

Aerosol optical properties over Europe: an evaluation of the AQMEII Phase 3 simulations against satellite observations

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The authors present the evaluation of the aerosol optical properties simulated in the frame of the Air Quality Model Evaluation International Initiative. As a reference, MODIS AOD is used.

I have several concerns about the paper, which are specified below.

The manuscript needs a major revision before it can be considered for publication in ACP.

General comments

The language should be thoroughly checked.

The authors say that MODIS “combined” product is not validated (page 8, line 3). If this is true, I would be very careful to evaluate the model results with the product, which is not validated. However, this is not true. Several validation papers for MODIS C6 are published, among them:

<http://www.mdpi.com/2072-4292/10/3/475>

<https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1002/2014JD022453>

<https://www.atmos-meas-tech.net/6/2989/2013/amt-6-2989-2013.pdf>

http://home.iitk.ac.in/~snt/pdf/Mhawish_RSE_2017.pdf

Please, include MODIS validation results and possible bias of the model results comparison, related to bias in MODIS AOD into the discussion.

MODIS provides very good but not perfect product, and validation results show weaknesses of the AOD product over certain areas. Thus, I strongly recommend to include AOD validation with AERONET (<https://aeronet.gsfc.nasa.gov/>) and MAN (https://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html). Otherwise, the results of your analysis are biased by the MODIS quality.

MODIS coverage is surprisingly low in your analysis. How many (in %) pixels you discarded with your mask? Please, show it on the map. Please, repeat the analysis for all reported MODIS AOD pixels. As far as I know, MODIS deliver AOD data which passed the quality control.

Specific comments

Abstract.

- Please, add numbers (abs, or %) for under/overestimation results
- I disagree with the conclusion that “spatial and temporal variability of this variable is well-represented by all the models”. Is that conclusion done from the comparison with MODIS? As I see from figure S3, almost all models have similar tendencies to underestimate, compared to MODIS, AOD over Siberia and underestimate AOD in the southern part of AOI

Page 4, Line 20. Please, correct to “ATSR”

Page 7, Line 14. Please, specify “x” in MxD

Page 8, Line 22. What is EE for AE MODIS product? Please, include the discussion to explain your choice for AE between -0.5 and 4.

Page 8, lines 4-5. Please, discuss briefly the results here.

Page 8, Line 27. Please, explain the mask in the other words. The current explanation is not clear. Was that mask applied for AOD? Or AE? Do you mean, that if for certain location max AOD was 1, you discarded all the cases when $AOD < 0.1$ for that location? Why?

For AE, AOD limit of 0.1 is acceptable.

Page 8, Line 29. What is the measure of confidence here?

Technical comments

Please change the color scale for MODIS AOD to max. 1. With the current color scale, the AOD variation below 0.5 is hardly visible. I advice to include also the red color to the color panel.