Atmospheric
Measurement
Techniques
Open Access

Discussions

EGU

AMTD

Interactive
comment

Interactive comment on "Examination on total ozone column retrievals by Brewer spectrophotometry using different processing software" *by* Anna Maria Siani et al.

Anonymous Referee #1

Received and published: 10 February 2018

Genereal comments: This paper provides comparison of three data retrieval software available to Brewer spectrophotometer users. As the data retrieved with different software might sometimes be compared to each other or used side by side without knowing the original software used, the information about any possible biases or false trends or other discrepancies any algorithm might produce is important. This is especially true for Brewer instruments that are, together with Dobson spectrometers, the most reliable source of total ozone column data. The way each software tracks changes and drifts in the instrument are considered in the paper. Mean biases in comparison to other software are defined. However there is no discussion if using specific software could affect the trends in any way.

While the differences between the software are quite nicely quantified, the analysis does not go very deep into thinking what could cause the differences. Only source of difference considered in more detail was the way to apply standard lamp test information. The standard lamp test being the way to follow the changes in the instruments spectral sensitivity that affects the ozone retrieval significantly. However even for this variable there was no quantification of its effect; if it explains all the difference or not. Also using only the daily averages produced by the software, the information is lost if the differences are due to different way of selecting "good" measurements or because of something that happens when processing a single measurement.

There should be more detailed analysis if the standard lamp correction makes all the difference or if there is more reasons and what the reasons could be. Also comparison of data rejection rules is required when comparing daily average values.

I found the paper quite well structured in general but there were some irregularities that are highlighted in specific and technical comments. The language was heavy to read at times, when too much information was being compressed into a single sentence. This was highlighted by extensive use of parentheses.

Specific comments:

Abstract line 32: if the difference between software is in order of the instrument uncertainty is it a good result? I would expect different software that calculate the same thing to be well within the uncertainty of the measurement itself.

page 3 line 51 inaccurate phrasing, maybe "...to measure ground level spectral intensities of solar ultraviolet radiation attenuated by ozone absorption. Form these spectra it is possible...

line 108 "by measuring irradiances of the direct sunlight,..."

there are also measurement mode for focused sun (Josefsson, W. A. P. (1992), Focused sun observations using a Brewer ozone spectrophotometer, J. Geophys. Res.,

97(D14), 15813–15817, doi:10.1029/92JD01030.)

Perhaps the other modes are entitled to some reference if the global irradiance one is?

line 113 Dont both these papers conclude the ds accuracy of 1%?

line 118 the slit information is very specific so you need to introduce the operation of the slitmask before. Maybe leave out the specific slit number and just say wavelengths are selected by rapidly rotaing slitmask and photon counts are registered by a photo-multiplier.

line 120 Maybe highlight that dark count and dead time are characteristics of the pho-tomultiplier to help people not familiar with Brewers to have a clue what these are.

line 124 you have only introduced four wavelengths so no need to say "longer" here

line 143 suggested change "weighted ozone absorption coefficient" to" differential ozone absorption coefficient"

line 162 change to "conditions with small..."

line 184 mentioning the slit mask here also makes it even more important to introduce its meaning earlier in the text

line 207 Highlight that the reference value is determined at every calibration.

line 211 Hard to interpret but i think i finally understood it. Suggest to give out the normal case first (abs(r6ref - r6) <= 250 units)

The way BPS determines the r6 reference value may already introduce offset as for others the r6 is given by hand after the calibration based on the sl test values during calibration campaign. Offset propably very small though but should be looked into.

line 228 There is a lot of information here not relevant of how the sl test is introduced in EUBREWNET algorithm

These differences of processing software specific rejection rules should be stated es-

pecially where they differ but this is not the right position for them as this paragraph was supposed to be about sl-test. Could you add data rejection criteria to a more suitable place in text?

line 335 By using daily mean values you include the effect of different rejection criteria also. Would be good to see if there is more or less perfect agreement when comparing simultaneous measurements or if there are differences even then.

Maybe there should have been a seperate comparison of individual measurements and the resulting daily values? Comparing the individual measurements might have given more clue of the origin of the differences.

Usually daily values (or even more sparse time grid) are used for time series analysis, so it is important to see if any software introduces nonexistent drifts or biases to the data. Still, when comparing methods together it would be good to make more detailed analysis of where the differences come from.

Figure 1 Why are there no points in 2008 summer in EUBREWNET data?

Figure 2 upper panel I dont understand. Here the cut-off for R6smooth is for sure lower than 500 units which was stated to be the threshold earlier.

Figure 2 lower panel I assume the R6 presented in the figure 2 are daily averages. I am not sure though. I am just wondering how many sl-tests there were when such spikes appear. I think it is a bit weird that the algorithm (BPS) has been made to pick up spikes so easily and use that to mistake them as valid r6 measurements. However I am also surprised that the results may be better than with the other software during those spikes.

There should be information of standard lamp changes also. Or maybe they were changed only at calibration. Usually drifts like in Rome 2006 are caused by lamp being at the end of its lifetime but when looking at the corrected data it is apparent that the spectral response of the instrument really changed that dramatically and thus

R6smooth can not follow the changes. Changes this big are rare and probably it should be considered alarming sign if R6 changes more than the threshold of O3Brewer?

Figure 3 Could you address the amount of ozone difference because of difference in SL R6? Maybe not change these figures but in addition to this information. Just take the standard lamp part of equation (5).

line 399 I think the sl-corredction should be used especially on those days because the etc has dramatically changed. Now the O3Brewer with its cut-off does not follow the changes and the result of this is seen in figure 1 where O3Brewer data is very different than other around 2006-2007. Now if this change in r6 would have been because of a rapidly changing lamp irradiance then these values of r6 should not be used.

line 400-402 Many of these other reasons can be checked from the raw files. I think anomalous R6 values should not be used in processing the data. Smoothing filter somewhat helps avoid these spikes. I think O3Brewer might do well if there was no cut off at 500 units (or whatever the cut off is).

line 406 Why? No other sources of disparity between the sofware are really adressed than R6. Does it explain all the differences? It is stated that there are discrepancies in "good data" also but no explanation or theory or a guess what would be the reason.

There should be a case study of good measurements that differ greatly to address other sources of differences.

line 486 and table 5 Does it makes sense to think about the change in RMSE in case of O3Brewer as it has been shown in figure 1 that in special cases it does not follow the changes in spectral sensitivity of the instrument correctly. Hopefully no one uses these software so loosely that they don't check their data in case of large drifts.

line 491 It was stated earlier (page 12 line 298-) that the use of daily value is fine because ozone is so stable but here it is noted that it might have an effect.

line 501 The drift still needs to be quite fast and dramatic to exceed the O3Brewer

threshold between two calibrations (1-2 years).

line 505 Which one is most "correct". Does the BPS not follow the outliers a bit too closely? Usually the spikes are false R6 and should not be followed. The spectral sensitivity of the instrument is not expected to chance rapidly back and forth. For sure in the case of drifts it is not a good option to do the O3Brewer way and cut off but on other cases I would not want to follow every bump and spike in the R6 data.

line 515 I agree on the responsibility of the instrument operators. I also agree that there could be ways to work round some problems regarding to software behaviour. But also I think if there are behaviour in the instruments that the software dont handle well, the software should be changed accordingly if possible. I wonder if there was a way to get rid of the cut off in O3Brewer for the revised version.

Technical/typographical: page 1 line 24 loose the parentheses, maybe "Italian stations Rome and Aosta"

page 1 line 26 can you loose parentheses for example EUBREWNET level 1.5 product

page 1 line 31 remove clearly and (as expected)

page 3 line 60 This sentence should be rephrased. This sentence should be rephrased. "Satellite... made by using the solar UV light backscatterd..."

page 4 line 73 could this be rephrased to not use brackets

page 4 line 74 implementation

page 4 line 84 Brewers

line 87 suggestion to lose the parenthesis and write ... packages: the Brewer Processing Software, hereafter called BPS, deve...

line 89 confirm title for Mr Stanek

line 90 inconsistent way of using parentheses inside a single sentence, could it "be

EUBREWNET level 1.5 ozone product."

line 94 to what extent

line 95 change to "no other collocated TOC measurements were available" ? Somehow this sentence needs to be simplified

line 97 Paragraph starting here could be rewritten so that there are full stops between the sentences. The information is there but somehow the structure makes it hard to read.

line 107 suggest to leave out the (DS) from the header and introduce it in the text and "... spectrophotometer"

line 110 is this a paragraph change or not?

line 169 suggest change to "time series of the internal standard lamp tests, described in the following section."

line 180 "to verify that"

line 181 "and to follow the changes" (probably you can not really control them too much)

line 185 rephrase so there is no need for brackets, and "using an internal 20 W quartz-halogen lamp as the light source"

line 187-188 Rephrase so there is no need for parentheses.

line 189 rephrase so there is no need for parentheses. Maybe give hg test its own paragraph?

line 195 no need to repeat the lamp power in my opinion, suggest to change "is performed using the internal quartz-halogen lamp as the light source"

line 198 rephrase so you can lose the parentheses

line 201 repharse to lose the parentheses

line 227 suggest to start sentence with "Level 1.5 total ozone column data were..."

line 278 "stray light"

line 280 "is not available" to "was not available"

line 307 "The Aura satellite describes a..." to "The Aura satellite travels in a..."

line 308 suggest to start a new paragraph from "Two algorithms..."

line 313 Could this be simplified to something like: "Here we used OMI-TOMS because it has been shown to have a better agreement with the ground based Brewer and Dobson instruments. (Balis et al., 2007)" ?

line 323 Mean Bias says bias alredy so "(or bias)" is not needed

line 439 missing a full stop.

line 462 This should be stated in the caption of the picture!

figure 5 More detailed caption needed! What are the panels? It was actually in the text but the caption needs to be more detailed.

line 472 rephrase to loose the parentheses

line 476 A bit confusing way to put a sentence together. Also, can it be "about less than 1%"? It is either less than 1% or about 1%.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-441, 2018.