Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2019-205-RC2, 2019

Atmospheric Measurement Techniques Discussions

Interactive comment on "Towards verifying CH_4 emissions from hard coal mines using mobile sun-viewing Fourier transform spectrometry" *by* Andreas Luther et al.

Anonymous Referee #2

Received and published: 19 August 2019

The paper by Luther et al reports the field deployment of an EM27/SUN in a coal mining area of Poland. The purpose of this study is to test the EM27/SUN system's ability to estimate the emissions of CH4 above background from fugitive coal seam emissions. The spectrometer itself has been used in a number of studies of greenhouse gases, using the technique of direct solar spectroscopy. The EM27/SUN has successfully measured CO2 and the target gas, CH4, to measure/monitor their background concentrations. Its inherent precision (that is measurement to measurement is « 1ppb in CH4) is such that a measure of enhanced CH4 from coal seam gas emissions would be a valuable addition to the available techniques to estimate this important GHG.

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Discussion paper

There has been an extensive review of this paper by another referee, who has picked up on a number of issues with the paper, particularly clarifying statements made on the method, improving the flow of the text, and numerous technical writing corrections. The authors have responded to this in detail and made numerous appropriate corrections. The paper is therefore much improved. In this review comments will be made on a couple of specific issues to do with the technique and assumptions made that are central to the purpose of this work.

It is clear from the method that this paper uses, the cross-sectional flux method, that the potential sources of error include the plume enhancement (directly related to the CH4 measurement), the effective wind speed Ueff, and the cross-plume segment Del y. Of these error sources, the dominate error is the use/derivation of the effective wind speed; this dominates the error budget and limits the precision and accuracy of the method. So the first question is: what do the authors consider to be a useful measurement? The authors state that comparing this with independent data, that is, the European Pollutant Release and Transfer Register, is only a “rough comparison”. How will we know if this method is successful; there must be a measure of what success looks like in terms of what would be useful to the community (mines, local govt regulations etc).

The paper by Varlon et al stipulates that this method should not be used in calm conditions, that is, with Ueff < 2 ms-1. In Varons study it is suggested using meteorological databases to estimate Ueff at 10 meters; has there been any attempt to compare the lidar wind data with independent meteorological data? The authors did undertake a sensitivity study, and this might imply that such a comparison with independent wind data is not possible.

In terms of the error introduced from Ueff, there is the question of how accurate the estimation of the wind speed is from the lidar, and secondly, how turbulence in the wind flow leads to inherent variability in the wind speed. There is also the variability in the CH4 sources themselves. The authors build these error sources into the error budget.

The text states that these sources, up to 20% or more, are estimated. How is this estimate actually done? In most cases it appears to be based on the standard deviation of data from the lidar for example, or is there also factors based on the operation of the lidar? Perhaps the question is what control did the authors have over the operation of the lidars in terms of direct analyses? Did the authors do this wind speed determination directly?

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-205, 2019.

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