Reply to comments by Referee #1

Overall comments.

In this paper, the authors described detailed experiment assessment of the performance of several filter radiometers for the measurement of the photolysis frequency j-(O1D). Although these radiometers have been somewhat superseded by the use of spectroradiometers, as the authors point out, the literature still suggests that the use of these radiometers is still widespread in the atmospheric chemistry community and still provide valuable data on this photolysis frequency especially when spectroradiometer are not available.
The paper describes several important findings about the nature of these radiometers and describes how to employ necessary instrument corrections for the future use of filter radiometers. In addition, which was encouraging to see, the authors re-evaluated the data from a previous field campaign to ascertain the effect of the new corrections on literature data. The paper is well written and its scope is within the parameters for publication in AMTD following some clarifications I feel would help the reader in understanding the experimental work done here.

We thank referee #1 for the positive evaluation and give detailed answers to specific questions and recommendations below:

Specific comments.

(1) *Section 2.2, Following their dismantling, the lab characteristics of the instruments are compared. The authors discuss the parameter Drel and how it was measured from 280 500nm. This "tail" in the sensitivity is discussed in section 3.2 with respect to the potential of counting photons in this region as signal and hence, incorrectly assessing j-(O1D). Although section 3.2 explains this feature, upon first reading it was unclear to me why this spectral region was considered as this is clearly far beyond the normal spectral window of j-(O1D) of 290-340nm. I feel that this section should be reworded or this section merged with section 3.2 to make it clear why such a broad spectral window was evaluated. As this is one of the most important findings of the paper, it would help the reader greatly if this was clarified.*

Reply: We agree that the wide spectral range considered may confuse readers upon first reading. We added a sentence that gives an explanation at the beginning of Sect. 22:
“For a quantitative evaluation of the filter radiometer data, the relative spectral sensitivities D_{rel} of the instruments in a range 280-500 nm are required. This wide spectral range is necessary because of an imperfect blocking of interference filters resulting in unwanted

signal contributions, as explained in more detail in Sects. 3.1 and 3.2. The spectral sensitivities were determined ..."

(2) *Figure 3: The authors describe the performance of the instruments at the peak and at the tail of the wavelength ranges tested but say nothing about the strange increase in sensitivity (Drel) that is seen in all instruments at around 340nm. I do not understand why all of the radiometers tested show this apparent increase at the traditional wavelength "cut off" for j-(O1D) and this feature should be explained, even if it is removed by the application of the filter described in the paper as shown in Figure 4. Is this some sort of artifact in the PMT response of the instruments?*

Reply: This spectral feature comes from the type of interference filter used in the old configuration. It also shows up in the manufacturer's data sheets. We'll mention this at the end of the first paragraph of Sect. 3.1:
"As will be shown in the next section even such small residual D_{rel} in a range up to 500 nm can affect the performance of the instruments under low sun conditions. The secondary peak around 340 nm found for all instruments is a feature of the MAZ-8 interference filter which is in line with the typical transmittance curve provided by the manufacturer."

(3) *Conclusion Clearly, the paper describes the improvements made in the determination of j-(O1D) by filter radiometer. As j-(O1D) is the driving force for much of the OH chemistry of the troposphere, it might be useful to include a few sentences on how atmospheric chemists that determined OH concentrations derived from the j-(O1D) data provided by filter radiometer could benefit from the new and improved determinations of j-(O1D). I assume that the correction factors would be small enough to not significantly affect OH concentrations (which of course, rely on several production and loss steps), but it would be perhaps useful for the authors to add a few sentences on whether they feel literature data of OH should be re-evaluated based on their findings.*

Reply:
We extended the conclusions section accordingly and added a few sentences to clarify the importance of calibrations and correction factors for radical chemistry related questions:
"These calibrations ensure that the measured data are accurate, in particular under conditions of small solar zenith angles when $j(O^1D)$ is high and important, e.g. for predictions of noontime OH radical concentrations and the atmospheric oxidizing capacity. The complementary correction factors gain significance under conditions with low sun when $j(O^1D)$ is getting smaller which is important, e.g. for an accurate assessment of ozone

photolysis compared to other primary radical sources like HNO_2 or $ClNO_2$ photolysis in the early morning. Overall, filter radiometers are suitable to accurately measure $j(O^1D)$ in a wide dynamic range. In this work previously described deficiencies of the investigated instruments were examined and widely removed. However, these deficiencies are considered moderate and require no major revision of previous work caused by incorrect $j(O^1D)$."

(4) Minor comments

Page 4: Line 13: Sentence should read, "The outdoor units were connected to external power via 10-20m cables" rather that the other way around.
Page 8, Line 33: Sentence should read, "The quality of the data is now very similar", rather than the other way around.

Reply: These changes were made as recommended.