Replies to comments by reviewer 2

Comment: The paper presents a radiative transfer modelling study to explain the blueness of the sky. In most cases the color is due to Rayleigh scattering, but during twilight also ozone absorption plays a role. In 1953 E. Hulbert claimed based on a simplified modeling approach that the color during sunset is to 1/3 caused by Rayleigh scattering and to 2/3 caused by ozone absorption. In this work the color of the sky is investigated quantitatively by simulating spectra under various conditions and converting those to the CIE color space. The study basically confirms the result by E. Hulbert. The paper is clearly written, well understandable with appropriate number of figures. Altough the result is not really new because it just confirms what is expected, it provides some new insights. Therefore I recommend to publish the paper after minor revisions.

Reply: We thank the reviewer for his/her constructive and helpful comments. We tried to answer every comment in an appropriate way.

Comment: General comments:
1. Eq. 6, Quantification of color difference: Wouldn't it be better to use the absolute valud of the difference vector between the vectors in the CIE diagram instead of distances to the white point, e.g.

abs((x,y)ozone-(x,y)) ?

You explain that if a point is in another direction (e.g. red) you can not evaluate the result. If you take the difference as a vector, couldn't you also evaluate the reddish points during sunset?

Reply: Since the paper deals with the ozone influence on the blue colour of the sky, there is no need to evaluate data points where the resulting colour is no longer blue. As already answered in more detail in the first report, it is exactly about the relative difference, i.e. how large is the contribution of ozone to the blue colour of the sky (in %). Nevertheless, we have now added the absolute differences to the main points of the paper.

Comment: 2. Impact of polarization (l. 71): 1% seems relatively small. Is this result in line with Mishchenko et al 1994? Probably the effect would be largest for a scattering angle around 90° and for large AOD, e.g. SZA=90° and VZA=0°. Has this been tested?
Reference:
Mishchenko, M.I., A.A. Lacis, and L.D. Travis, 1994: Errors induced by the neglect of polarization in radiance calculations for Rayleigh-scattering atmospheres. J. Quant. Spectrosc. Radiat. Transfer, 51, 491-510, doi:10.1016/0022-4073(94)90149-X.

Reply: Please note that in the manuscript we talk about the influence on the x,y chromaticity coordinates and not about the radiance spectra themselves. Simulations considering polarisation for SZA = 90° and different viewing geometries led to similar results with, e.g., VZA = 0° of slightly more than 1 % relative difference of the x, y chromaticity coordinates. In agreement with Mishchenko et al. (1994), our calculations also show a larger maximum relative difference in the intensities at SZA

= 90° and VZA = 0° (here: ≈ 7 %). In our manuscript we speak only of the relative difference of the x, y chromaticity coordinates, since these form the basis of the method and are thus crucial for the presented results.

Comment: 3. l. 124: AOD=0.04 is quite small. Is it a typical value for Greifswald or rather at the low end?

Reply: The tropospheric aerosol optical depth of 0.04 at 550 nm is in the range of AOD values observed with the AERONET photometer at the Institute of Physics of the University of Greifswald (as mentioned in L126 – L128). Smaller values of 0.03 (at 550 nm), for example, have also been observed. However, the tropospheric aerosol optical depth is highly variable (as mentioned in L132 – L133).

Comment: 4. l. 210ff.: "With 37% the ozone contribution to the blue colour of the sky is comparatively large for this viewing geometry. For a SAA of 0° , the ground-based observer looks in the sun-ward direction, but with VZA = 50° not directly into the Sun. A final explanation for this high value cannot be given at this point."
Have you looked at the scattering phase function of the aerosol particles? This could explain why you get the largest contribution for this particular geometry.

Reply: This is a very plausible idea and we also believe that the phase function plays an important role for this geometry (although we cannot strictly show it). We added a sentence to the manuscript discussing this possibility.

Comment: 5. A general RT modelling question: How is refraction modelled in combination with polarization. For scalar RT the ray is bended according to Snell's law, is this valid when polarization is considered? Or do you need to use the Fresnel equation when the ray crosses a layer boundary? Could you provide a reference describing how this is treated?

Reply: Thank you for the comment. We do not have any publication to this topic, but refraction is treated in exactly the same way with the polarisation as without. This is just a geometrical ray bending according to Snell's law.