Biogeosciences Discuss.,
doi:10.5194/bg-2016-397-RC2, 2016

Biogeosciences Discussions

Interactive comment on "Technical Note: Differences in the diurnal pattern of soil respiration under adjacent *Miscanthus x giganteus* and barley crops reveal potential flaws in accepted sampling strategies" *by* J. Ben Keane and Phil Ineson

Anonymous Referee #1

Received and published: 9 November 2016

General comments: This is an interesting study. The fact that it is submitted as a technical note is maybe confusing, as it attempts to resolve plant/soil physiological phenomena at the same time as making a point regarding measuring techniques. As far as the technical point is concerned, I think the authors argue very well that the diurnal fluctuation of respiration (Rs) has to be known for a given setting in order to put single measurements into context. I have oly some technical comments on that score (see detailed comments below).

Where the physiology of respiration is concerned, I think that more care is needed in how data are presented and interpreted. Based on the objective to assess Rs measurements during a specific daytime window, some data are separated into those obtained between 9:00 and 16:00 when drivers of Rs are considered. This splitting of data is however entirely arbitrary as far as regressions with temperature or lagged radiation is concerned. Continuous data sets are obviously powerful in resolving temporal dynamics, but rather than presenting a complete time series analysis, the authors split fluxes into convenient sections to assess drivers independently, when clearly photosynthate supply dynamics as well as temperature effects both act continuously. What I can see in the presented data are hints at possible flux dynamics based on diurnal photosynthate supply, but this accounts for a rather small variation of mean daily fluxes. Fig. 2 emphasises deviations by using % of flux mean, but these are rather small in absolute terms.

Also the temperature dependence is treated somewhat inconsistently. It was not clear to me why the temperature response was plotted for monthly average values by hour, rather than the raw data or daily averages. Averaging by hour integrates values over up to 30 days, during which time considerable variation can occur. What's not at all clear is why all diurnal data are presented for one data set (barley), but only a subset for the other (Miscanthus). If the authors wanted to show that there is a distinction between different time of day, then a much better way would be to include those data too and use different colour/shading to make this point.

Specific comments: P. 1, l. 8-10: I don't follow the logic of the sentence. The first half refers to a mode of measurement, based on "convenience" of working in daylight hours, the second invokes an assumption that temperature is a dominant control of soil CO2 efflux. Why this conflation? I assume you want to set up the issue of contrasting diurnal maxima periods, but this is not at all clear in the way it is phrased.

P. 1, l. 12: The statement that Rs in Miscanthus peaked in the night is not true. For May and June, Miscanthus "peaks" during the 9:00 – 16:00 window. Diurnal variations

in July are subtle (+/- 10%), and interpretation should take account of this magnitude.

P. 2, l. 3-7: Here is the same conflation of measurement mode and temperature control. The two concepts are not logically linked here – the single measurement is not a consequence of temperature being widely held as a dominant control on respiration, as the sentence suggests.

p. 3, l. 30: As you chose to express fluxes on a mass basis, please specify whether these are grams of carbon, or grams of CO2. Using molar units would avoid any confusion.

P. 4, l. 12: "fully"???

P. 4, l. 17: Which protocol do you refer to here?

P. 4, l. 30-32: Picking-and-choosing your data points so they fit the narrative is not appropriate. The temperature response for both data series have to be balanced, and you should show all hourly data for Miscanthus in Fig. 4. Or, as you are interested in a temperature regression across all months, I'm not sure that hourly data are meaningful to show in any case. It's a shame that you don't have temperature data for June in Miscanthus, but for a seasonal temperature response (which is what is sown by regression lines in Fig. 4), you can use monthly average Rs and soil temperature measured in barley as an approximation. From Fig. 2, this would place fluxes of around 300 mg CO2 m-2 h-1 near 12 deg C – what does that do to your curve? Regarding your regression functions – is an apparent saturation curve for the temperature response meaningful for Miscanthus? Finally, there seems to be a mismatch between short-term temperature response (e.g. June in barley, where diurnal flux response to temperature change is very sluggish) vs. seasonal response – this may be worth commenting on.

P. 5, l. 5: delete "however" (not needed as you start the sentence with "although")

P. 4, l. 32 – p. 5, l. 2: I don't completely follow this analysis. Why do you suppose that the relationship between solar radiation and soil CO2 flux is linked to the "typical

measuring window"? It seems an entirely arbitrary separation of daytime/nighttime of your data set. What I can see in these graphs is that by introducing a time shift between two essentially sinusoidal curves, you can create an apparent correlation. . The same analysis would work for soil temperature with a time lag, but I obviously see what you're getting at with the lag analysis. An analysis of regression between instantaneous flux and preceding photosynthesis (or radiation used as a proxy) would be more meaningful. If what you try to show is the case, then the deviation from the mean in CO2 flux should be greater during nights following days with high radiation, and less following days of low photosynthesis (i.e. low radiation).

Figure 1: Placing both data series on top of each other is not helpful. Please split into separate panels. What happened around the 20th July in the barley field? It seems strange that fluxes should suddenly fall dramatically and then remain constant for days (with only little diurnal variation visible), to then jump back. Any hints in the meteorological data or management (harvest)? What is the impact on your diurnal calculations?

Figure 3: I'm not sure that this graph provides much new information It should be the same as Fig. 2, only that average fluxes per hour and month are multiplied by the number of measurement days, or not? Dynamics should hence be identical.

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-397, 2016.