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Interactive comment on "Seasonal distribution of aerosol properties over Europe and their impact on UV irradiance" *by* N. Y. Chubarova

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The answers to the Interactive comment on "Seasonal distribution of aerosol properties over Europe and their impact on UV irradiance" by N. Y. Chubarova by Anonymous Referee #2

I would like to thank anonymous reviewer #2, whose comments help to improve the text. 1. Abstract. To indicate that the aerosol optical thicknesses are monthly mean, the time period considered is from 2000 to 2008, and the aerosol impact on UV irradiance is comparable with the total ozone influence.

I have added the "monthly mean" characteristics and periods in the first sentence of the abstract: Using the aerosol optical thickness at 550nm from MODIS (collection 5)

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for the 2000-2008 period combined with the aerosol products from the ground-based AERONET network since 1996, monthly mean values of key aerosol parameters have been obtained with 1 degree resolution over Europe.

Mean ozone dramatically attenuates Qe- irradiance (10- 100s times). In Discussion and Conclusions I am only speaking about the possible comparable effects in Qe variations driven by ozone and by aerosol in some conditions (low solar elevation, high aerosol loading). I am not sure I need to include this discussion in the abstract.

2. p. 1865 Parag. 20: Describe how overcast cloudiness, which is usual over Europe, can affect the MODIS aerosol dataset in various regions and seasons.

MODIS have the most reliable cloud filtering procedure compared with other aerosol products. I have added the following paragraph from MODIS webpage.

For cloud filtering a standard MODIS cloud mask (MOD/MYD35) is used, which employs a series of visible and infrared threshold and consistency tests. Additional masking has been added, including an internal cloud mask based on spatial variability to identify low clouds and the reflectance in the 1.38-ïĄ■m channel to identify high clouds (http://modis-atmos.gsfc.nasa.gov/MOD35_L2/).

3. P. 1868 Parag. 15 How the spatial distribution of Angstrom parameter was obtained over the ocean if there are few AERONET stations in the ocean.

The main aim of the paper is to describe the aerosol properties over the European continent, where we have a lot of AERONET sites. However, the data from even few sites in ocean area due to smooth character of Angstrom parameter changes provide us with reliable information. We obtained the spatial distribution of Angstrom parameter using the robust Kriging interpolation method with small density lines, no drift, linear type of variogram. The result has physical sense: noticeable decrease of Angstrom parameter comparing with continent conditions.

4. In Part 3.2, the author should indicate that the presented analysis of the aerosol

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sources and transport affecting the aerosol temporal and spatial distribution over Europe is partly speculative and only in part is proven by the presented climatology of wind and precipitation and by the results of a numerical transport model. Further ground based aerosol observations and model simulations are needed in order to clarify this issue. Yes I fully agree with this statement. The idea was just to show the regions which can be the source of aerosol particles and how this changes from season to season. I have included the following paragraph in the text:

It should be stated that the analysis of the aerosol sources and transport based on wind and precipitation climatology can be considered as the first approach to explain the observed spatial distribution of aerosol optical thickness. Further ground based aerosol observations and model simulations are needed for clarifying this issue.

5. In Part 3.3, significant sensitivity of UV loss to aerosol single scattering albedo (SSA) is shown (Fig. 9). Hence, how to justify the use of mean SSA in the construction of UV loss climatology? May be to use the available range of SSA (0.77-0.99) for UV loss calculations?

The significant decrease in UV shown in Fig.9 is attributed to the cases with extremely high aerosol optical thickness. We have only few cases with these conditions. If speaking of mean values, the range of aerosol optical thickness is much smaller and single scattering albedo seems not vary so significantly. Therefore the effects will be much smaller. Unfortunately, the statistics on single scattering albedo is poor andit is impossible to build up its spatial distribution. However, I have added the paragraph to the 3.4 section describing the assessments of the SSA effects to the erythemally-weighted irradiance.

The effects of single scattering albedo on UV attenuation can be quite pronounced. Unfortunately, due to the lack of statistics it is impossible to generate the maps with spatial distribution of this characteristic. However, we evaluated the range of UV relative changes due to 2sigma variations in single scattering albedo observed over Eu-

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rope. The estimations were fulfilled for aerosol optical thickness averaged over 10x10 degrees from Table 1 using the equation (3). As a result, mean uncertainty in Qe attenuation due to single scattering albedo is about 5% varying from 2 to 8%.

6. Formula (3): Does the aerosol asymmetry factor influence UV loss?

This characteristic plays much smaller role in attenuating the UV irradiance. I have added the following information in the paper, section 3.4.

Our estimations have shown that the changes in asymmetry factor within 2sigma lead to less than plus-minus 1% variations in erythemally-weighted irradiance. Therefore it is possible not to use it as an independent parameter in the equation (3).

7. To check the references: There is no ((McKenzie, et al., 2002) in the Reference List. Yes, The year of issue was wrong. It has been corrected.

Interactive comment on Atmos. Meas. Tech. Discuss., 2, 1863, 2009.