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Atmospheric Measurement Techniques Discussions

Interactive comment on "Intercomparing CO_2 amounts from dispersion modeling, 1.6 $\mu m differential absorption lidar and open path FTIR at an$ release at Caldara di Manziana, Italy" *by* M. Queißer et al.

Anonymous Referee #1

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In the presented manuscript, the authors attempt to compare three different techniques for deriving column-averaged CO2 concentrations along a given line-of-sight in the diffuse CO2 degassing

Caldara di Manziana in Central Italy. The most established technique that the authors apply is CO2 detection by active Open Path Fourier Transform Infrared (OP-FTIR) Spectroscopy along a fixed light path. In addition to this, a novel Differential Absorption Lidar (DIAL) specifically designed for measuring CO2 is used. This instrument is still under development, and the comparison with the FTIR is used to verify its functionality. In a third approach, the authors also perform micro-scale meteorological dispersion modeling using a combination of the DISGAS code and the DWM wind model. The model is used to simulate the CO2 concentration in the air above the degassing features in three dimensions. Then, the concentration map is sampled along the approximate measurement line-of-sight of the instruments.

The study is of considerable interest to the volcanology community because it discusses two rather new techniques for quantitative determination of CO2 concentrations and fluxes: the DIAL and the dispersion modelling. In principle, the combination of the two approaches might in the future be used to determine the CO2 flux emitted from a diffuse degassing region, an application that I believe the authors fail to mention but should be touched upon, as it lends additional importance to their study.

Unfortunately, there are a number of unresolved issues with the experimental setup and the author's interpretation of the data. One stems from the fact that the light paths along which the two open-path measurements were performed were not the same. Given the strong vertical non-linear gradient of CO2 concentration

expected in the area, this mismatch causes problems. It is also unclear whether modelling the CO2 concentration at a single height above ground (0.5 m) is sufficient to assess the situation in the pit crater. The presented modelling study requires quite a number of assumptions, many of which are not mentioned in the manuscript. And while the model time resolution of two minutes is significantly lower than that of the measurements, it did not become clear to me how this can cause the systematic bias toward lower values that the authors argue for. Finally, the authors state that the datasets recorded by the FTIR and the DIAL are consistent and see this is a successful validation test of the DIAL. I am not convinced of this. The DIAL does appear to be calibrated such that its average measured concentration is about the same as that of the FTIR, but it fails to pick up

any fluctuations at all during the measurement period. This is worrisome and to me indicates it may not be working properly. I feel that these issues, which are described in more detail below, all need to be addressed before the manuscript should be considered for publication in Atmospheric Measurement Techniques.

Please see the attached supplement for the full review of the manuscript.
Please also note the supplement to this comment: http://www.atmos-meas-tech-discuss.net/8/C1338/2015/amtd-8-C1338-2015-supplement.pdf

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Interactive comment on Atmos. Meas. Tech. Discuss., 8, 4325, 2015.