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Biogeosciences Discussions

Interactive comment on "Suitability of quantum cascade laser spectrometry for CH_4 and N_2O eddy covariance measurements" *by* P. S. Kroon et al.

Anonymous Referee #3

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General comments

The paper presents an evaluation of quantum cascade laser spectroscopy for eddy covariance (EC) flux measurements of methane and nitrous oxide. Quantum cascade laser spectroscopy shows promise as a reliable technique for making EC flux measurements of a range of trace gases in the atmosphere, while requiring minimal attention. The authors show that this technique met various criteria for EC flux measurements, although it required regular calibration and may have underestimated the flux due to the damping effect and other factors. The development of such advanced techniques for measuring the fluxes of trace gases is important, so it is good to see such work being published. The paper is generally well written and presented, and the authors describe their methods thoroughly and make good use of references. A few specific

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questions and comments are listed below.

Specific comments

1. The authors note that the Reynolds number for the inlet reduced from 5020 to 1720 as dirt collected on the filter (page 1145, line 9). The flow regime, therefore, went from being turbulent to laminar. This will have implications for the extent to which the flux is underestimated (see Lenschow and Raupach, 1991, Journal of Geophysical Research, 96(D8), 15259). Have the authors investigated this (by spectral analysis, or use of ogives), and if this is a significant effect, could the flow be prevented from becoming laminar?

2. Related to the previous point, the authors discuss a method of investigating the damping effect due to the presence of the inlet, and give an example from their own data (page 1145, line 13 and onward). Can the extent to which the flux is underestimated be derived from these ogives? If it is not too time consuming, perhaps the authors could do these analyses for different conditions and discuss their findings in a few sentences. This would add to the discussion of how well the overall EC flux measurement system performs.

3. The authors make an extensive investigation into the validity of the observed negative fluxes (section 4.2.1), including a look at the correlation function, the detection limit of the QCL, and the Webb correction. However they then conclude that further analysis is needed to investigate the reliability of these negative fluxes. What further analysis can be done here? If the observed deposition of CH4 and N2O is real, what could be the cause?

Minor corrections

Title: Replace “spectrometry” with “spectroscopy”. While the instruments are “spectrometers”, the technique is generally referred to as “spectroscopy”.

Page 1139, line 15-16: Change to “...the instrument should be able to operate unat-

BGD

4, S562–S564, 2007

tended on a continuous basis."

Page 1139, line 16: Change to "...quantum cascade laser spectrometers can..."

Page 1140, line 15: Replace "fertilizing" with "fertilizer"

Page 1141, line 10: Put a space between the number and the units ("3 m")

Page 1143, line 1-2: The standards are repeated three times in the paper (also same page, line 22-23, and page 1149, line 8-9). They should only need to be mentioned once, with reference to the relevant sections where necessary.

Page 1144, line 6 (and other locations in the text): "seeing that" is informal English. Replace with "since" or "because".

Page 1147, line 6: Replace "to to" with "to"

Page 1147, line 7: Close brackets after "Sect. 3.1". Also, what is meant by "non exactly uniform sampling", and what is being referred to in section 3.1? Do you mean "slightly non-uniform"?

Page 1148, line 26 (and other locations including some figure captions): "October" is not spelt with a "k".

Page 1153, line 5: Replace "related" to "relating"

Page 1153, line 19: Replace "also uptake" with "uptake also"

Interactive comment on Biogeosciences Discuss., 4, 1137, 2007.