

## ***Interactive comment on “Ecosystem fluxes of hydrogen: a comparison of flux-gradient methods” by L. K. Meredith et al.***

### **Anonymous Referee #1**

Received and published: 3 June 2014

Meredith et al. developed a field-deployable, automated gas chromatograph (GC) system equipped with the newly available pulsed discharge helium ionization detector (HePDD) for high-precision gradient measurements of molecular molecular hydrogen (H<sub>2</sub>) at the Harvard Forest. It is a proper way to measure H<sub>2</sub> fluxes, as direct eddy covariance measurements of H<sub>2</sub> are not possible due to the slow response of the GC system, especially when the precision of the measurements is high enough to detect small vertical gradients below and above the canopy.

Furthermore, three flux-gradient methods have been employed to calculate the fluxes of a trace gas (CO<sub>2</sub>, H<sub>2</sub>O, and H<sub>2</sub>) from the measured vertical gradients, and are carefully evaluated against each other and against direct eddy covariance and chamber measurements in the case of CO<sub>2</sub> and H<sub>2</sub>O. The paper is well written and well

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structured. I recommend publication with a minor revision.

General:

As the trace gas similarity method systematically underestimates CO<sub>2</sub> fluxes and overestimates H<sub>2</sub>O fluxes due to significant sinks and sources within the canopy. Have the authors considered developing a method to correct for the systematic bias?

Details:

Page 2885 line 7-11: what is the sampling flow rate? The flow rate will allow the reader to get an idea about the exchange time in the 2L and 25 L mixing volumes.

Page 2889 line 20: “measurement error” may better describe the session 2.4.3 than “Bias” does, because the session discusses the potential error due to measurement issues.

P2892 line 16: what is the relevant eddy length scale?

P2898 line 16: slightly different  $u^*$  values are used in the cited literatures, e.g. 0.05 m s<sup>-1</sup> vs. 0.07 m s<sup>-1</sup>. This is not an issue, but it might be useful to check and see whether some differences between gradient method and eddy covariance measurements for CO<sub>2</sub> are due to the choice of this threshold.

P2906 line 28 as data from a very limited period is shown in the paper; it is not sufficient to conclude that “consistent uptake of H<sub>2</sub> by the biosphere”. Do the authors have more data to support this statement? Does the data filter procedure affect the conclusion?

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Interactive comment on Atmos. Meas. Tech. Discuss., 7, 2879, 2014.

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