

Interactive comment on “On the phenomenon of the blue Sun” by Nellie Wullenweber et al.

Anonymous Referee #1

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1 General Comments

This manuscript examines the unusual atmospheric conditions under which a blue sun can occur. The analysis is similar to previous work, in particular that by Horvath et al., (1993), but the authors extend the analysis by including more complete radiative transfer simulations. Results generally agree with previous work, but the authors find that higher aerosol optical depths are required when a realistic atmosphere is accounted for. Overall, the manuscript presents a well written description of the topic and analysis performed. I would recommend publication after minor corrections.

C1

2 Specific Comments

Line 126: Why is a reference of 350nm chosen? This seems generally beyond the limits of human vision. If “maximum anomalous extinction” is the ratio of red/blue extinction this seems an odd choice given the sensitivity curves in Figure 1.

Line 130: Along those lines, please define “maximum anomalous extinction”.

Line 149: A brief description of what “int - transmission - CDI” means would be useful.

Line 149: Ehlers (2014) found that the forward scattering by aerosols was an important contribution to the blue sun on Mars. Do the radiative transfer calculations take this into account and is this not an important factor for the cases investigated here?

Line 223 – 227: Is a particle size assumed in this analysis, or is the wavelength-dependent extinction used directly?

Figure 7: How does this compare to the wavelength dependence of the particle sizes used in the previous analysis?

Line 237: “... despite the questionable spectral signatures in the solar transmission spectra.” Although the included figures make it clear, I think this wording is a bit ambiguous as to whether your simulated spectra reproduce this feature. Just a suggestion, but I would rephrase to something like “... although the minimum in the solar transmission spectra near 490nm was not reproducible”

Line 250: Do the water vapour simulations fix the entire mixing ratio profile at 4/40

Line 276: It is not clear to me from Pollack (1973) that the absorption could not be increasing for certain particle makeup. While clearly not necessary for a blue sun, I don't think this work has shown that it is an unlikely contributor, especially given the unknown makeup and rarity of the events.

C2

3 Technical Corrections

Figure 1: should the x, y, z labels have bars over them?

Line 191: remove “of” from “aerosol with of a sufficiently small. . .”

Line 223: “. . .variation is with about 10

Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2020-117>, 2020.