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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "On the variability of the Ring effect in the near ultraviolet: understanding the role of aerosols and multiple scattering" *by* A. O. Langford et al.

**Anonymous Referee #1**

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Review of the paper "On the variability of the Ring effect in the near ultraviolet: understanding the role of aerosols and multiple scattering" by A. Langford et al.

The paper reports on direct measurements of the filling in of Fraunhofer lines in scattered sun light relative to direct sun spectra, and the dependence of the effect on aerosol optical depth. It presents a simplified model to explain the change in filling in with wavelength and aerosol optical depth and compares model and measurement. It finally proposes a simple empirical treatment of the wavelength depending Ring effect in DOAS measurements of scattered light and demonstrates the improvement that can be achieved using this approach compared to the standard treatment.

The paper is clearly structured and well written. It deals with a topic that is of interest both from the point of view of radiative transfer in the atmosphere and the application in remote sensing of atmospheric composition. It provides a sound and simple explanation of a well known but up to now not fully understood phenomenon and proposes a correction that potentially can improve many atmospheric measurements based on the DOAS technique. I therefore recommend publication after some minor changes as suggested below.

* The authors might want to add a remark to the paper that their results provide some justification for the empirical approach used by many groups working with DOAS who add a nonlinear intensity offset ("offset and slope" or "additive polynomial") to the fit in order to compensate the well known wavelength dependence of the Ring signal.

* It would also be interesting to think about the implications of the findings presented in the paper on the filling in of molecular absorption lines, a small effect that becomes relevant at low sun or high precision measurements e.g. of stratospheric ozone. The corrections used so far are based on Rayleigh scattering only and modifications might be necessary in the presence of aerosols.

* section 3, page 10158 bottom: please add the wavelengths used to define the background continuum for I2

* section 5, page 10164: May be I miss something obvious here but it is not clear to me why eq. 3 is valid. In particular, why should the filling in from second order scattering be subtracted for N_R $<$ 1?

* section 6, page 10167 top: "... and the term ... " something appears to be missing here

* all figures: in the printed paper, I had difficulties reeading the labels and axis

* Fig. 2 and related text: While I agree that the amount of filling in must be related to aerosol OD, the same could be said of intensity at 344.1 nm according to the figure.



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I suspect that just as it is the case for intensity, any attempt to retrieve quantitative aerosol quantities from FI will face problems from the interference of various other effects also affecting FI in complex ways. The wavelength dependence will help but still it will be a challenge.

* fig. 5: there is a mismatch between the colors used and the description in the figure caption

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Interactive comment on Atmos. Chem. Phys. Discuss., 6, 10153, 2006.