

## ***Interactive comment on “A field-based method for simultaneous measurements of the $^{18}\text{O}$ and $^{13}\text{C}$ of soil $\text{CO}_2$ efflux” by B. Mortazavi et al.***

**B. Mortazavi et al.**

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We would like to thank the referee for the constructive comments on the manuscript. The referee recognizes that "comparision [of methods] in this field are rare". In addition, the referee recongnizes that the new method based on mini-towers "looks promising", and that "a reliable method to determine the  $^{18}\text{O}$  signature of soil respiration is needed". The referee has concerns on the diffusion fractionation factor for  $^{13}\text{CO}_2$  and we have addressed this concern below and in the revised manuscript.

General Comments: The contradiction in the results and discussion has been addressed (please see specific comments). Thank you.

Specific Comments: Methods. The sequence of sampling has been clarified. Indeed the soil probes are only inserted after a 45 minute period, which allows for soil  $\text{CO}_2$  to requilibrate. We sample mini-towers, chambers at site 1. Go to site do and sample mini-tower and chambers and return to site 1 for sampling with the probe, etc. Thank you for helping us clarify this issue. The referee is "not convinced that it is possible to simply apply a Keeling plot approach to the mini-tower data". This concern rises from

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a confusion about application of the fractionation factor. In the revised manuscript we have included the result of the calculation for diffusion of the lighter isotope from the top of the (open top) mini tower. By applying the appropriate diffusion coefficient and the Fick Law of diffusion we have demonstrated that diffusion from top of the mini-tower is 2 orders of magnitude lower than CO<sub>2</sub> addition at the base of the tower by soil flux. We can therefore ignore this factor. In essence the mini-tower is similar to a portion of the canopy at nighttime, where CO<sub>2</sub> is added by soil and canopy and it diffuses upward. A Keeling plot is used for nighttime canopy profiles without the application of the diffusion fractionation factor. Thank you for pointing us to this direction, which has now been addressed. Page 5. There is limited information available for this site. We have provided all that is known about this site. Page 6, line 4. The sampling was terminated in 15 minutes.

Results and Discussion: Page 11, line 14. We sought help at the Florida State University Statistical Consulting Center and have included in the manuscript the appropriate statistics. Thank you for this suggestion. We are now more fully able to assert the differences in the methods where they exist. Page 11, last 2 lines. We believe that the large variability from one mini-tower to the next, reflects the heterogeneity in soil water <sup>18</sup>O or reflects the diffusional fractionation factor that varies depending on soil properties. This variability in <sup>18</sup>O of soil CO<sub>2</sub> flux has largely been ignored! Page 12. Last line and upper paragraph on page 13. We have rewritten this offensive paragraph. By including the statistics we can be more assertive and we rely only on results from this manuscript, instead of another data set from a previous manuscript. Thank you.

Conclusions: Page 14, line 5. The offensive paragraph on page 13 has been changed.

References: We have added the seminal paper by Hogberg and Ekblad (1996), Ekblad and Hogberg (2000), and Ekblad et al. (2002) are now cited. Thank you.

Technical Corrections: The typographical errors have now been corrected. Thank you for catching those. Thanks you.

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