

## ***Interactive comment on “Sulphur dioxide (SO<sub>2</sub>) vertical column density measurements by Pandora spectrometer over the Canadian oil sands” by Vitali E. Fioletov et al.***

### **Anonymous Referee #2**

Received and published: 14 April 2016

The paper presents the retrieval of SO<sub>2</sub> column by Pandora sun-photometer, and discusses an application to an area in Canada with elevated concentrations of SO<sub>2</sub>. It is a well presented paper with sufficient innovation, demonstrating the capabilities of Pandora to use used for monitoring the SO<sub>2</sub> in addition to ozone and NO<sub>2</sub>. The subject is relevant for AMT and the quality of the paper is good to be accepted for publication in AMT. However, before publication I recommend to the authors to address the following issues:

General comments:

1, 17: The fitting uncertainty of 0.05 DU is true only for 60% of the data.

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2, 27: Delete “visible” since SO<sub>2</sub> does not absorb in this range.

3, 19: Please clarify: Is 0.6 nm the FWHM or the width of the base of the slit function? Or is it the average pixel width of the CCD (i.e. the full spectral range divided by the number of pixels)?

3, 24: Subtracting a constant offset to correct for stray light does not make any sense in DOAS retrieval, because it is a smooth function which is finally removed by the polynomial fitting.

5, 3: It would be good to show on Figure 2 the residual noise which is a measure of the signal to noise ratio and hence the fitting uncertainty.

5, 18: Please elaborate briefly on the “synthetic reference spectrum”. How it is determined? Is it one spectrum or a synthesis of more spectra? Does it correspond to a zero SO<sub>2</sub> column? In not, what is the SO<sub>2</sub> amount corresponding to the reference spectrum used?

5, 29: 90% of the data have fitting errors below 0.15 DU. Where the upper limit of 0.35 DU comes from?

5, 30: The discussion in this paragraph is rather vague: How one can detect that a measurement is artificially elevated by an amount of up to 1 DU? How these cases are detected and processed with another reference spectrum, and why with this reference spectrum gives better results compared to the synthetic spectrum? It is stated that data are filtered based on the standard error, what is the threshold value?

6, 24-26: I don't understand this sentence “the low percentiles are close to the same percentiles for clean conditions”. Could you please make it clearer? Up to this point there has been no discussion about the VCD of SO<sub>2</sub> associated with the reference spectrum. Here it is implied that this value is determined based on the “low” percentiles. How is this done? Is the average value for one of these percentiles considered as the SO<sub>2</sub> column in the reference spectrum?

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6, 28: This justification is not very accurate: With increasing airmass factor the measured radiation decreases but the absorption signal increases due to the longer path length through the SO<sub>2</sub>.

7, 1: What is meant by “distances” between percentiles? Is it the difference between the intercepts of the two regressions?

7, 27: Figure 5 and the correlation coefficient of 0.7, does not give the impression of a very good agreement between the two datasets, so the statement “tracks each other very well” is too strong statement.

8, 19: There is no experimental evidence that the SO<sub>2</sub> plum was above the ground. I would say “was probably above the ground”

9, 28: With six numbers it is not safe to calculate the “average” and “standard deviation”. Maybe it would be better to provide the range of differences for the six cases.

Technical comments:

2, 20: Replace “modification” with “type”

3, 26: Replace “the interval” with “an interval”

4, 27: It is not obvious to what “etc” refers. Perhaps it is better to remove it.

5, 12: “values retrieval” is not proper English. Please revise.

11, 20: Replace “characteristics” with “quantities”

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-54, 2016.

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