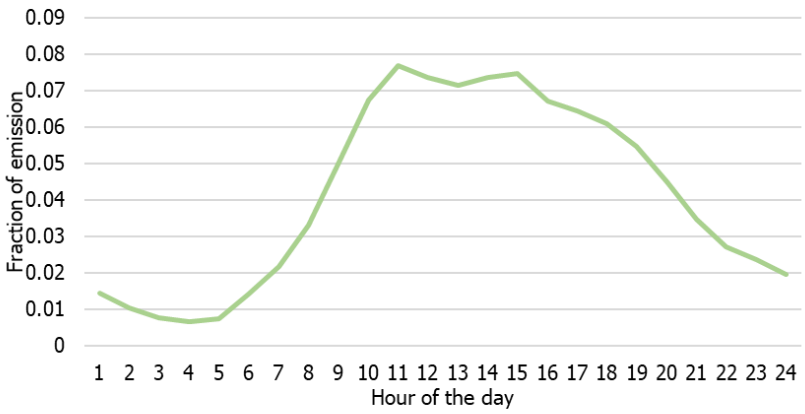

Figure S2. Weekend emission profile for the transportation sector based on the temporal profiles from the EDGAR database for road transport.[4]

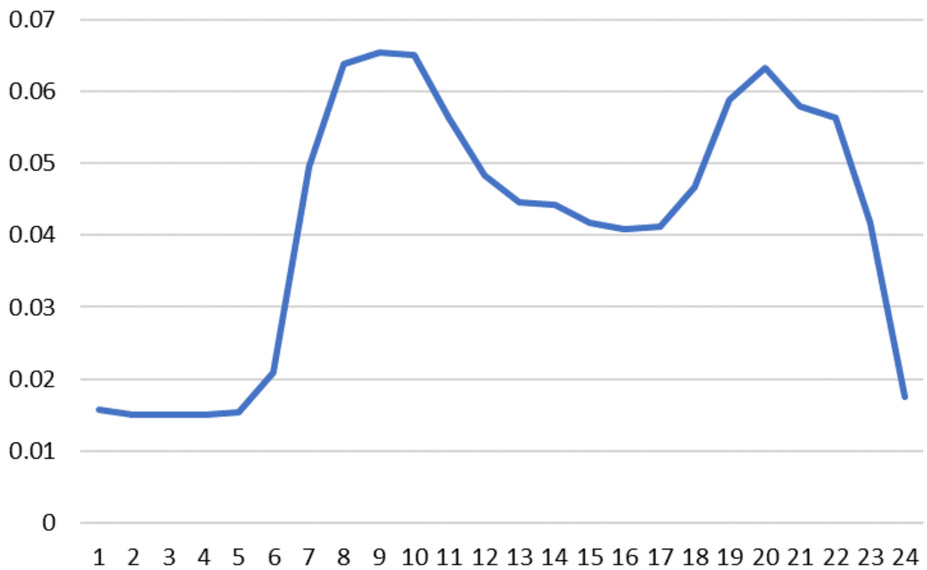

Figure S3. Weekday emission profile for the residential sector based on the temporal profiles from the EDGAR database.[4]

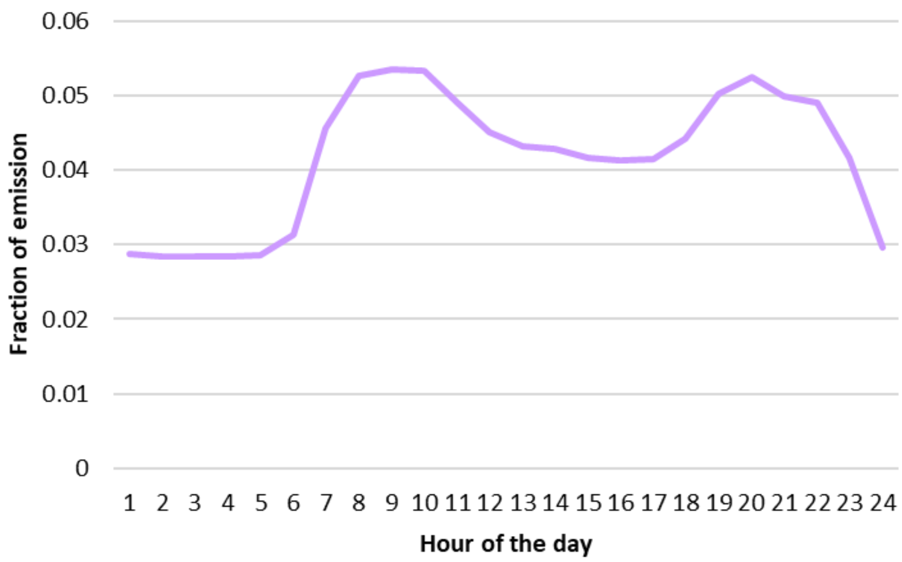

Figure S4. Weekend emission profile for the residential sector based on the temporal profiles from the EDGAR database.[4]

References

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