

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2022-83

Anonymous Referee #1

Referee comment on "Columnar and surface urban aerosol in the Moscow megacity according to measurements and simulations with the COSMO-ART model" by Natalia E. Chubarova et al., Atmos. Chem. Phys. Discuss.,
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The paper assesses the Moscow megacity's aerosol pollution, focusing on urban air pollution and its radiative effect. The authors employed both experimental and modeling approaches to give a comprehensive picture of the magnitude and temporal variability of urban pollution in Moscow. The paper is well written and logically organized. It has a comprehensive introduction and discusses new valuable observation results. It could be published after a minor revision according to the below comments.

General comments

The model itself and especially its aerosol component should be better explained. It would be helpful to discuss the spatial maps from the model to see how representative (spatially) the observations are. I am not clear how does the model with 7-km grid spacing describe in-city aerosol concentration? Is any parameterization for the urban terrain used?

PM_{2.5} was not measured, and all information about a fine aerosol fraction came from AERONET retrieval? It is unclear what are the natural aerosols that contribute to PM₁₀? The model does not account for any natural emissions, including urban dust. If observations are not available, it will help discuss aerosol vertical distributions, at least from the model perspective.

Specific comments

L10: COSMO-ART is a regional meteorology and chemical transport model.

L39: The aerosol forcing is negative

L160-165: How is aerosol microphysics calculated?

L175-178: Are there any natural emissions in the model, e.g., biogenic? Do you account for the resuspension of urban dust? How significant is it?

L187: In observations, one site is urban, and the another is in the suburb. It is not much coverage. Could you tell from the model simulations that these two locations represent urban and pristine conditions?

L190-192: It is irrelevant to have instant observations at the same time. The averaging over time would give more reliable results.

L225-230: The definitions of the fine and coarse aerosol fractions came from AERONET. What are coarse and fine aerosols in the model? Could you explain this in the text?

L260-265: I suppose sulfate is low because SO₂ is low. What are the secondary aerosols in your observations and simulations?

L272-274: I suggest stronger winds more effectively generate coarse aerosols, like urban dust.

L284-287: I would say that in unstable conditions, BC PM is more effectively dispersed vertically, the BC source is fixed, and the PM source gets stronger with stronger winds.

L308-309: Do all Moscow power stations work on gas? What about SO₂ emissions from traffic?

L369: "results" > "result"

L400: Do anthropogenic emissions have a diurnal cycle?