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Evaluation of updated photodissociation scheme on CHASER model: the impact to chemical reaction in troposphere

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To improve the accuracy of calculated photodissociation rates (J-values) in global chemical climate/transport model (CHASER), we updated the scheme for estimation of absorption cross section (ACS) and quantum yield (QY), which is coupled with the broadband radiative transfer model in AGCM. The new scheme used data from NASA-JPL recommendations in 2006 (Sander et al., 2006). Based on the method of Langdraf and Crutzen (1997), ACS and QY were weighted by the attenuated solar spectrum and were averaged into the bins. The average value obtained at each grid point of the model was approximated by multivariable polynomial of temperature, pressure, and a partial ozone column. The comparison between the result of old and new scheme shows that 1) the changes of J-values for ozone photodissociation of both two channels (O_3->O_2+O(^{1}D), O_3->O_2+O) are less than 10% in the troposphere but indicate considerable increase in tropics and decrease in polar region, 2) J-values for some ketones increase in free troposphere, reflecting the pressure-depentdent variation of quantum yield, and 3) updated ACS of formaldehyde (HCHO) increased the photodissociation rate of both of channels (HCHO->CO+2HO_2, HCHO->CO+H_2), and as a result, the chemical production rate of CO was increased in the tropical region.

Keywords: atmospheric chemistry, photochemical reaction, chemical climate model, atmospheric radiation