Comment on gmd-2022-153
Anonymous Referee #1

Referee comment on "SCIATRAN software package (V4.6): update and further development of aerosol, clouds, surface reflectance databases and models" by Linlu Mei et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-153-RC1, 2022

GENERAL COMMENTS

The article aims at describing the improvements of the cloud and aerosol database of SCIATRAN software package. A precise description of the optical properties of clouds and aerosol is an important part of a radiative transfer package. The article gives a good overview of this database. The new features are well distinguished. The article presents a scientific interest and is worth being published in GMD.

However, some points could be improved:
- To avoid the need to refer to external articles, it would have been preferable to give some more details on the components of CAS which have not been updated. Of course, if wouldn't be necessary to delve into the details, since they are available in the references.

- It would have been interesting to have more comparisons of modelizations done with the new version of SCIATRAN/CAS with former versions and with other modelizations or measurements.

- Even if the acronyms are properly defined throughout the text, it seems to me that it would be more easy for the reader if they were gathered in an appendix.
Lines 41 to 52 about the use of SCIATRAN do not seem necessary to me, as well. The same applies to figure 1.

Lines 94 and 95, it is said that the calculation can be performed 175.44 nm to 40 micrometer.
Lines 99 and 100, it is mentioned that aerosol and cloud scattering can be taken into account.

However, line 180 and 181, it is said that database can be used "at least" between 225 nm and 2.5 micrometer. Is seems to me that there is a contradiction there: is it possible to model aerosols and clouds between 175.44 and 225 nm, and between 2.5 and 40 micrometer or not ? This point should be made clear in the article.

Line 111, it would be interesting to specify with jacobian can be computed (derivative of radiances with respect to which variables ?)

Line 118, I understand that the goal of the paper is not to delve into details which have been extensively covered in other papers, but the list of the solvers which can be used should be precised.

Line 187: by "optical characteristics" do you mean refractive indexes or (SSA, extinction coefficient and phase function ?)

Line 205: it could be interesting to give references for OPAC version 3. This could also be done in section 4.1.1, event if the details have been given in [Rozanov, 2014]
Section 4.1.1: it could be interesting to give references for OPAC version 3. This could also be done in line 205, even if the details have been given in [Rozanov, 2014]

Line 205-212: I understand that the refractive indexes and size distributions from OPAC are used to compute the topical properties of an aerosol type. Why not use directly optical properties (i.e. SSA, extinction coefficients and phase function) from OPAC?

Line 218-225: it is mentioned above that the optical properties are computed from the refractive indexes. Here, it is said that they can be set for different altitudes. Does it mean that optical properties can either be directly specified or computed from refractive indexes?

Even if OPAC v3 is not the focus of this paper, the way optical properties are defined (specified or computed from refractive indexes) should be precised.

Line 243: the same applies to OPAC aerosols, where optical properties can be specified.

Line 265: logarithms/exponentials of dimensioned quantities units are used. The formula should be modified so that no dimensioned quantity is used as an argument to ln or exp.

Line 286 Same remark. Moreover, the dimension of both sides should be the same.

Line 296: it is said that the user can define the shape of the aerosol number density vertical distribution. What is the default shape (i.e. if the users does not define it)?

Paragraph 4.1.4: why a "dust aerosol type" is mentioned, whereas, in this paragraph, other aerosol types are mentioned (OPAC, XBAER-OC, MODIS-DT), which are considered in other paragraphs? This paragraph should focus on the Dubovik dust aerosol type, which is not described elsewhere.

Line 389: for the "size bins" tracer: is it an aerosol with a defined size? This aerosol type should be precised.
Line 406: mixing ratio: with respect to dry air?

Line 442: is soot accounted for by adding an extra aerosol type? Or by considering a layered sphere with both water (liquid or solid) and soot?

Line 490: in [Yang, 2013], there are 11 habits, not 9.

Line 497: It would be nice to have more details about the implementation, even if the full description is available in [Pohl 2020].

Line 565 and 580: without going into the details of Malinka's articles, it would be nice to recall briefly the principle of stereological approach and the definition of chord length.

Lines 588 and after: some details would be given about the RPV and Kernel-based Ross-Li. Not a full description, but something basic which would avoid the need to look in the references.

Line 775: "newly implemented in SCIATRAN aerosol types" => "aerosol types newly implemented in SCIATRAN".

Figure 3b: it is difficult to see the difference between the forward peaks of the different aerosols, which are mentioned in lines 800-810. Perhaps adding another figure for the phase function, zooming on 0 degree scattering angle.

Caption of figure 3: "newly implemented in SCIATRAN aerosol types" => "aerosol types newly implemented in SCIATRAN".

Figure 4: it would be nice to have another figure, zooming on 0 degrees, to better see the forward peak.

Line 888: for S+R+A, the agreement with MODIS is not so good above 900 nm, if we look
Line 904 and bottom of figure 5: It would be more clear to plot the total TOA reflectance and the contribution of each aerosol, instead of the difference.

Line 927: could you give some examples of such satellite instruments?

Figure 6: it is not so easy to compare SCIATRAN BRDF to RTLSRS and FASMAR BRDF. Another figure, with the same kind of graphs, but with the difference SCIATRAN - RTLSRS and SCIATRAN - FASMAR would allow to see more clearly the differences.

Lines 958 -> 968.
It is nice to see that SCIATRAN can well reproduce the measurements by choosing the parameters that minimize the residual. What would be interesting is to give the experimental values of snow layer optical thickness and (if available) mean chord and DOM absorption. The comparison of these experimental values with the parameters would be interesting.

Lines 996 -> 995
Same remark: It would be interesting to give the experimental values of ice thickness, water depth and (if available) transport scattering coefficient.

TECHNICAL CORRECTIONS

Line 311: typo: wavelegths => wavelengths
Line 855: responce => response
Line 924 show => snow
Line 993: "the optical" => "an optical"
Line 994: "the geometrical" => "a geometrical", "the top height" => "a top height"