

Supplementary electronic materials

Impact of biogenic emissions on air quality over Europe and North America

Karine N. Sartelet ^{a,*} Florian Couvidat ^a Christian Seigneur ^a

Yelva Roustan ^a

^a*CEREA, Joint laboratory École des Ponts ParisTech/ EDF R & D, Université
Paris-Est, 77455 Marne la Vallée Cedex 2, France*

1 Model performance evaluation over Europe

The Polyphemus simulations are compared to observations for NO₂, SO₂, sulfate, ammonium and nitrate in Tables 1, 2, 3, 4 and 5, respectively. Observational data at rural and suburban stations were extracted from the Ensemble system, except for sulfate, ammonium and nitrate, which are obtained from the EMEP databases.

2 Model performance evaluation over NA

The Polyphemus simulation is compared to observations for NO₂, SO₂, elemental carbon of PM_{2.5}, organic mass of PM_{2.5}, sulfate of PM_{2.5}, ammonium

* Corresponding author.

Email address: sartelet@cerea.enpc.fr (Karine N. Sartelet).

NO ₂ - Europe	Pol 1	Pol 2	Pol 3	Pol 4	AQMEII models		
					Min	Mean	Max
Number of stations	684	684	684	684	681	683.7	684
Mean obs	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Mean sim	8.8	8.3	8.7	8.8	5.6	9.3	15.1
rmse	13.8	13.1	13.2	13.1	12.5	14.1	15.9
correlation	38.0%	41.3%	40.1%	40.4	20.7%	33.2%	42.4%
mfb	-40.9%	-44.3%	-38.4%	-36.2	-66.7%	-32.3%	-2.7%
mfe	77.7%	78.6%	77.1%	76.2%	67.6%	77.8%	90.9%

Table 1

Comparisons to observations for surface NO₂ over Europe (concentrations and rmse are in $\mu\text{g m}^{-3}$).

of PM_{2.5} and nitrate of PM_{2.5} in Tables 6, 7, 8, 9, 10, 11 and 12, respectively.

Observational data at rural and suburban stations were extracted from the Ensemble system.

SO ₂ - Europe	Pol 1	Pol 2	Pol 3	Pol 4	AQMEII models		
					Min	Mean	Max
Number of stations	501	501	501	501	498	500.7	501
Mean obs	3.7	3.7	3.7	3.7	3.7	3.7	3.8
Mean sim	4.3	4.2	3.5	3.6	1.1	2.5	4.2
rmse	9.5	9.4	9.3	9.3	9.0	9.3	10.2
correlation	14.5%	14.0%	12.9%	12.9%	7.6%	16.0%	20.8%
mfb	19.6%	17.5%	1.7%	2.3%	-110.0%	-46.6%	-0.7%
mfe	79.2%	79.0%	78.5%	78.4%	74.3%	95.0%	127.4%

Table 2

Comparisons to observations for surface SO₂ over Europe (concentrations and rmse are in $\mu\text{g m}^{-3}$).

PM ₁₀ sulfate - Europe	Pol 1	Pol 2	Pol 3	Pol 4
Number of stations	25	25	25	25
Mean obs	2.2	2.2	2.2	2.2
Mean sim	3.1	3.1	3.0	3.0
rmse	1.8	1.8	1.7	1.7
correlation	65.7%	65.4%	69.0%	68.6%
mfb	32.5%	31.6%	31.7%	32.9%
mfe	54.5%	54.3%	53.7%	53.8%

Table 3

Comparisons to observations for surface PM₁₀ sulfate over Europe (concentrations and rmse are in $\mu\text{g m}^{-3}$).

PM ₁₀ ammonium - Europe	Pol 1	Pol 2	Pol 3	Pol 4
Number of stations	7	7	7	7
Mean obs	0.8	0.8	0.8	0.8
Mean sim	1.7	1.7	1.9	1.9
rmse	1.4	1.3	1.6	1.6
correlation	42.7%	39.9%	40.1%	39.2%
mfb	79.1%	75.7%	83.7%	86.3%
mfe	92.9%	91.2%	97.9%	99.5%

Table 4

Comparisons to observations for surface PM₁₀ ammonium over Europe (concentrations and rmse are in $\mu\text{g m}^{-3}$).

PM ₁₀ nitrate - Europe	Pol 1	Pol 2	Pol 3	Pol 4
Number of stations	11	11	11	11
Mean obs	1.3	1.3	1.3	1.3
Mean sim	1.9	1.7	2.3	2.4
rmse	2.6	2.5	3.1	3.2
correlation	14.3%	13.9%	14.2%	12.6%
mfb	-13.1%	-25.2%	-3.0%	2.2%
mfe	108.2%	112.7%	113.2%	112.7%

Table 5

Comparisons to observations for surface PM₁₀ nitrate over Europe (concentrations and rmse are in $\mu\text{g m}^{-3}$).

NO ₂ - NA	Polyphemus	AQMEII models		
		Min	Mean	Max
Number of stations	315	315	315	315
Mean obs	8.2	8.2	8.2	8.2
Mean sim	8.4	3.0	9.7	17.8
rmse	10.0	8.3	11.6	19.0
correlation	43.1%	41.5%	46.9%	53.5%
mfb	-16.6%	-79.7%	-11.2%	53.2%
mfe	74.4%	67.7%	78.2%	93.4%

Table 6

Comparisons to observations for surface NO₂ over NA (concentrations and rmse are in ppb). Six models are included in the AQMEII models used for the comparison.

SO ₂ - NA	Polyphemus	AQMEII models		
		Min	Mean	Max
Number of stations	379	379	379	379
Mean obs	2.7	2.7	2.7	2.7
Mean sim	3.8	0.7	4.0	8.1
rmse	6.8	6.7	8.0	10.7
correlation	21.0%	12.5%	16.8%	22.3%
mfb	26.6%	-108.8%	0.2%	71.0%
mfe	81.9%	86.6%	94.1%	119.3%

Table 7

Comparisons to observations for surface SO₂ over NA (concentrations and rmse are in ppb). Six models are included in the AQMEII models used for the comparison.

PM _{2.5} EC - NA	Polyphemus	AQMEII models		
		Min	Mean	Max
Number of stations	262	262	262	262
Mean obs	0.4	0.4	0.4	0.4
Mean sim	0.5	0.2	0.5	1.1
rmse	0.5	0.5	0.7	1.3
correlation	51.5%	39.5%	46.5%	56.3%
mfb	23.6%	-70.5%	1.5%	80.6%
mfe	56.5%	50.4%	70.7%	90.4%

Table 8

Comparisons to observations for surface PM_{2.5} elemental carbon (PM_{2.5}EC) over NA (concentrations and rmse are in $\mu\text{g m}^{-3}$). Five models are included in the AQMEII models used for the comparison.

PM _{2.5} OM - NA	Polyphemus	AQMEII models		
		Min	Mean	Max
Number of stations	265	265	265	265
Mean obs	2.6	2.6	2.6	2.6
Mean sim	3.5	0.4	4.7	11.5
rmse	3.1	2.4	5.6	12.7
correlation	24.6%	19.7%	37.1%	50.0%
mfb	41.5%	-132.4%	15.7%	120.3%
mfe	72.1%	56.2%	97.2%	136.7%

Table 9

Comparisons to observations for surface PM_{2.5} organic mass (PM_{2.5}OM) over NA (concentrations and rmse are in $\mu\text{g m}^{-3}$). Four models are included in the AQMEII models used for the comparison.

PM _{2.5} SO ₄ - NA	Polyphemus	AQMEII models		
		Min	Mean	Max
Number of stations	113	113	113	113
Mean obs	4.2	4.2	4.2	4.2
Mean sim	4.0	3.4	4.1	4.8
rmse	3.2	1.9	2.5	2.9
correlation	55.7%	63.9%	75.3%	85.8%
mfb	-8.1%	-28.9%	-2.5%	14.6%
mfe	54.8%	32.7%	43.8%	53.0%

Table 10

Comparisons to observations for surface PM_{2.5} sulfate (PM_{2.5}SO₄) over NA (concentrations and rmse are in $\mu\text{g m}^{-3}$). Four models are included in the AQMEII models used for the comparison.

PM _{2.5} NH ₄ - NA	Polyphemus	AQMEII models		
		Min	Mean	Max
Number of stations	112	112	112	112
Mean obs	1.4	1.4	1.4	1.4
Mean sim	1.9	1.2	1.4	1.5
rmse	1.4	0.8	1.0	1.2
correlation	50.4%	27.3%	61.5%	78.5%
mfb	28.8%	-4.9%	8.1%	16.7%
mfe	62.9%	41.0%	54.3%	77.7%

Table 11

Comparisons to observations for surface PM_{2.5} ammonium (PM_{2.5}NH₄) over NA (concentrations and rmse are in $\mu\text{g m}^{-3}$). Four models are included in the AQMEII models used for the comparison.

PM _{2.5} NO ₃ - NA	Polyphemus	AQMEII models		
		Min	Mean	Max
Number of stations	264	264	264	264
Mean obs	0.4	0.4	0.4	0.4
Mean sim	0.9	0.3	0.4	0.7
rmse	1.8	0.7	0.8	0.8
correlation	35.3%	36.0%	38.0%	40.0%
mfb	-32.6%	-96.7%	-50.3%	60.9%
mfe	129.3%	90.5%	115.7%	129.9%

Table 12

Comparisons to observations for surface PM_{2.5} nitrate (PM_{2.5}NO₃) over NA (concentrations and rmse are in $\mu\text{g m}^{-3}$). Four models are included in the AQMEII models used for the comparison.