Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2020-424

Anonymous Referee #2

Referee comment on "A new gas absorption optical depth parameterisation for RTTOV version 13" by James Hocking et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2020-424-RC2, 2021

Summary: A well-written paper that elucidates the key issues associated with transmittance regression training in the RTTOV model. Some elements are missing that harm the reproducability aspect, particularly regarding the "correction term" and how exactly that is implemented. I have some minor comments below, and some questtions that could be answered in the text in a future revision.

Minor issues / formatting:

Equation 1: formatting needs improvement. If LaTeX formulation is being used in the equation, enclosing the /mathrm tag will make the text non-italic.

e.g., /mathrm{mixed}, consider /mathrm{O}_3 as well

Throughout: "i.e." should have a comma after it, unless there's a specific style requirement here that I'm not aware of. First seen on line 140.

Figures 13 and 16: could be larger for viewability

Table A3 can be cleaned up with regard to italicization of species, subscripts etc.

Technical elements:

Line 144 - 146:

"Finally, where any individual predicted gas layer optical depth is less than zero, it is set to zero before the correction term regression is computed. Similarly, where the predicted total layer optical depth (including the correction term) is less than zero, this is also set to zero."

Does this "truncation" introduce biases into the regression correction term?

Regarding excluding the Rayleigh scattering calculation from LBLRTM, I wonder how this choice impacts UV channel simulations for future expansions? Seems like it would be potentially preferable to keep the Rayleigh option from LBLRTM on the table as a backup.

Also, Rayleigh scattering has a polarization dependence, which does not seem to be accounted for here.

In the work leading up to figure 1, did you recompute the v7, v9, and v13 predictors for CO_2 to reflect current values?

Figure 1: A clean read of this figure suggests that v7 predictors perform better than v13 on the whole, with notable exception at 13.36 microns.

Across figures 2-8, the additional noise in the visible / near-IR channels suggests that, perhaps, the correction term is not an adequate approach compared to the V7/V9 methods. i suspect that there's an additional correction that would be needed here, but without knowing the specific coding details, it's impossible to speculate what that might be.

Figure 10,11 really needs a %difference plot to understand the difference in Jacobians, particularly at the upper atmosphere.

Figure 12: Looks like a software package made these plots, so my recommendation may not be easy to incorporate. It looks like the mean difference and the standard deviation difference are approximately the same order of magnitude, it would be nice to see the mean difference also, similar to the standard deviation difference panel. These could both be on that panel, or on a 4th panel.

General comment: With polarized solvers coming down the pipe, and the importance of polarization to accurate RT calculations, you may want to mention somewhere in the body of this paper about the importance of polarization in transmittance calculations, particularly for Rayleigh scattering.