Atmospheric Chemistry and Physics Discussions

Interactive Comment

Interactive comment on "A modified band approach for the accurate calculation of on-line photolysis rates in stratospheric-tropospheric Chemical Transport Models" *by* J. E. Williams et al.

Anonymous Referee #4

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I was saddened in my reading of this manuscript. The authors clearly spent considerable effort to implement the best possible algorithm for computing photolysis rates in their CTM. This is a painstaking task, and I duly appreciate the effort to generate a workable solution to getting those difficult J-values computed on-line in a CTM so that they can respond immediately and correctly to changes in the local column of O3, aerosols, and clouds. The authors have a solid and clear understanding of what is needed, they appear to have expertise in spectroscopy and related issues of photodissociation, but they do not understand radiative transfer. This remains an Editor's call, but I personally could not recommend publication of this manuscript, nor would I recommend that the authors implement this in their CTM.

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In spite of their opening references to the fast-J and fast TUV (FTUV) methods that are already published, the authors continue to proceed down a path of antiquated radiative transfer. Two-stream RT solutions are truly inadequate to describe scattered light, either for clouds (with a strong forward scattering peak) or even Rayleigh scattering at large zenith angles. For the former, the primary transmission through clouds or large aerosols (ie, a volcanic stratosphere) is in the forward peak and cannot be accurately attenuated in the ¡ or 1/sqrt(3) angle used in two-stream. For the latter, the scattered light is transmitted primarily from the zenith, and thus not described by the angle used in two-stream to carry scattered light. That is why BOTH FTUV and fast-J use 8-stream multiple scattering codes, AND both can be readily implemented in CTMs.

FTUV and fast-J are truly approximation methods to the solution of computing J-values and hence approach the correct answer in the asymptotic limit of more streams and better vertical resolution. The method of scaling here is outdated and should be viewed as a parametric fit. All the corrections needed at zenith angles of 82-85, much less at >85 are unnecessary in either of the two approximation methods. The idea of errors of 20% for cloudy conditions at SZA = 60 is not acceptable. Of course 2-stream cannot do scattered light at the ground in twilight since these ray paths come from zenith angles near 0 degrees and not the 2-stream angle. These authors should really adopt modern RT methods (either FTUV or fast-J), and hence just might as well adopt either method in whole. It would be useful to know if the expertise of the authors in spectroscopy has led to improvements over these published methods in the calculation of J-values.

The band approach, initiated by this group, also seems a bit out of date. It is not clear how these bands compare with those from FTUV or fast-J. If the work here is an improvement, please make that clear so that others can adopt it. That would be useful.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 3513, 2006.

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