

Interactive comment on “Automation of soil flux chamber measurements: potentials and pitfalls” by C.-M. Görres et al.

Anonymous Referee #2

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This discussion paper examines the quantification of soil respiration under varying environmental conditions by two commercially available automated soil respiration systems, the greenhouse gas monitoring system AGPS and the Licor 8100 automated soil CO₂ flux system. The authors have adapted the AGPS system to run in-line with a Los Gatos greenhouse gas analyzer.

The authors compared each system using a third methodology, flux gradient method, as an independent comparison to the two systems. They further measured soil characteristics at each location to assess the impact of soil disturbance from collars as well as the any soil characteristics that might explain differences between sampling systems. The author’s experimental design is a well thought through comparison that accounts for different environmental conditions as well as soil characteristics that may influence

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the inherent spatial heterogeneity in soil flux, even in seemingly homogeneous looking forests and soils. It is unfortunate that the authors could only compare the two systems in the wide row location due to the large size of the AGPS system. Although comparison between the Licor and flux gradient method for the narrow and wide rows along with the inter-comparison of narrow and wide row fluxes for the Licor system alone provides useful insight to the Licor system.

The authors identify a number of challenges to the use of each system including the increased root growth around the collar for the LI800, a newly identified and interesting artefact as yet unquantified. Further they discuss the issues of nighttime fluxes and the chamber disturbance of a stratified CO₂ gradient due to calm conditions. The authors offer new insight into chamber design that may help to address this issue of nighttime fluxes.

I think this work provides useful direction toward standardizing chamber design, flux measurement and quality control methods. They have further identified two interesting artefacts that need to be addressed. I would recommend acceptance with minor revisions addressed.

Specific comments:

Was the APGS system tested for pressure differences between the inside and outside of the chamber during a measurement period? The pressure vent is designed to address this issue and this has been tested for the Licor systems “special pressure vent” to show that there is no alteration of pressure, but it is unclear if the APGS has done the same type of test for their system and their specific vent.

The tubing lengths vary between systems (Table 1). For the AGPS system, each chamber appears to have a different tubing length (11-25m), while the Licor system has one tubing length (15m), and presumably it is the same for each chamber. Was there any examination of the influence of different lengths of tubing on fluxes? For the AGPS system: ie .were there less discarded data during QC for chambers that may have had

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a shorter tubing length? The issue from tubing length is that [CO₂] from one time point, moving through the long tubing lines is then returned to the chamber volume, presumably this [CO₂] is lower than what is currently in the chamber, thus possibly diluting or affecting the subsequent measured fluxes. Chamber volume may be sufficiently large that this small dilution is undetectable but can the authors comment on this potential artefact?

The Lloyd and Taylor temperature function was used to model soil C fluxes for each system, filtered and unfiltered. In Table 3, can the authors provide the number of measurements used for the model fits for each time period (E, OC and CC). These models were then applied to soil temperature to estimate the cumulative soil C fluxes for each system: for comparison of how each system and QC altered estimates of carbon loss. More data was discarded from the AGPS system via QC protocol and mechanical issues, compared to the Licor system (Table 2). This indicates to me that the estimate of cumulative flux from the AGPS system were more dependent on model fit compared to the Licor system. It would be useful for the authors to address a direct comparison of fluxes, ie when both systems were working and passed QC protocols at the same time points. This would obviously be a smaller dataset, and the authors could only compare means as opposed to cumulative flux estimates, but should eliminate any influence of model fit on the comparison of fluxes from each system.

Technical Corrections

Pg 14703 line 17 and pg 14709 line 18: the authors mention that fluxes were calculated over either 4min or 9min periods on pg 14703 but then on page 14709 they say 3 min and 8 min calculation. Is this just a typo?

Pg 14714 line 23: "rot" should be changed to "root"

Interactive comment on Biogeosciences Discuss., 12, 14693, 2015.