Impact of emissions and boundary conditions on PM levels over Europe as simulated by a multi-model ensemble in frame of AQMEII3

U. Im[1], K.M. Hansen[1], C. Geels[1], J.H. Christensen[1], J. Brandt[1], E. Solazzo[2], U. Alyuz[3], A. Balzarini[4], R. Baro[5], R. Bellasio[6], R. Bianconi[6], J. Bieser[7], A. Colette[8], G. Curci[9], J. Flemming[10], X. Francis[11], A. Fraser[12], P.Jimenez-Guerrero[5], N. Kitwiroon[13], G. Pirovano[4], L. Pozolli[3,*], M. Prank[14], R. Rose[12], R. Sokhi[11], P. Tuccella[9], A. Unal[3], M.G. Vivanco[15], C. Hogrefe[16], S. Galmarini[2]

[1] Aarhus University, Department of Environmental Science, 4000 Roskilde, Denmark
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Presenting author email: ulas@envs.au.dk

AQMEII (Air Quality Model Evaluation International Initiative) promotes research on regional air quality model evaluation across the European and North American atmospheric modelling communities, providing the ideal platform for advancing the evaluation of air quality models at the regional scale (Solazzo *et al*., 2012; Im *et al*., 2015).

In frame of AQMEII3, eleven regional chemistry and transport modelling groups are simulating the air pollutant levels over Europe for the year 2010, along with a number of sensitivity simulations of reductions in anthropogenic emissions and boundary conditions.

All participating groups have performed a sensitivity simulation with 20% reductions in global (GLO) anthropogenic emissions (Table 1). In addition, various groups simulated sensitivity scenarios of 20% reductions in anthropogenic emissions in different HTAP-defined regions such as North America (NAM) and Europe (EUR). The boundary conditions for the base case and the perturbation scenarios were derived from the C-IFS global chemical model. The anthropogenic emissions used in the models were either the European TNO-MACCII emissions or the global EDGAR-HTAP emissions.

Table 1. Changes in the emissions and boundary condition (BC) inputs at each perturbation scenario.

	GLO	NAM	EUR
Emissions	-20%	-	-20%
BC (C-IFS)	-20%	-20%	-

The present study will evaluate the impact of the GLO and EUR emission perturbation scenarios on European surface PM levels. Detailed analyses will be conducted to explore the impact on the levels over individual surface measurement stations over both continents and vertical profiles over AERONET stations.

Preliminary results

The preliminary results show that a 20% decrease of the global anthropogenic emissions (GLO) leads to a 6.6±2.3% and 11.2±6.3% decrease in the domain-mean surface PM_{10} and $PM_{2.5}$ levels over Europe, respectively Table 2). The EUR scenario leads to relatively smaller decreases in surface PM_{10} and $PM_{2.5}$ levels (5.8±1.4% and 8.7±0.5%, respectively).

Table 2. Response (in %) of models to the perturbation scenario GLO and EUR (in parenthesis) for surface PM_{10} and $PM_{2.5}$.

Models	PM_{10}	$PM_{2.5}$
M1	-2.7	-1.6
M2	-7.1 (-6.9)	-8.7 (-8.4)
M3	-7.2 (-4.8)	-12.6 (-9.1)
M4	-6.8	-18.0
M5	-9.1	-14.9

Figure 1 presents the spatial changes in the annual-mean surface $PM_{2.5}$ concentrations as simulated by five of the modelling groups for the GLO scenario together with their multi-model mean.

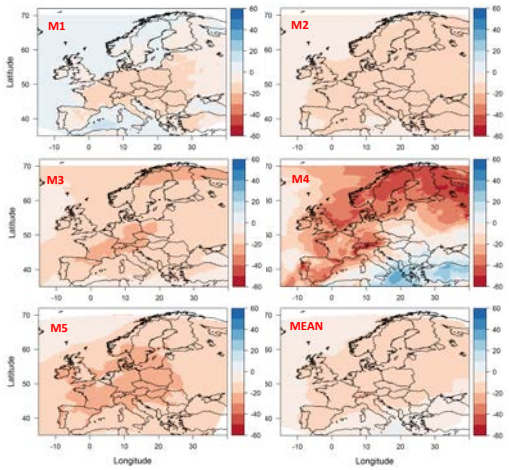

Figure 1. Changes in the annual-mean $PM_{2.5}$ surface concentrations as simulated by the different modelling groups and the multi-model mean.

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Im, U. *et al*. (2015) *Atmos. Environ*. **115**, 421-441.
Solazzo, E. et al., (2012) *Atmos. Environ.* **53**, 75-92.