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Atmospheric Measurement Techniques Discussions

Interactive comment on "Industrial SO₂ emissions monitoring using a portable multi-channel gas analyzer with an optimized retrieval algorithm" *by* Y. W. Sun et al.

Anonymous Referee #2

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The paper under consideration describes a useful extension of current filter radiometer approaches for the measurement of SO2 concentrations. It fits well into the scope of AMT. I recommend publication of this work after minor revisions. Although the demonstrated method is obviously a major improvement over the linearized retrieval, I wonder about some choices made by the investigators which still seem suboptimal, perhaps the authors could comment on these items in the finalized version: What is the value of assuming a Gaussian filter transmission? The filter characteristics can (and have been, as shown in figure 7) be measured with spectrometer and the transmission functions can be used as measured for calculating effective band-integrated absorptions from spectrally resolved calculations. Instead of using ad-hoc third order polynomial

fits to the optical depth the computational performance of even a moderate computer certainly is sufficient today for treating the whole problem numerically (convolution of measured filter transmissions with monochromatic cross-sections) using pre-calculated cross-sections for all gases involved. This numerical approach based on a physical model is a standard for the analysis of laboratory and atmospheric spectra taken with higher spectral resolution, and would probably also in the case of filter radiometer measurements result in an improved convergence behavior and an improved ability of diagnosing limiting factors of the instrumental and retrieval setup, thereby finally ensuring an optimal reconstruction of the concentrations of the various absorbers involved.

Minor comments: It would be useful for the reader to add additional plates to figure 2, showing the absorption bands of all absorbers involved. Figure 9 indicates a systematic difference between the SO2 retrievals based on either the strong band (low values of SO2, bias of 2%) or the weak band (high values of SO2, bias of 1.2%). Are there possible explanations for this finding? Figures 13 and 17 indicate that the discrepancy between the DOAS and the filter radiometer is not due to a random scatter, but periods with excellent agreement and periods during which a larger bias seems to prevail seem to alternate. Are there explanations for this finding (perhaps related with certain measurement conditions)?

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 13331, 2015.