

Interactive comment on “Aerosols at the Poles: An AeroCom Phase II multi-model evaluation” by Maria Sand et al.

Anonymous Referee #2

Received and published: 21 April 2017

This is a comprehensive study comparing a multi-model ensemble of AOD with ground based and satellite observation. Analysis are performed for both poles and for different aerosol components. The analysis is performed in good detail and shows that there is a wide model spread and the model median predicts the observation well. I recommend this paper for publication after some modifications:

A map showing where all the locations of the stations are would be useful. In the map also the area over which the satellite comparison has been performed could be added.

In the introduction you write: Arctic AOD typically has a maximum during late winter and spring. In the data you show this is only true for some stations (e.g. Fig 2) and only clear for dust and sea-salt (Fig 8). Why can't this typical maximum not be seen in black carbon or sulfate? In Figure 2 only some stations show the spring peak - is

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this based on the location of the station, or is it a specific component which causes it and is not transported to the other stations. Would you expect, that the spring peak is stronger for surface or for the total column? I suggest to add some further description focusing on the seasonal cycle as well as the horizontal distribution of the aerosol.

For the sensitivity study you change the emission and lifetime and look at the impact on AOD in the Arctic. To put this better into context: How long is the average lifetime in all the models compared to the case study model and how does the lifetime change over the seasons? Do you expect the BC emissions used are too low, or the lifetime is too short, can the sensitivity study help answering this?

Comparing Fig 4 and 5 it seems that MODIS retrieved AOD are twice as high in April compared to August. In the CALIPSO AOD July values are double as high as April value. Is this big differences based to the screening in MODIS, you mention? If you could add a panel like Fig 4a) to Fig 5, it might be easier to see how well the model capture the different annual cycle.

here are some further comments, given for the page and line number:

p1, li30 - there is a too abrupt change from transport to radiative forcing to AOD, you could add a sentence connecting those two topics.

p2, li 1 - in winter

p2, li 11 - add also the percentage of the changes due to doubling the lifetime

p2, li 23 - it should be “Faluvegi”, you wrote “Feluvegi”

p3, li 28 - Can you give a reference for aerosols transported into the Antarctic?

p5, li 7 - for “the” year 2000

p5, li 9 - what do you mean with “double calls”? please explain in more detail or rephrase.

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p5, li 10 - species is the singular form of species, the word specie appears also later in the text, please change.

p5, li 12 - biomass "burning" emissions (correct?) - this also appears later in the text

p7, li 25 - of "the" year 2000

p7, li 25 - It would be easier to understand if you also refer to the figure (Fig 1, black thick line)

p8, li 10 - r could be reported in the figure next to the rmse, so it is available for each stations

p8, li 17 - either write "high reflectivity" or "highly reflective"

p8, li 19 - (see methods section)

p8, li 23 - you give the uncertainty range here, how is it calculated?

p8, li 25 - Some of the models "do" have a steeper slope

p9, li 7 - You explain how the rms was calculated, the rmse value should also appear the text when discussing them.

p 12, li 7 - it is written that you don't include semi- or indirect cloud effects, or surface albedo modifications, how much approximately would the cloud effects and surface albedo modification impact the DAE?

p 12, li 17 - you give a percentage of the effect by doubling emission, what would be the corresponding value for the changes in lifetime? (also in the abstract)

Figures:

Fig 3, caption: the average "observation" over the 9 stations

Fig 14, caption: "total" in small case

Fig 8: also here the multi model median could be added.

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Fig 17: you could add the information that the left panel shows the experiment with doubling emission, while the right panel shows the effect of the changes in e-folding lifetime in the figure title.

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