

Interactive comment on “A case study on biomass burning aerosols: effects on solar UV irradiance, retrieval of aerosol single scattering albedo” by A. Bagheri et al.

Anonymous Referee #2

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The paper shows data of direct sun and global irradiance, which have been measured in Norway for a clear and a turbid day. The turbid day aerosol was biomass burning aerosol due to forest fires in Eastern Europe. Thus the data can be used to show aerosol properties for a typical day at the Norwegian coast and for an example of long range transport biomass aerosol. However, the paper should be improved as mentioned in the following.

The title mentions a case study. This could be an argument for the one day biomass burning measurements, because they are seldom. However, to get typical Trondheim aerosol data, measurements averaged from some more clear days would be an advan-

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tage. What is the information content of the ratios of global and direct irradiance? The reasons are different aerosol properties, which however are mixed with different ozone. For atmospheric physics the change in the aerosol properties for clear and turbid conditions is of much more interest. They are the basics for the ratio of the irradiances. Thus instead of Fig. 1, AOD values should be shown. To model (the ratio of) global and diffuse irradiances (Fig.1) already assumptions on the single scattering albedo (SSA) are necessary, besides that on surface albedo and asymmetry factor. Thus these results are of minor relevance, even if they are fitted in a way to agree with the measurements. It is mentioned that the measurements of the direct Sun have been used to determine the spectral aerosol optical depth (AOD). However, this procedure does not need any radiative modeling, with assumptions on alpha. In contrary, alpha would be one of the results. The changes in AOD for the different conditions should be shown as a result. It directly could explain the effects for the direct irradiances, including variable Ozone. Moreover, the values of alpha could be used to test the assumptions on the aerosol type.

Global irradiance and direct irradiance have been measured with different instruments, with different calibration. Is this the reason why not direct measurements have been shown, but only ratios? Taking into account the width of the filters, the data should be made comparable and used to determine the diffuse irradiance directly from the measurements. Based on these data, and individually for each wavelength with measurements, the SSA should be determined with the DDR method, as mentioned. If this is done independently for the wavelengths with global irradiance measurements, no assumptions for alpha are necessary and the actual ozone could be taken into account directly. Is there an explanation for the low SSA values for the background aerosol (Fig.3)?

As a consequence of improved results, the abstract and the figures would change. The introduction could be shortened to the topics analyzed in this paper. In the radiative transfer modeling chapter it is not clear, how different AOD at different wavelengths

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can be combined with independent assumptions on alpha and aerosol type. Why has urban aerosol been used for the lower level? What about sea salt or clean continental? Does the measured SSA for the clear day fit with the SSA results coming for the aerosol assumptions in the model? In the uncertainty analysis for SSA no uncertainty for the irradiance measurements has been taken into account.

Minor suggestions: What is the reason for the sentence on effects of long-term and short-term changes on page 17988 lines 20+21 ? Is the effect of aerosol vertical height really responsible for a 25% effect in the irradiance at the surface (17989/14-16)? I can not imaging, but if so, it should be taken into account in the analysis. If the quantity beta is shown (17989/20), it should be explained. No different words for the same instrument should be used: monochromator = spectroradiometer (17990 /18 + 21). GUV should not be mentioned before it is explained (17990/17+26). The filter radiometer was not "also" used to measure global irradiance (17990/26), it was only used to measure global irradiance. The data for AOD and SSA for the two aerosol types should be combined in a table.

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