

Interactive comment on “Impact of tropospheric nitrogen dioxide on the regional radiation budget” by A. P. Vasilkov et al.

Anonymous Referee #1

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Review of “Impact of tropospheric nitrogen dioxide on the regional radiation budget”, submitted to ACPD

Paper Summary:

This paper calculates the global distribution of net atmospheric heating from NO₂ absorption based on cloud, surface and NO₂ information on the A-Train satellite constellation and provide a parameterization that can very be easily incorporated into std radiative transfer code. They assess the sensitivity of this calculation on SZA, albedo, cloud profiles vs. altitude of absorbing layer, and the chemical lifetime of NO₂. The show, as expected, that the net effect of NO₂ on the global radiative budget is small, but found that local, instantaneous absorption can be quite high (2-4 W/m², clear sky 1°x1°).

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General Comments:

I found this paper very clearly written, with assumptions plainly stated and past work sufficiently referenced. I think my main comments are to provide more clearly stated/accessible numbers and for more discussion of the consequences of these calculations for atmospheric temperatures/radiation budget under the general question of “why should we care about NO₂ absorption?” as detailed below.

Specific Comments:

- 1) The surface albedo error is very big (Fig 3). Do you have any estimate for your observational albedo error estimate and how this will affect your in practice results presented in section 4?
- 2) p12682 ~L5 states layer heights to which NAH are = to case where NO₂ uniformly distributed within cloud are different. Does this affect the conclusions in the Solomon et al., 1999 paper? NAH & zenith radiance in the uniform case is also v. different within the two clouds. Can this tell us something more broadly about the importance of cloud height (low vs high clouds) in affecting NO₂ NAH?
- 3) While the NAH of NO₂ it is small, I suggest giving the number for the direct global mean and range Jan/July NO₂ NAH somewhere.
- 4) Can you say something as to 2-4 W/m² mean in terms of local surface temperature change? Dynamical changes? (e.g., climate sensitivity thought to be 0.7 K(W/m²)-1, ..not sure if that is correct number).
- 5) P12691: Can you give estimates of the combined tropospheric and stratospheric NO₂ contribution. It is unclear to me from the text that NO₂ absorption is important to include.
- 6) I think the abstract and conclusion would very much benefit from more quantitative information for ease of access for readers, in particular:

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- “we compute global distribution...for Jan/July 2005” to we compute global distribution. . . xx-xx W/m2 NAH Jan/July with maximum over. . .
 - “We assess the impact of clouds. . .” clear sky vs. cloudy causes xx-xx % difference, cloudy/clear sky, with max effect over. . .
 - “diurnal averaging. . .” causes . . .xx %
- 7) Suggest saturating color scale in Fig 6 at lower value so we can see a bit more of the structure of biomass burning region/Europe comparison etc.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 12675, 2009.