Biogeosciences Discuss.,
doi:10.5194/bg-2016-341-RC1, 2016


Biogeosciences Discussions

# *Interactive comment on* "How many measurements are needed to estimate accurate daily and annual soil respiration fluxes? Analysis using data from a temperate rainforest" *by* Jorge F. Perez-Quezada et al.

**Anonymous Referee #1**

Received and published: 28 September 2016

General Comments This paper is well written and presented. The specific questions the authors address are 1) to assess the performance and accuracy of different numbers of measurements per day 2) compare the performance of linear vs non-linear gap filling based on sampling frequency 3) analyze the effects of including night time respiration measurements on estimations of daily and annual respiration. I disagree with the authors that questions still remain on how many samples are needed per day; this has been addressed in the literature, which the authors cite. I do agree with the authors that how many samples per year as well as gap filling techniques are issues that need addressed. The authors presented a good examination of issues related to sampling



frequencies, gap filling strategies and methods for assessing their performance. This manuscript is very useful to researchers planning an effective sampling strategy and contributes to the overall understanding of estimates of daily and annual respiration.

I have a couple of issues that the authors should address:

1. The authors used only 3 chambers to represent the "true" soil respiration from their site. In the Davidson et al. 2002 paper that the authors cite, they have a table showing how many soil respiration measurements are needed to be within a certain % of the "true" population mean in a northern temperate forest. Using this as a guideline, the authors, having used only 3 chamber measurements at their site, may only be within $\pm$50% of the true population mean. This is something that I think the authors should address in their discussion. Their manuscript is intended to give guidance as to sampling frequency and so they should also reference how many samples may be necessary to capture the "true" respiration mean per site.

2. I understand the use of only the soil temperature model for gap filling since the authors did not see an increase in model fit when adding soil moisture. However, my concern is that there are issues with the soil moisture measurements, the wide range in soil moisture measurements among the 3 respiration chambers is somewhat suspicious. Not including moisture in the gap filling model may have changed the outcome of non-linear gap filling strategy. Can the authors comment on their moisture measurements and the potential impact on their gap filling results? There are also questions regarding the soil moisture measurements below.

Scientific Questions

Pg 4 line 29: Did the authors conducted a soil specific calibration for the CS616 probes or use the supplied calibration equation? The bulk density of the soil shows a very wide range in Table 2 and these types of probes do not function as well in soils with low bulk density. Further Figure 4c graph shows a very large range of measured soil water contents among the 3 probes, this might be more related to the calibration equation

used than to a true range of soil moisture at the site.

Pg 6 line 6: The equation presented here is the Van't Hoff equation: although cited in the Lloyd and Taylor 1994 paper, it is not their equation.

Pg 7 line 3: The authors talk about low variability in the cold month and higher in warmer. Can the authors add estimates of the coefficient of variation for these periods?

Figure 4a: The authors use Rs in $\mu$mols m-2 s-1 in this graph; but use mg in other graphs. It would be preferential to use one type of unit throughout the manuscript. Also note that Figure 4a is missing the $\mu$ in the y axis label.

Please add the units for soil water content-. these are missing on graphs and in the text.

Technical Correction

Figure 2: please label the secondary y axis.

Figure 4c: please label the y axis

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