

***Interactive comment on* “The impact of aerosols on photolysis frequencies and ozone production in urban Beijing during the four-year period 2012–2015” by Wenjie Wang et al.**

Anonymous Referee #2

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Comments on “The impact of aerosols on photolysis frequencies and ozone production in urban Beijing during the four-year period 2012–2015”

This paper is investigating the effect of aod on $J(O_1D)$ and $J(NO_2)$ photolysis rates, considering not only the significance of photolysis rates in atmospheric chemistry but also taking into account the continuously increasing pollution in the area of Beijing. The results demonstrate the stronger extinction of actinic flux (and photolysis rates) due to aerosols in urban Beijing compared to other sites. The paper is clearly written, the methodology is well understood and the results are well summarized.

COMMENTS

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1) In the introduction, after the definition of actinic flux (line 68) the authors could include that since the photolysis rates are proportional to the actinic flux and not all stations acquire a 2π spectroradiometer or chemical actinometers for J measurements, several methods have been developed to determine actinic flux and photolysis rates from ground based measurements of irradiance (Kylling et al 2003, Kazadzis al. 2000, 2004, Topaloglou et al. 2005, Trebs et al. 2009).

2) It is stated, in the abstract, that the reduction of J(O1D) and J(NO2) is in the order of 24.2% and 30.4% (for summer and winter respectively) while for the J(NO2) in the order of (27.3 an 32.6%) compared to an aerosol free atmosphere (aod=0?). Since the parametric equations include sza and AOD, the authors could clarify how exactly these percentages have been calculated i) to what sza are these percentages referring to? Also for what ozone class for J(O1D)? ii) are these maximum reductions for maximum aod observed or for a mean aod value (i.e. 0.76)? iii) Through which parameters are summer and winter percentages calculated?

3) How do the authors comment the (low) r2 coefficient in the linear fits of of J(O1D) and J(NO2) versus aod for aod<0.7?

4) Concerning the TUV radiation model, information (apart from ssa values) about the input that was used could be included, such as solar spectrum used, aerosol profile etc. In p.2.2 it is stated that global irradiance spectra are calculated. Do you maybe mean actinic flux spectra? Since photolysis rates are proportional to actinic flux, has any comparison been done between the actinic flux measured by the spectroradiometer and that from the TUV model in order to demonstrate the level of agreement?

5) In line 419, the enhanced aerosol level in Beijing is quantified (4-year mead aod = 0.76 ± 0.76). Some references to the studies should be included

6) In Line 254: "...according to another study in urban Beijing, ..", the reference of the study should be included.

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7) Figure 6: Similar results have been obtained by Bais et al., 2005, Krotkov et al., 2004 and Kazadzis et al., 2017). Is this AOD -SSA dependence from August 2012 obvious during all seasons ? For which wavelength are SSA values given? As both parameters have a wavelength dependence and since PF ozone "effective" wavelengths are ~305-315nm, could this dependence play some role in the provided analysis of the AOD and SSA effects on PFs. ?

8) Figures 4 and 7 : Some commentation on the scatter of J's would be helpful Technical corrections

Line 249-250: Repetition of "in summer" "This implies that the aerosols in summer have stronger extinction capacity in summer than in winter"

Lines 384 &385: cos(SZA) instead of SZA

Line 423: "..The result of this study is comparable to the reduction ratio of this study possibly due to.". Probably the one "this study" refers to the previous study mentioned, Hodzie et el. 2007 and the second one to the authors study, it would be helpful to rephrase.

Line 559: "...in August 2014..", refers to the field campaign in August 2012, mentioned in the paper.

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