Comment on acp-2021-954
Anonymous Referee #1

Referee comment on "Aerosol radiative effects with MACv3 and satellites retrievals" by Stefan Kinne et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-954-RC1, 2021

Review

Aerosol radiative effects with dual view AOD retrievals

by Stefan Kinne, Peter North, Kevin Pearson, Thomas Popp

The paper is devoted to the assessment of the quality of aerosol optical depth retrievals from ATSR-2, AATSR and SLSTR satellite instruments and evaluation of the radiative effects obtained using these data. The comparison with MODIS AOD retrievals have revealed significant biases and inconsistency so the authors claimed that decadal regional trends were not possible to retrieve from these data. However, the authors were able to solve two tasks: firstly, according to these data they showed the minor effect of lockdown due to COVID-19 and, secondly, they obtained reasonable climate relevant TOA net-flux changes, which were in agreement with other available satellite datasets and MAC climatology. I guess that the publication of the analysis concerning the quality of these satellite data is important, and the manuscript can be published after editing and some structural changes.

General comments:

- Since the paper in the scientific journal should be clear not only for specialists in satellite aerosol retrievals but for the broad scientific community I would recommend to extend Introduction (adding there the information concerning the current state of the quality of aerosol satellite retrievals, the assessment of radiative effect of aerosols, etc) and the potential advantages of dual view AOD retrievals.
The Section "Dual view (DV) radiometer data" is of most concern. I would recommend to include there the description of the method, the characteristics of the satellite instruments. It would be useful to add the Table with different characteristics of the instruments. It is not enough only to mention that the statistics is poor for the ATSR (row 67), but it is necessary to show the statistics for different sensors.

It is not clear why the authors used MODIS data for the trend analysis if the paper is devoted to the analysis of other sensors. This is possible to do only if these data are somewhat useful for the aims of DV method retrievals or RT assessments. I guess that the analysis of trends according to the MODIS data here is inconsistent with the title of the paper. Or the title of the paper should be changed.

The study of COVID impact is now a very popular topic. However, to my understanding, it should be analyzed more carefully to evaluate the local effects of aerosol over urban areas. I understand that it is easier to say that it is no effect of COVID-19. I agree that the effect of lockdown on AOD is small, however, it might be seen, if the accurate analysis is done. However, the quality of these satellite retrievals is not good, and the effects are comparable with the uncertainty of satellite retrievals. I would recommend to discuss the uncertainty of the retrieval method and after that make a statement that the evaluation of the COVID-19 lockdown AOD changes lies within this uncertainty.

I would recommend to re-arrange the material into the standard Sections: Introduction, Methods, AOD quality assessment, Radiative effects and Discussion with Conclusions. Small subsections can be incorporated in this structure.

Specific comments:

- The quality (resolution) of Figures is not very good. It is not clear what means "sea" in the left up corner of them. Does this mean the specific retrieval over sea or seasonal? Please, show the meaning of all abbreviations.
- Section 6 has a poor title. Please, clarify.
- In Section 7 the comparisons of the results with other studies should be demonstrated.
- Discussion is too short. I would recommend to combine this part with the conclusions.

Technical corrections:

- Row 88. SLSTR: forward, ATSR-2 and AATSR: rearward – should be clarified. I understand this, but I am not sure that any reader would be happy with such kind of explanation.
- Row 90. If it is any publication concerning these biases? The reference would be useful here.
- Row 96. 2008, 2019 and 2020 – they are not the same. Please, correct the text.
- Row 168. ref? – Reference should be given.
- Row 172. What is the uncertainty of the applied RT method?
- Row 177. What about SSA and ASYM factors? Were the changes made only in AOD values?
- Row 179. Please, add the reference and short description of the applied indirect method.
- Row 179. It is unclear. what the letter “a” means here.
- Row 188. It is not clear, how the anthropogenic aerosol presence is evaluated from satellite data.
- Row 194. Please, give the reference here.
- Row 195-198. It is not obvious from the text that satellite data can be used to solve these tasks. Should be clarified.
- Row 221. I do not understand from the text, how the satellite data are used for inferring anthropogenic pattern (Table 2, right side).
- Row 227-228. There is relatively large difference in radiative effects between MAC climatology and satellite retrievals. This should be underlined. Otherwise it is strange, since there is large difference in AOD.
- Row 229-230. I do not understand the last sentence. What is SR – single retrieval? In this case the short description of this method should be given.
- Row 231. I would recommend to add the quantitative estimates in Section 7. Otherwise, the statements are too lightweight. It would be useful to show the limits in the range of different parameters (1- SSA, size distribution, etc), when their uncertainties do not play vital role.
- Row 261 and 266. What does word “presence” mean here?
- Row 264. What is “dir: at the upper part of Figure 6? Does this mean direct effect? All abbreviations should be clarified.
- Row 277. It is not clear again, what does mean “aerosol presence”? May be better to use “direct effect” or it is not the same thing?
- Row 300. I do not understand “...also informs on...”? Informs about, may be? Or “separated on”?
- Row 321. From Fig.9 I eventually understand that the anthropogenic AOD is evaluated using AODf retrievals from these satellite instruments. Please, clarify this in a better way in the text and show the equation, how the anthropogenic AOD is estimated.
- Row 335. I do not clearly understand the following sentence: “Compared to the direct impact (at TOA?? should be added!), net flux reductions at the surface are mainly increased over (dark) ocean regions affected by pollution outflow.” Does this mean that over bright surface net flux does not have reduction due to pollution? Or there is another meaning?
- Row 347. There is a difference in numbers here and in Table 2. They should be the same or not? It should be clarified.