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Atmospheric Measurement Techniques Discussions

Interactive comment on "A new method to determine the aerosol optical properties from multiple wavelength O_4 absorptions by MAX-DOAS observation" *by* Chengzhi Xing et al.

Anonymous Referee #1

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The paper entitled "A new method to determine the aerosol optical properties from multiple wavelength O4 absorptions by MAX-DOAS observation" by Xing et al. presents a new method to determine the multiple aerosol optical properties (AOPs) from the MAX-DOAS observation of O4 absorption at UV and visible wavelength during the autumn-winter seasons. According to the RH, visibility and PM2.5 concentrations, the observation periods were classified into different types, among which the AOPs behave significantly different. Then the empirical relationships between measured O4 absorptions in different bands and characteristics of AOPs were summarized and further used as a new method to determine the aerosol optical properties, which is well validated in another independent campaign. The manuscript is generally well written,

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clearly presented and is recommended for publication in AMT after some minor corrections. Major concern: The new method is based on the dependence of O4 absorptions in different wavelength bands on the aerosol optical properties, which is summarized from the measurements. So I suggest the authors can present some evidences of theoretical estimation with the forward RTM to enhanced the principle basis of the method somewhere, even in the supplementary materials. Minor comments: P2, L34: need to be developed P2, L83, February of which year? P4, Sect. 2.2 & P4, Fig. 1: Please provide the basic information of the measured spectrum in the fitting example, which can help to evaluate the performance of spectral analysis better. P6, L143: growth -> increase P6, L161-165: Any special consideration for using different RH for clear days, non-haze days (RH<80%) with haze days (RH$\leq$80%)? P10, Fig. 3: Besides the discussion about the correlation coefficient, could the authors give some explanations of the changes in slopes among different weather types? Obviously, the slope in clear and non-haze days are much larger than those in haze and heavy-haze days. Why? P12, Fig. 4: The scat. and abs. changed around 09:05 and 12:00, while the correlation relationship analysis use the break point of 10:00 and 12:00. Why they are different in time? Moreover, why the authors choose the index of variations of scat. instead of abs.? P13-14, Fig. 5, Fig. 6: the empirical relationships between measured O4 absorptions in different bands and characteristics of AOPs were mainly concluded from the statistic plots of Fig. 5 and Fig. 6. I have a concern that the some of the factors (e.g. correlation R2 and VIS/UV O4 DSCD in haze days, as well as scat. and abs.) have wide value range even covers some cases of other weather conditions. How to obtain the precise and accurate the correspondence between O4 absorptions and AOPs under different weather conditions? P16-17, Sect. 4: For the validation, the authors classified the observational period segments into the different weather conditions, however, no further AOPs information, e.g. AODs, sca. and abs., were inferred and achieved. Is the sentence in line 321 ("The σsca, σabs and AOD are mainly located at 200-900 Mm-1, 20-60 Mm-1 and 0.9-2.5 under haze or heavy-haze conditions, respectively.") a conclusion of measurement results or inference from O4 absorptions?

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