Supplementary Materials:

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This supplement provides a Table including the description of the selected monitoring sites in Greece as well as a description of the statistical measures used for the model evaluation.

Table S1. Description of the selected monitoring meteorological sites in Greece.

Monitoring Network	Location in Greece	Site Name	Type of site	Altitude (m)	Lon(°E)/ Lat(°N)
NOAA	Athens	Athinai	Urban/Traffic	21	37.88/23.73
NOAA	Heraklion	Heraklion	Suburban/Airport	35.05	25.18/35.34
meteo.gr	Athens	Nea Smyrni	Urban/Traffic	51	23.72/37.95
meteo.gr	Larissa	Larissa	Urban/Traffic	82	22.4/39.63
meteo.gr	Ioannina	Ioannina	Suburban	475	20.85/36.92
meteo.gr	Patra	Patra	Urban/Port	3	21.74/38.26
Municipality of Thessaloniki	Thessaloniki	Martiou	Urban/Traffic	20	22.96/ 40.60
Municipality of Thessaloniki	Thessaloniki	Egnatia	Urban/Traffic	15	22.94/40.64

Table S2. Description of the selected air quality monitoring sites in Greece.

Monitoring Network	Location in Greece	Site Name	Type of site	Altitude (m)	Lon(°E)/ Lat(°N)
YPEN	Liosia, Athens	LIO	Suburban Background	165	23.69/ 38.07
YPEN	Nea Smyrni, Athens	SMY	Urban Background	50	23.71/ 37.93
YPEN	Peristeri, Athens	PER	Urban Background	80	23.68/ 38.01
YPEN	Agia Paraskevi, Athens	AGP	Suburban Background	290	28.81/ 37.99
YPEN	Lykovrisi, Athens	(LYK)	Suburban Background	234	23.78/ 38.06
YPEN	Koropi, Athens	KOR	Suburban Background	140	23.87/ 37.89
YPEN	Volos	VOL	Urban Background	31	22.94/ 39.36
YPEN	Larissa	LAR	Urban Background	85	22.41/ 36.63
YPEN	Ioannina	IOA	Urban Background	520	20.85/ 39.65
YPEN	Kalamaria, Thessaloniki	KAL	Suburban Background	60	22.96/ 40.57
YPEN	Kordelio,	KOD	Urban	30	22.89/ 40.67

	Thessaloniki		Industrial		
Municipality of Thessaloniki	Thessaloniki	Dimarxeio	Urban	20	22.95/ 40.62
Municipality of Thessaloniki	Thessaloniki	Martiou	Urban Traffic	20	22.96/ 40.60
Municipality of Thessaloniki	Thessaloniki	Lagada	Urban Traffic	20	22.93/ 40.65
Municipality of Thessaloniki	Thessaloniki	Malakopi	Urban Background	20	22.94/ 40.63
National Observatory of Athens	Athens	THISSIO	Urban Background	105	23.72/ 37.97

Description of the statistical measures used for the model evaluation.

The statistical metrics used to evaluate the parameterizations performances are defined as follow:

a) Mean Bias (MB):

$$MB = \frac{\sum_{i=1}^{N}(M_i - O_i)}{N}$$

as a measure of the data tendency.

(b) Mean Absolute Error (MAE),

$$MAE = \frac{\sum_{i=1}^{N}|Mi - Oi|}{N}$$

that represents the deviation between the modelled and the observed data.

(c) Factor of two criterion (Fac2):

$$0.5 \leq \frac{M_i}{O_i} \leq 2$$

(d) Pearson's Correlation coefficient (R):

$$R = \frac{\sum_{i=1}^{N}(M_i - \bar{M})(O_i - \bar{O})}{\sqrt{\sum_{i=1}^{N}(M_i - \bar{M})^2}\sqrt{\sum_{i=1}^{N}(O_i - \bar{O})^2}}$$

(e) Index of Agreement (IOA):

$$IOA = 1 - \frac{\sum_{i=1}^{N}(M_i - O_i)^2}{\sum_{i=1}^{N}(|M_i - \bar{O}| + |O_i - \bar{O}|)^2}$$

Where M_i and O_i denote modelled and observed data, respectively, N is the number of paired data considered, $\bar{O}$ and $\bar{M}$ are the mean of observed and modeled data, respectively.
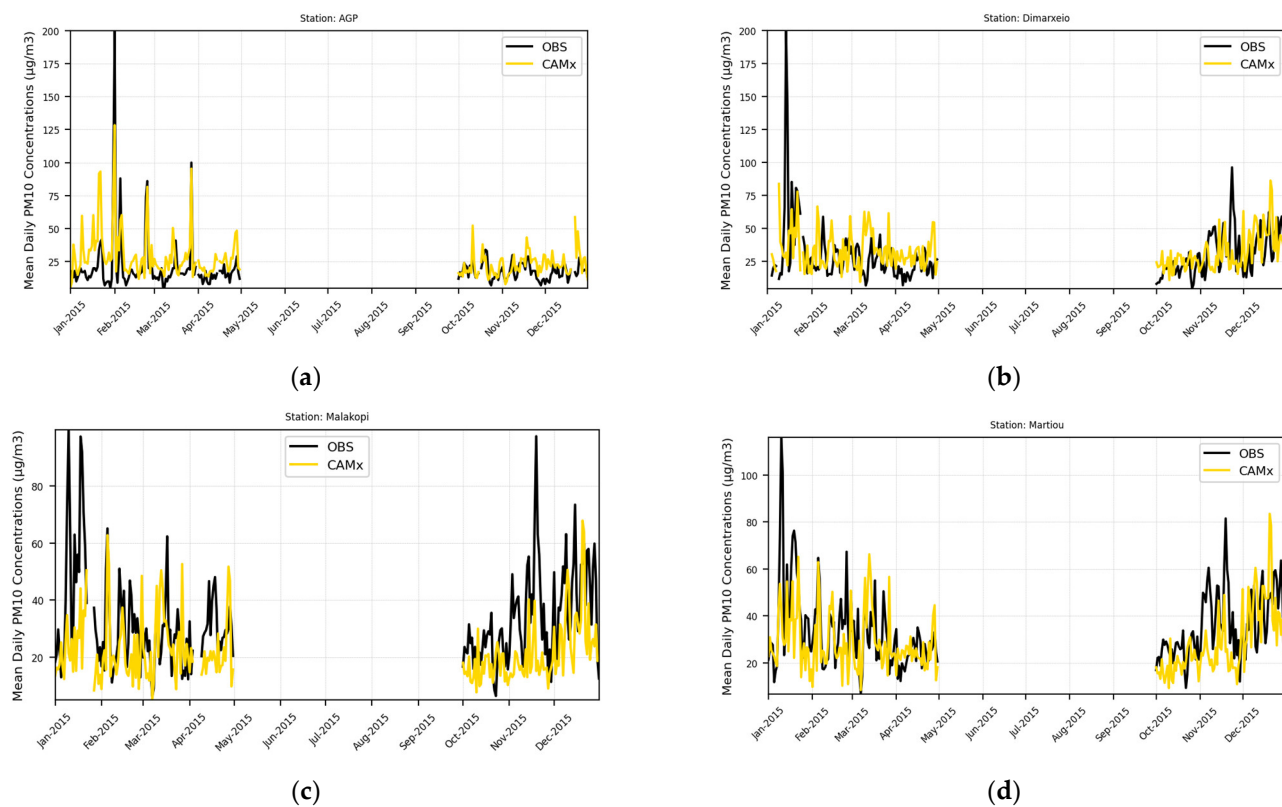
Figure S1. Mean daily PM10 concentrations of measurement and simulated data at (**a**) AGP, (**b**) Dimarxeio, (**c**) Malakopi and (**d**) Martiou stations for the cold period of 2015 (January–April, October–December) for the On-line SCN.