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Geoscientific Model Development Discussions

Interactive comment on "Implementation of the Fast-JX Photolysis scheme into the UKCA component of the MetUM chemistry climate model" *by* P. J. Telford et al.

Anonymous Referee #1

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An excellent model development paper that transcends mere development and teaches us, giving us a new scientific understanding of atmospheric chemistry. For the most part this paper is clearly written. It contains no extraneous material, and it accurately describes the new MetUM chemistry-climate model. There are some minor revisions that I recommend below, but otherwise this manuscript should proceed almost directly to GMD.

3218/8 Indeed the 'new methods of validating' are excellent and make important scientific contributions to our understanding of atmospheric chemistry.

3218-3219 Introductory section is clear and cleanly written.

3219/24 This shift from ERA-40 to ERA-Interim is very important, as we all remember the troubles with ERA-40. If possible it would be good to have a very short section on what improved or worsened with this change.

3220/11 Perhaps begin this sentence with clarification that we are not looking at radical change in the overall rate of HO2 + NO, but its small quantum yield to HNO3: " In terms of reactions that transform NOx to HNO3, we also. . ."

3220/17 Is methane fixed at 1.76 ppm (NOT 'v') throughout the stratosphere also? Note if a fall-off similar to observed is used. Also, the 'v' is incorrect and we all need to expunge it. Measurements are made as mole fraction relative to dry air. The 'volume' is incorrect as the Virial corrections are not applied. And thus 'by volume' has some potentially large and undefined errors.

3221/2-4 For the VOCs, the Tg yr-1 is correct, but for the lightning and soil NOx the units should be Tg-N yr-1.

3223/1 ' of this code (v64) into. . ." - if possible insert version that you took, it is used later also. The only significant changes post v64 in fast-JX are noted in the later versions, you may or may not want to note these insofar as it impacts your analysis later. V66: JPL-2010 updated (not VOC) gives very small changes; NO X-sections multiplied by 0.6 based on CCMVal analysis. V67: All VOCs updated to JPL-2010, some large changes.

3223/16 'cross section (including quantum yields). . .' /17 For all species but O(1D) the quantum yields are included with the X-sections. Not sure how you want to say this. /24 Somewhere in Bian's fast-J2 paper it notes that these J's were designed to be good to about 64 km (0.1 hPa), but not much above because the larger S-R cross sections were ignored and Lyman-alpha is not included.

3224/7-10 Give units of LWP, also the units of the parameters make no sense to this reviewer: e.g., the 'b' unit is 1670 m/kg, when I divide by the cloud R-eff (m), I get 1/kg,

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which is then added to the 'a' parameter with units of m2/kg (this unit makes sense). Am I missing something?

3227/19 (as above) – you can note that the more recent fast-JX versions recommend scaling the NO X-section by 0.6 to deal with this.

3228/1-12 This is very useful knowledge for the community and could be expanded as much as the authors wish.

3230/16 Use of "frequencies" to described the photolysis rates is odd, I keep thinking maybe you mean different wavelengths?

3231/4 "much attrib...ozone column" – Is this compatible with the fact that J-O1D is probably the most sensitive J-value to ozone column? Most of the others are in the blue region which is less sensitive. /14 Lower => shorter wavelength bins

3234/15-18 Good point. /19-27 Interesting analysis, this is clearly an area where almost all of us are puzzled.

3237/14-20 This section missed a proofreading. "Even with resolution of the biases in ozone there are still potential ways....One obvious opinion regards...." Also use of "import" in line 20 reads awkwardly. Figure 9 is difficult to read and get a message from – is there any easier way to show the data?

Interactive comment on Geosci. Model Dev. Discuss., 5, 3217, 2012.