Atmos. Meas. Tech. Discuss., 6, C838–C841, 2013
www.atmos-meas-tech-discuss.net/6/C838/2013/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Observations of SO_2 and NO_2 by mobile DOAS in the Guangzhou Eastern Area during the Asian Games 2010" *by* F. C. Wu et al.

F. C. Wu et al.

fcwu@aiofm.ac.cn

Received and published: 11 May 2013

We would like to thank the referee for taking the time to read the paper carefully and provide helpful suggestions to improve the paper. We have revised the paper according to the referee's comments carefully, where the revised parts are indicated by red font. The detailed revisions are described as follows: 1. What is aperture of the instrument? What is the length of the optical fiber? Explain what does "stable temperature" mean? Was detector cooled, and to what temperature? What is the power source for the instrument? What are the best and nominal detection limits? Response: The instrument consists of two main parts: spectrometer (14.8cm$\times$10.5cm$\times$4.5cm), GPS module and

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

laptop in the car; GPS antenna, telescope (80mm diameter) and weather station outside the car. The length of optical fiber is 3m. The "stable temperature" means that the spectrometer unit is cooled to a stable temperature of +25°C. The detection limits of SO2 and NO2 column densities for this system are about 3∼5×1015 molec./cm2. (Page 6 Line 148-162) 2. Were trace gas references convoluted using instrumental function? For SO2 retrieval – HCHO absorptions are also present in the 310-324 nm range, why HCHO absorption cross section was not included in the retrieval? Similarly, for NO2 retrieval – HONO and HCHO absorptions are also present in the evaluation range, why these absorption cross sections were not included in the retrieval? Response: The cross sections of trace gas included in the fit are all convoluted with the instrumental function. (Page 9, Line 241-242) Thank you for your valuable suggestions. For SO2 retrieval, the HCHO absorption should be included, and HONO and HCHO absorptions also ought to be included for NO2 retrieval. The variations of retrieval result included HONO and HCHO or not are less than fit uncertainties approximately over high pollutant area (such as GEA). So we didn't include the HCHO and HONO absorptions for the retrieval originally. However, in order to obtain reasonable retrieval results we re-retrieved all the spectra considering HONO and HCHO absorptions for NO2 and SO2 (Page 9, Line 238,246). 3. How are aerosol parameters used for mobile DOAS data differ from ones used for OMI? Were sensitivity studies performed? Response: We adopt an assumption that the slant column densities for the zenith viewing direction approximate those of the vertical columns around noon. So we don't used aerosol parameters for mobile DOAS data. However, absolute VCDs corrections are presented using data from stationary MAX-DOAS. The aerosol parameters are used for VCDs calculations from MAX-DOAS data as shown on Page 11 Line 283-291. We download OMI NO2 VCDs product from website directly. The NO2 VCDs calculations from OMI don't include aerosol information described by Bucsela et al. (2006). We perform sensitivity studies by varying the setting of different AODs and trace gas loading, as shown on Page 11 Line 295-300. We are preparing another paper about sensitivity and error studies of mobile DOAS and have carried out some experiments for

AMTD
6, C838–C841, 2013

this purpose. So, a brief discussion on sensitivity studies is presented here. 4. In my opinion it is insufficient to report daily averaged values for SO2 and NO2. NO2 has a very strong diurnal cycle. In my opinion, discussion on photochemical production of NO2 is recommended. Response: We have attempted to estimate the influence of the diurnal variations of NO2 on these two comparisons. The corresponding discussions are now on Page16 Line 416-425 and 430-442. 5. I recommend expanding Figure 4 to show measured SO2 and NO2 VCDs along transects as well as daily averages. Combine Figures 4 and 5. Present the data by date and time of day, not spectrum number. Response: The SO2 and NO2 VCDs along transects have be shown in Fig. 5. We think the offsets between mobile DOAS data and MAX-DOAS data just are presented in order to avoid figure seems to be redundant (detail description in Fig.3). We have changed the spectrum number to time of day. 6. P 266, paragraph 2: Indicate light path length and viewing direction for the LP-DOAS instrument. P 267, paragraph 2: Indicate viewing direction of the MAX-DOAS instrument. Response: We have indicated the light path and viewing direction for LP-DOAS and MAX-DOAS instrument, as shown on Page 7 Line 169-171, Line 183-184 and Fig.1. 7. P 270, section 2.4.2: Discussion errors for the emissions calculations are missing. Response: We have now discussed errors for the emission calculations as shown on Page 12-13 Line 329-339. 8. P 275, paragraph 1: can you compare your estimates with the emissions inventories? Response: It is very difficult to get detailed emission inventories in China. So we didn't compare our estimates with the emission inventories in details. However, we obtained the SO2 emissions of Guangzhou in 2010 from "Guangzhou Municipality State of the Environment, 2010". The agreement on order of magnitude is found as shown on Page 18 Line 494-495. There is one question that the encircled measurement area is much smaller than the whole Guangzhou area. We consider two points: GEA including the fractions of Dongguang City (Fig. 1), the SO2 emission estimated by mobile DOAS contain the Dongguan fractional contribution of SO2. On the other hand, the major SO2 sources of Guangzhou located the GEA. And thus the results from mobile and local inventory are agreement on order of magnitude at least. 9. Fig-

AMTD
6, C838–C841, 2013

ure 1 – please display viewing directions for MAX-DOAS and LP-DOAS instruments. Include scales for the maps. Figure 6 is impossible to read, please enlarge. Response: We have displayed viewing direction for MAX-DOAS and LP-DOAS instruments and indicated the scales for the maps in Fig.1. We have changed plots of Fig.6, which may be better for reading now. 10. Figure 8 – what is the time of day for the shown NO2 VCD? Response: The time of day for the shown NO2 VCD in Fig.8 is from 11:00-12:00 (LT). 11. Figure 13 – consider plotting NO2 and SO2 emissions on different scales. Mark Phase1 through Phase 5 on the figure. Response: We have marked Phase 1 through Phase 5 on the figure. 12. Figures 14 and 16 – consider reducing number of trajectories shown and combining the two figures. Response: We have reduced the number of trajectories. Technical corrections: Expand the Introduction with NOx – O3 interactions. P 263, line 29 and P 275, line 23: replace "transportation" with "transport". P 264, line 7: replace "models" with "modeling efforts" or "modeling studies". P 264, line 9: insert ";" between "(Wang et al., 2008)" and "or used bottom-up approach" P 265, line 7: replaced "MAX-DOAS data at a fixed location" with "data from stationary MAX-DOAS". P 266, line 13: replace "sunlight that enters the spectrometer through an optical fiber" with "sunlight which is sent to the spectrometer by an optical fiber". P 267, lines 8-10: consider rewriting this sentence. For example: "MAX-DOAS telescope is equipped with a stepper motor, therefore allowing for pointing at different elevation viewing angles. During our measurements, scattered sunlight was collected sequentially from 5, 10, 20, 30, and 90 degrees elevation viewing angles. P 275, line 25: replace "hosed" with "hosted". Response: Thank you for your careful modifications. We have modified the above technical errors in our revised manuscript according to your suggestions in appropriate places.

Thanks for your opinions and very appreciated your time. If you have any questions about the manuscripts, please let me know.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 261, 2013.