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Atmospheric Measurement Techniques Discussions

Interactive comment on "A Fabry–Perot interferometer based camera for two-dimensional mapping of SO_2 distributions" *by* J. Kuhn et al.

Anonymous Referee #1

Received and published: 29 July 2014

The paper by Kuhn et al, outlines a proposed new remote sensing method for SO2 detection in the atmosphere using a Fabry-Perot Interferometer (FPI). Up to the present the most common methods use either correlation spectroscopy or the DOAS technique, derivatives if these (scanning schemes), and SO2 2D cameras using broad-band filters. This paper introduces the idea of using an FPI, not a new technique in itself, but the novel idea of designing a system for the UV and applying this to volcanic monitoring (for example, but it could also be equally applied to a range of atmospheric monitoring applications).

The authors give a brief overview of the basics of FPI theory, how this would be applied to the particular problem of SO2 in the UV, and compares the performance of the theoretical instrument with current broad-band filter SO2 cameras and DOAS systems.

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Finally the authors describe 3 potential optical configurations for FPI SO2 systems, with their respective advantages/disadvantages. This makes a very good case for this instrument. It appears to have a number of advantages over currently employed technologies used in remote sensing of SO2 from volcanoes. If the instrument performs as well as stated it will be a significant advance for this field of measurement.

The paper is well written, clear and concise. The figures are easy to read. The paper outlines a new and novel method for UV SO2 remote sensing measurements and is therefore recommended for publication in AMT subject to a few minor comments list below, and a small list of minor typographical errors.

1) It is clear that a filter instrument when subtracting or differencing filter A and B, figure 1, obtains the SO2 signal without bias. That is, the filter B signal has no SO2 contribution at all. For the FPI though the SO2 band has a continuum associated with it. How is this potential bias dealt with in the FPI analysis when the differencing is between the maximum and minimum SO2 features, but the minimum SO2 signal is non-zero? Is this achieved through a calibration procedure or could this continuum be accounted for in the forward model?

2) It would be instructive to add to figure 1, if possible, the contribution of other terms in the spectra, that is, aerosol scattering and ozone. This could be a fourth panel. What about solar fraunhoffer and ring effects, are these significant and have any structure that might coincide with the FPI fringes?

Minor edits:

3) Page 1, line 19: suggest replacing "...become a more and more common ... " with " ... become an increasingly more common ..."

4) Page 2, line 46: densities

5) Page 5, line143: structure

6) Page 5, lines 144-147: This sentence seems to mean the opposite to what is in-

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tended. The intention here is to make the point that FPI measurements should take place at wavelengths shorter than lambda max and avoid regions where the SO2 absorptions are weak and therefore subject to interference from scattering effects.

7) Page 5 line 161: add a comma after “above”.

8) Page 5 line 162: suggest replacing “Similar as for the. . .” with “Similarly for the . . .”

9) Page 7 lie 208: ppm

10) Page 7 line 221 signal

11) Page 8 line 254: an OP FPI

12) Page 8 line 259: shifted

13) Page 9 line 307-308. This sentence is not very clear. Suggest replacing “. . .saturation at wavelength of strong SO2 absorption bands and therefore flattening of the calibration curve occurs earlier.” With “. . .saturation at the wavelengths of strong SO2 absorption bands, and therefore flattening of the calibration curve, occurs earlier.”

14) Page 11, line 358: suggest replacing “Even for the by a factor of. . .” with “Even for the factor of . . .”, and then later in this sentence add a comma after “camera” on line 359.

15) Page 11 line 377: increasing

16) Page 19 fig4 caption line 4: remove comma after “shows”

17) Page 20 fig 5 caption line 5: separates

18) Page 22 fig 7 caption line 6: increasing

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 5117, 2014.