We would like to thank Dr. Zhai for the comments and suggestions on the manuscript. We have replied to all and revised the manuscript. Please see the replies below. The original comments are in black italic font, and the replies to the comments are in blue normal font.

This paper describe the Determining Instrument Specifications and Analysing Methods for Atmospheric Retrieval (DISAMAR) computer code, which performs both forward radiative transfer model and inversion simulations for the Earth's atmosphere with different components, for instance, trace gases, aerosols, and clouds, and properties of the ground surface from passive remote sensing observations of the Earth. The main novelty is that DISAMAR flexibly uses a variety of radiative transfer methods when solving multiple scattering of light in the atmosphere, including the layer-based orders of scattering method, adding and doubling, integration of source function, etc. For weakly gas absorbing spectral region, the DISMAS (DIfferential and SMooth Absorption Separated) method is developed to significantly expedite the simulation time while keeping the accuracy. Jacobian (differential of radiance field with respect to retrieval parameters) can be calculated semi-analytically, which is a great advantage in comparison with the finite difference method. The manuscript is clearly written and organization is logical. I suggest the publication of this paper at Geoscientific Model Development (GMD) with some minor revisions. Specifically:

1. *Figure 1 and 2 are referenced out of order. I suggest the authors revise the manuscript to reference them in sequence. Minimally, they could simply rename Fig. 1 as Fig. 2 and vice versa.*

We have arranged the figures in the right order. In the revised manuscript, Fig. 1 becomes Fig. 3.

2. *Figure 2, the selection of wavelength grids is quite vague to me, especially when absorbing lines are involved in the channel. I strongly recommend the author revise the description the wavelength selection scheme.*

The determination of the wavelength grid has two steps: selection of the wavelength interval and division of the interval using Gaussian points. We have revised the description of the wavelength grid in 3.2.1 close to line 115.

original :
" For constructing the wavelength grid, we start from the shortest wavelength with the interval of one full-width-half-maximum (FWHM) of the ISRF. If there is a strong absorption line in the interval, the interval is reduced until the position of the strong line is reached, so this interval is smaller than the FWHM. The next interval starts from the position of the strong line. This procedure is repeated until the end of the wavelength range. The number of Gaussian points is scaled with the size of the interval, which means that a smaller interval is having less Gaussian points than the number of Gaussian points specified for the FWHM. Therefore, the wavelength grid is not equidistant: a finer wavelength grid is used for denser absorption lines, and a coarser grid is created if there are no absorption lines."

new:

There are two steps to construct the high resolution wavelength grid: 1) determining the wavelength intervals and 2) dividing each interval with proper Gaussian division points. The full-width-half-maximum (FWHM) and number of Gaussian division points for one FWHM (N_0) and minimum number of Gaussian division points are specified in the configuration file.

1) We start from the shortest wavelength with an interval of one FWHM of the ISRF. If there is a strong absorption line in the interval, the boundary of the interval is set to the position of the strong line, so this interval is smaller than one FWHM. The next interval starts from the position of the strong line with one FWHM interval again. This process is repeated until the last wavelength of the wavelength grid.

2) If the interval is one FWHM, the interval is divided by the number of Gaussian points. If the interval is smaller than one FWHM, the number of Gaussian points is scaled with the size of the interval. For example, if the interval is half of one FWHM, the number of Gaussian point is 0.5 N_0. If the scaled number of Gaussian points is smaller than the minimum number of Gaussian points, the minimum number of Gaussian points is used. Note that the Gaussian quadrature weights and abscissae are determined for each interval.

Therefore, the wavelength grid is not equidistant: a finer wavelength grid is used for denser absorption lines, and a coarser grid is created if there are no absorption lines.

3. *Figure 3, I thought it would be more natural to use optical depth as a vertical coordinate in radiative transfer. Thus to me using pressure as the vertical coordinates is a bit unusual. This is just a comment and I won't force the authors to make any changes, as this would be most likely an overhaul of the computer code.*

Thank you for this comment. We think that pressure as a vertical coordinate is convenient for users and applications, therefore it is used in the input and output of DISAMAR. However, we calculate optical thickness per layer, because the optical thickness is the vertical coordinate that is used in the doubling-adding scheme.

4. *Line 150-151, the paper discussed different Gaussian quadrature points for different optical depth situation. Again it would much natural to use optical depth as the vertical grid, so that you would easily built a universal criterion of how many discrete layers are needed in terms of optical depth. By the way, how large is the optical depth considered as "thick"?*

We do not have a universal criterion to determine number of layers. We have to try out different settings. We usually assume optical thickness of larger than 10 is 'thick'.

5. *Line 408, please give a list of "strong" absorbers and their associated wavelength ranges to which DISMAS should not be applied. How strong of a gas absorption line is considered strong?*

Weak absorbers such as NO_2, HCHO, O_3 (visible only), BrO, SO_2, O_2-O_2 can be used in DISMAS. The optical thickness of these weak absorbers is smaller than 0.1, which meets our assumption. O_2, H_2O, CH_4, CO, O_3 (UV) cannot be used in DISMAS. We have added the list of absorbers that can be used in DISMAS in the manuscript close to line 425.

DISMAS can be used for the retrieval of total columns of weakly absorbing gases, like O_3 (in visible wavelength range), NO_2, SO_2, BrO, and CH_2O, but not for strong absorbers, such as O_2, H_2O, CH_4, CO, O_3 (UV).

6. For the spherical shell correction, there are some new developments recently. Specifically

Korkin, E.-S. Yang, R. Spurr, C. Emde, P. Zhai, N. Krotkov, A. Vasilkov, A. Lyapustin,

Numerical results for polarized light scattering in a spherical atmosphere, Journal of Quantitative Spectroscopy and Radiative Transfer, Volume 287, 2022, 108194, ISSN 0022-4073, https://doi.org/10.1016/j.jqsrt.2022.108194.

(https://www.sciencedirect.com/science/article/pii/S0022407322001297)

Peng-Wang Zhai, Yongxiang Hu, An improved pseudo spherical shell algorithm for vector radiative transfer, Journal of Quantitative Spectroscopy and Radiative Transfer,

Volume 282, 2022, 108132, ISSN 0022-4073, https://doi.org/10.1016/j.jqsrt.2022.108132.

(https://www.sciencedirect.com/science/article/pii/S0022407322000693)

Thank you for the references.

For Raman scattering and other inelastic scattering in the ocean waters, there are some new development as well:

Peng-Wang Zhai, Yongxiang Hu, David M. Winker, Bryan A. Franz, and Emmanuel Boss, "Contribution of Raman scattering to polarized radiation field in ocean waters," Opt. Express 23, 23582-23596 (2015)

Peng-Wang Zhai, Yongxiang Hu, David M. Winker, Bryan A. Franz, Jeremy Werdell, and Emmanuel Boss, "Vector radiative transfer model for coupled atmosphere and ocean systems including inelastic sources in ocean waters," Opt. Express 25, A223-A239 (2017)

Thank you for the references.