

## ***Interactive comment on “Data flow of spectral UV measurements at Sodankylä and Jokioinen” by J. S. Mäkelä et al.***

**J. S. Mäkelä et al.**

kaisa.lakkala@fmi.fi

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Authors' response to the review of the manuscript “Data flow of spectral UV measurements at Sodankylä and Jokioinen” by Mäkelä et al.

The Authors appreciate the constructive comments of the Referee #2 and respond here below to each remark. The comments/questions presented by the referee are indicated as C. The answers are indicated as A. The manuscript has been upgraded following the referee's comments. The corresponding changes in the manuscript are indicated as U.

The revised manuscript has been uploaded as supplement.

C: This paper does not provide any scientifically sound results. It contains a pure out-

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line of the procedures followed for the UV measurements at the two FMI stations but it does not contain any details of the methods or algorithms used in these procedures, or any data. In its present form, it can serve only as a source of general information, like a web site. It is true that detailed descriptions of sites and procedures and different steps in the data processing chain have been published elsewhere, but just a listing of procedures and referencing other papers cannot justify the publication of the manuscript. I think it must be further expanded and structured in a way that could be useful and applicable to other, for example newly established, stations. Furthermore, I think that it could be useful to show at least some sort of time series with measurements at the two sites.

A: The manuscript has been considerably expanded and restructured with an objective to provide useful information in an applicable form to other stations. Description on the steps taken in the processing chain and the phases the data go through has been added, as well as details on the methods and algorithms employed. Three distinct levels of data have been identified and defined. In addition, the phases of the data flow and the outcome of the phases are illustrated using a case scan from Jokioinen.

U: The expanded manuscript is now restructured as follows: 3. Dataflow 3.1. UV data acquisition 3.2 IDEAS - A quality control tool 3.3 UV data processing 3.3.1. Calibration with Level 1 and Level 2 responsivities 3.3.2. Processing algorithms 3.3.3 Online processing - Level 1 data 3.3.4 Offline processing - Level 2 data 3.3.5 Products A case scan from Jokioinen is described in Table 1. This scan is used to illustrate the phases the data go through from the raw counts (Level 0) to calibrated (Level 1 and Level 2) irradiances and further derived dose rates. Time series of the responsivities of the instruments at a selected wavelength (305 nm) are shown.

Specific comments

C: 59-68: Are these statements supported only by “Groebner personal communication”? There have not been published elsewhere?

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A: The text has been changed to: The difficulty of the absolute calibration was already seen in intercomparison campaigns of the 1990's (Josefsson et al. 1994, Koskela et al. 1997) and in twenty-first century (e.g., Bais et al. 2001), in which the range of the deviations from the reference for UV spectra was up to  $\pm 20\%$ . Despite the efforts to homogenize measurements, in the last European Brewer comparison organized by the COST 1207 project in El Arenosillo, Spain, six Brewers out of 18 differed by more than 10% from the reference, when using the calibration provided by the operator ([http://www.pmodwrc.ch/wcc\\_uv/wcc\\_uv.php?topic=qasume\\_audit](http://www.pmodwrc.ch/wcc_uv/wcc_uv.php?topic=qasume_audit)). The differences are most likely due to slightly different data correction and data processing procedures (for example different procedures to correct for temperature and angular response). Since so many corrections have to be made, small variations can lead to large differences in the outcome."

C: 131: Is there any reference where the cosine correction procedure is described?

A: There is a reference to the procedure available.

U: The reference has been added. "This information and the total ozone calculated by the Brewer is used in the cosine correction procedure (Lakkala et al. 2008)."

C: 131: AWS sampling is ten minutes but the flowchart in Figure 4 states 5 min. Which of the two is correct?

A: AWS sampling is ten minutes, and the data is uploaded to the FMI climate database. The data is downloaded from the database whenever a new UV scan is transferred to the central server.

U: The Figure 6 has been updated and the text modified accordingly.

C: 136: Similarly, any reference that describes the use of SL-501 for Brewer QA? Otherwise some more information should be added.

A: There is a reference available.

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U: The reference has been added and some text added: "These measurements are used in offline quality assurance (QA) procedures to identify erroneous measurements, and to obtain information on changes in the cloud cover (Lakkala et al. 2008)."

C: 151 The paper is about UV measurements. The discussion here and Figure 5 are for total ozone. I suggest to remove both.

A: The authors agree.

U: The discussion has been removed.

C: 151-157: The stability of the UV measurements should be mainly assessed by the 1kW calibration lamps which are not mentioned here, and the 50 W lamps are mainly supporting the assessment of shorter term variations.

A: The authors agree.

U: A new section 3.3.1. "Calibration with Level 1 and Level 2 responsivities" has been added to the manuscript.

C: 183: Most spectral quantities extend beyond the spectral range of the measurements. How is this taken into account and what are the uncertainties involved?

A: We have added some discussion and a clarifying figure in Section 3.3.5.

U: The following text on the method for extending the spectrum has been added in section 3.3.5: "For the calculation of the dose rates requiring integration beyond the upper wavelength limit of the Brewer, the measured spectra are extended using a pre-defined reference UVA spectrum. The extension is adjusted onto the level of the measured spectrum by linear conversion. The ratio of the measured irradiance to the reference irradiance at selected wavelength is used as a scaling factor. For Brewer #037, the wavelength of 324 nm, and for Brewer #107 and #214, the wavelength of 361 nm is used as a point of adjustment." In addition, the following discussion on the uncertainties involved has been included: "All action spectra in routine processing approach

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zero towards the longer UVA wavelengths. This means that the uncertainty caused by the artificial UVA extension to the computed dose rate is of the order of 10-3. For the unweighted UV and UVA dose rates, our investigation based on a radiative transfer model simulation suggest uncertainties as high as approx. 2 % caused by the constant scaled UVA extension. This finding is in line with the result obtained by Fioletov et al. 2004.”

C: 185-195: The list of different quantities could be supported by a figure with action spectra and a description of how these effective does are calculated. Of course all these are already published elsewhere, but for the completeness of the presentation it would be useful to be included.

A: The authors agree.

U: We have added a description on how the dose rates are calculated in section 3.3.5. A figure on the different action spectra in routine use is also added.

C: 220-221: Again the paper is focused on UV measurements. It could discuss briefly ozone, but showing a figure for ozone (Figure 8) is too much. I suggest removing this Figure.

A: We agree.

U: The figure has been removed.

C: 369: The quality of the flow chart could be improved

A: We agree.

U: The flow chart has been upgraded.

C: 386: The quality of the flow chart is very poor.

A: Indeed, the quality of the flow chart can be substantially improved.

U: The flow chart has been upgraded.

C5

Please also note the supplement to this comment:

<http://www.geosci-instrum-method-data-syst-discuss.net/gi-2015-42/gi-2015-42-AC2-supplement.pdf>

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Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., doi:10.5194/gi-2015-42, 2016.

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