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Geoscientific Model Development Discussions

Interactive comment on "Photolysis rates in correlated overlapping cloud fields: Cloud-J 7.3" *by* M. J. Prather

Anonymous Referee #2

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Review of M. Prather, Photolysis rates ... GMDD 8, 4051-4073

This paper describes a recent further development of the widely used photolysis code fastj. In the presented version (named cloudj-7.3), a new method to include fractional cloud cover is introduced. The code implements several grades of sophistication, so the interested modeller can directly test which approximation already gives reasonable results compared to a more exact solution. As other papers of the author, the paper is focused and written for modellers who want to implement and work with the code. The paper developes the method using a simple example, and finally expands to the implementation of a cloud overlap model with 6 +1 groups to test and demonstrate the code and to evaluate several approximations. An improved approximation extending Neu etal. (2006) is presented. In addition, a new interpolation for the T and p dependent

quantum yields valid for tropospheric conditions of VOCs is derived.

The paper is well structured and clearly written. The topic is of general interest for modellers working in tropospheric chemistry, as clouds are a main uncertainty for the calculation of photolysis rates. In addition, the spread of high spatial resolutions codes demands fast and reliable codes. I only have minor comments and recommend the paper for publication after some small improvements.

1.) The derivation of eq. (10) is unclear. The term 'correlation coefficient' for the parameter cc links it to a statistical property of the cloud layers which is not further detailed in the paper and which is probably not really necessary. The 'definition' of cc in P4059L21ff as related to a correlation length is not further justified. This also makes the characterization of G6/.33 as the 'best' at least doubtable.

2.) Given the spread in Fig. 3 using the different approximations one may ask if the photolysis rates are still consistent with the solar flux calculated in the corresponding meteorological model, especially near the ground, should they? Is there any possibility to validate the code using a 3D code, at least for one cloudy profile?

3.) The average bias shown in Fig. 3 is derived from a 3h period on a equatorial belt (P4061L5) including all longitudes (caption Fig. 3). Or only longitudes with SZA < 90°?

Very minor comments:

Sometimes, the use of tenses seems not to be consistent (examples: P4059L13 will scale, L18 was added, L20 chose, P4062L12, P4062L26 did not perform, and others).

At some places, the sentences are rather cryptic, see for example: L4060L5 ff.

P4052L18: intensity and spectral distribution

P4054L12: approximate

P4054L13: cloud fraction f

P4054L14: increasing? f<1!

P4060LL3 require

P4044 eq(1): it would be nice to have the designation of f in the equations identical to the figure.

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