

Interactive comment on “Relationship between the NO₂ photolysis frequency and the solar global irradiance” by I. Trebs et al.

Anonymous Referee #1

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Based on a large amount of experimental evidence collected at different sites, the authors derived an empirical relationship to calculate the photodissociation rate of nitrogen dioxide (j_{NO_2}) as a function of the global radiation. This relationship can be very useful in modelling and experimental studies in absence of direct measurements of j_{NO_2} . I found the paper very interesting, with an appropriate structure and well written. However, in my opinion, the authors fell short in demonstrating the validity of the expression under cloudy conditions. By so doing, they can show that the proposed expression is more general than the currently proposed ones. In view of the completeness of the data set, the authors are in a unique position to provide a better understanding of the relation between G and j_{NO_2} under different cloud condition characteristics. Below my specific comments:

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1.- As mentioned, I think it is necessary to introduce new figures and a more elaborated discussion on how equation (1) performs under cloud conditions. The sentence at line 17-18 (page 1552) is very vague and the figures do not show the performance of the relationship with clouds.

2.- Since the data set is very complete, I will encourage the authors to provide a deeper verification of expression (1) as a function of cloud optical depth and cloud cover. The reader will appreciate very much if the following questions are answered:

- Is the decrease of the global radiation below the cloud linearly proportional to the NO₂ photodissociation rate?
- Is expression (1) valid for all cloud optical depth?
- Does expression (1) perform similarly under conditions of total cloud cover ($cc=1$) or scatter clouds ($cc<1$)?
- Is there any effect of the radiation scatter at the cloud sides?

In my opinion, the authors can treat the data sets at the measurement sites to provide concrete answers to the questions.

3.- For the completeness of the paper, the UV-albedo of the different sites needs to be introduced at table 1.

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