

Supplementary

A New Separation Methodology for the Maritime Sector Emissions over the Mediterranean and Black Sea Regions

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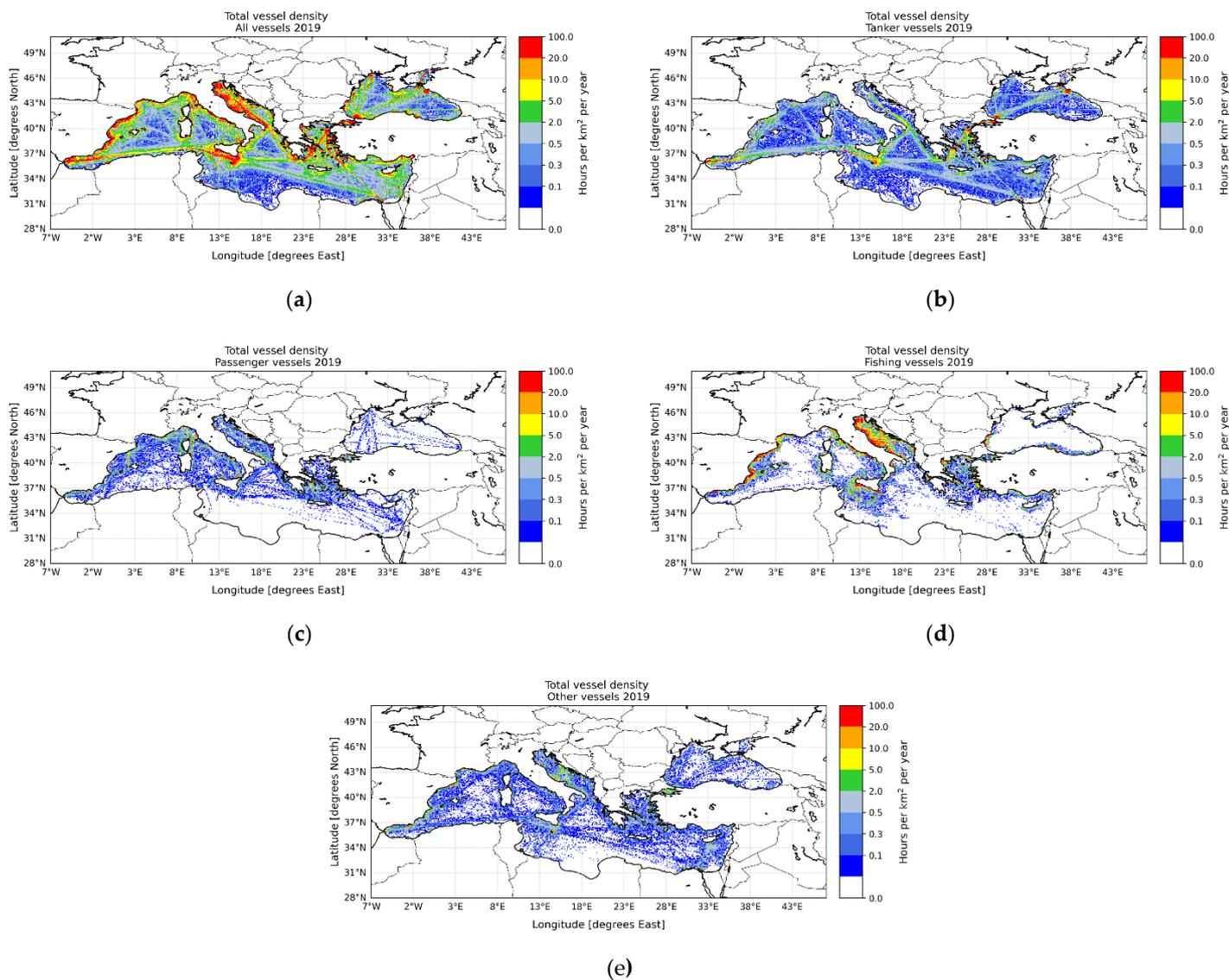


Figure S1. EMODnet total vessel density (in hours per km² per year) for 2019 per vessel type (a) All; (b) Tanker; (c) Passenger; (d) Fishing; (e) Other.

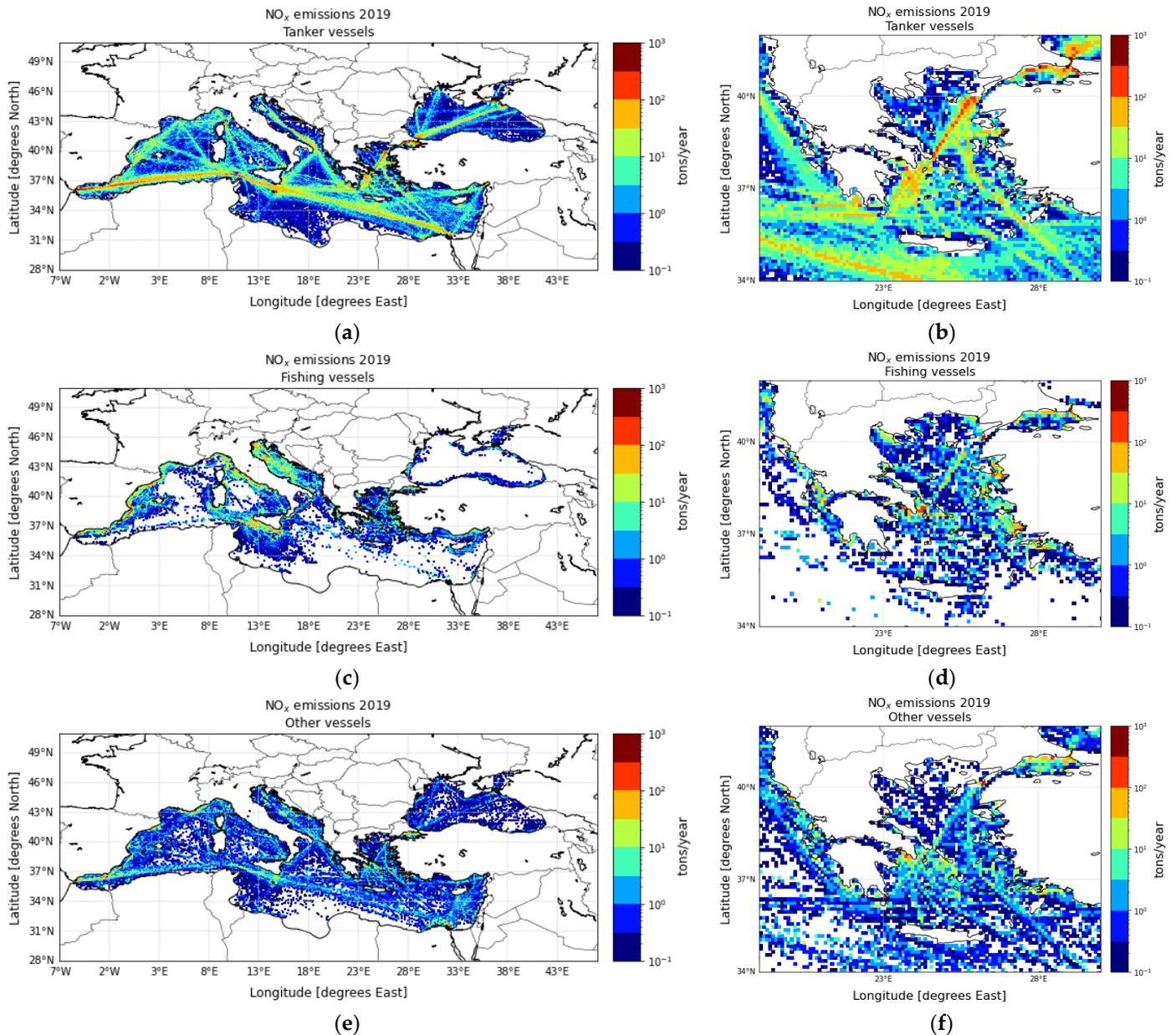


Figure S2. CAMS-GLOB-SHIP NO_x emissions (in tons per year) for the Mediterranean and Black Sea regions (left column) and the Greek domain (right column) classified according to the vessel density per vessel type: (a) & (b) Tanker vessels; (c) & (d) Fishing vessels; (e) & (f) Other vessels.

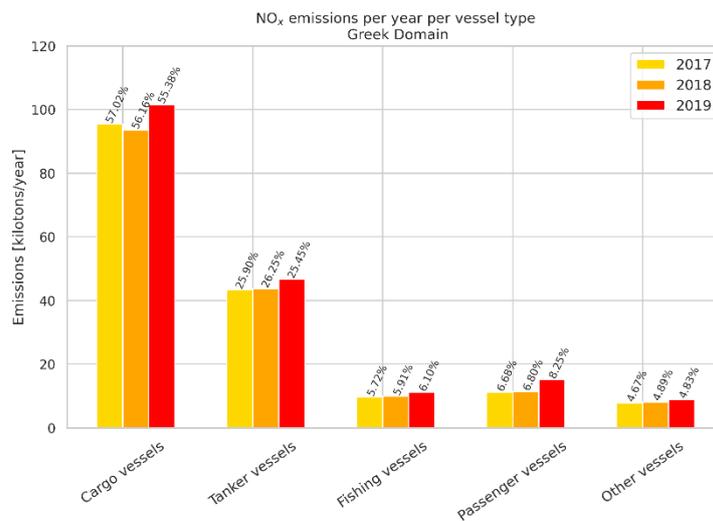


Figure S3. CAMS-GLOB-SHIP v2.1 NO_x emissions (in kilotons y⁻¹) per vessel type and year in the Greek domain.

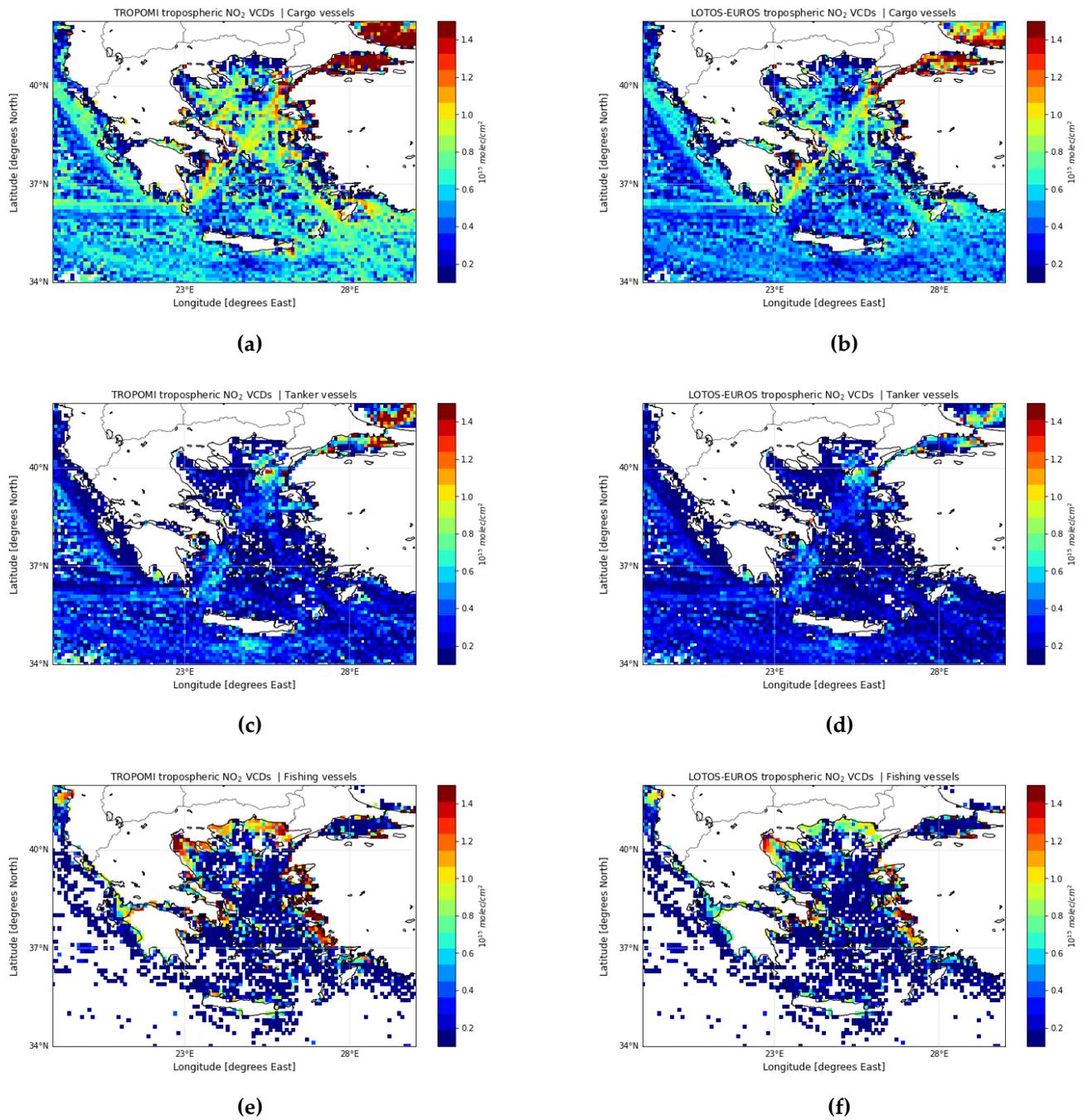
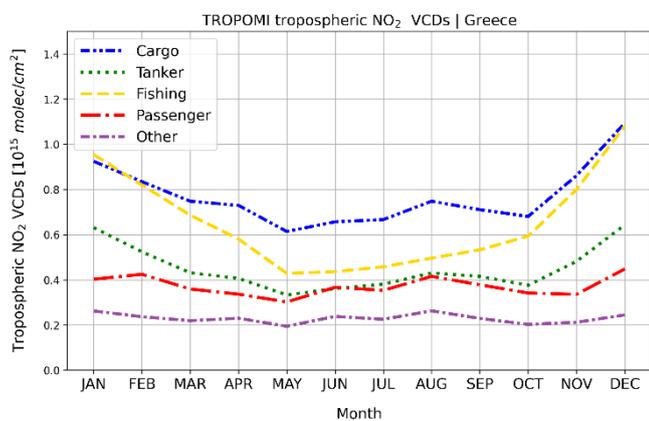
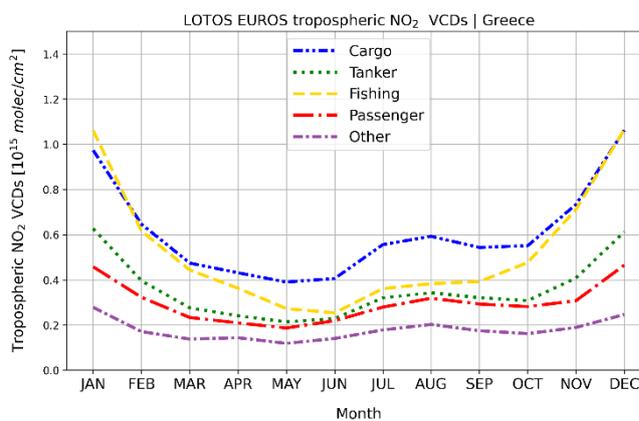


Figure S4. Tropospheric NO₂ vertical column densities (in 10¹⁵ molecules cm⁻²) classified according to the 2019 vessel density per vessel type: (a) TROPOMI Cargo; (b) LOTOS-EUROS Cargo; (c) TROPOMI Tanker; (d) LOTOS-EUROS Tanker; (e) TROPOMI Fishing; (f) LOTOS-EUROS Fishing.



(a)



(b)

Figure S5. Tropospheric NO₂ vertical column densities (in 10¹⁵ molecules cm⁻²) seasonal variability according to the 2019 vessel density for the Greek domain: (a) TROPOMI; (b) LOTOS-EUROS.

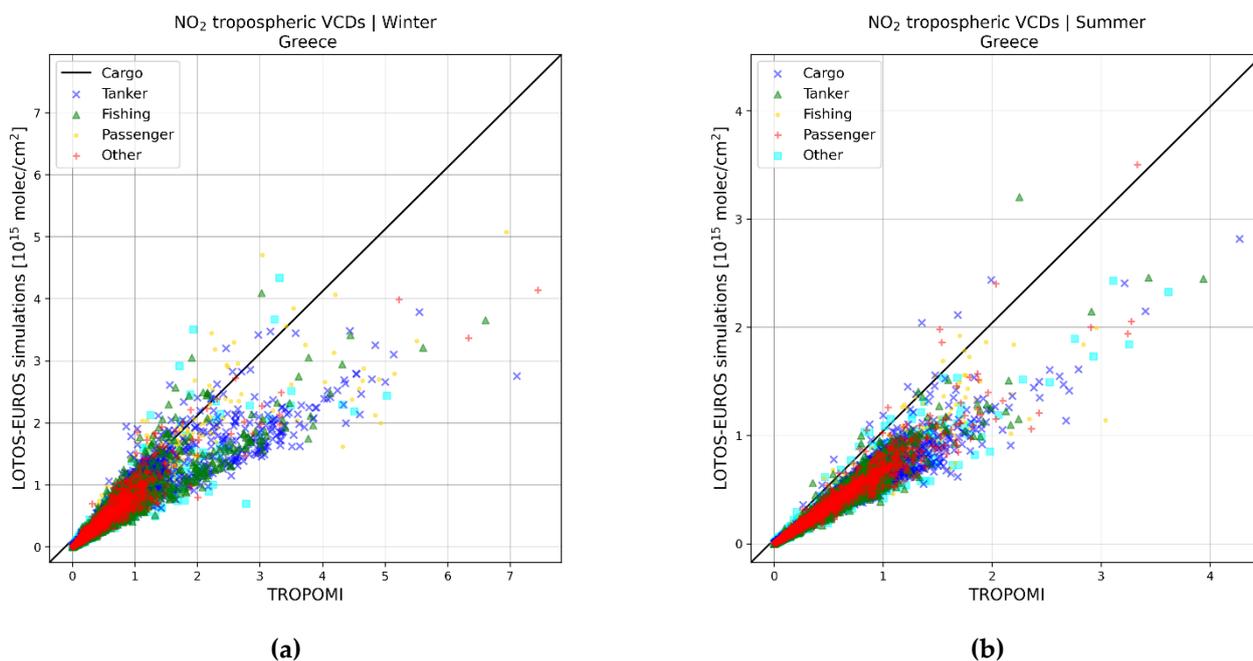


Figure S6. Seasonal comparison between the tropospheric NO₂ loads reported by TROPOMI and LOTOS-EUROS over the Greek domain per vessel type. (a) Winter; (b) Summer.

Table S1. Seasonal statistics for the shipping activities sensed by TROPOMI and simulated by LOTOS-EUROS in the Greek domain.

	Winter				Summer			
	TROPOMI mean NO ₂ *	LOTOS-EUROS mean NO ₂ *	R	Slope	TROPOMI mean NO ₂ *	LOTOS-EUROS mean NO ₂ *	R	Slope
Cargo	0.83 ± 0.55	0.70 ± 0.45	0.90	0.63	0.69 ± 0.29	0.48 ± 0.38	0.93	0.64
Tanker	0.52 ± 0.45	0.43 ± 0.40	0.92	0.69	0.41 ± 0.27	0.29 ± 0.34	0.96	0.70
Fishing	0.66 ± 0.72	0.56 ± 0.73	0.93	0.77	0.45 ± 0.42	0.32 ± 0.60	0.97	0.69
Passenger	0.33 ± 0.47	0.28 ± 0.45	0.95	0.76	0.33 ± 0.38	0.23 ± 0.38	0.97	0.69
Other	0.28 ± 0.42	0.23 ± 0.52	0.92	0.75	0.27 ± 0.34	0.19 ± 0.34	0.97	0.67

* In 10¹⁵ molecules cm⁻²