Biogeosciences Discuss., 8, C2222–C2224, 2011
www.biogeosciences-discuss.net/8/C2222/2011/

Biogeosciences
Discussions

Interactive comment on "Exploring the "overflow tap" theory: linking forest soil CO_2 fluxes and individual mycorrhizosphere components to photosynthesis" *by* A. Heinemeyer et al.

A. Heinemeyer et al.

ah126@york.ac.uk

Received and published: 29 July 2011

"I found the results from the time series analysis using wavelet coherence very compelling, but I am left in doubt about the quality of the original temperature corrections. The authors comment that the quality of the regressions (that were used to adjust for temperature differences in the various fluxes prior to TSA) were poor for some periods of the year. This is bound to affect the subsequent TSA. A more robust regression technique should be considered, e.g., linear mixed models or even better bayesian hierarchical models to properly propagate the uncertainty from period to period and to take advantage of the shrinkage of the coefficients and the strength-borrowing fea-

tures of mixed/hierarchical models. On a similar note, I wondered whether vertical differences in soil T may be better accounted for than at presently done, e.g., by discretizing soil efflux as if coming from different vertical soil layers, ie., as done in the past by M Reichstein."

Response: The temperature corrections for the wavelet coherence analysis: We thank the reviewer for the positive feedback on the wavelet coherence analysis (WCA) and acknowledge his/her doubts about how the temperature sensitivity analysis was done. We agree that the relationship of soil temperature with soil respiration is not perfect for every day and varies throughout the season (see Table 5). He/she suggests a more complex analysis such as using a mixed linear model or applying a bayesian framework. We are not familiar with bayesian models but the main aim of using temperature on SR fluxes here is to de-trend the time series not to understand its ecological function.

Basically, we choose one common equation (i.e., exponential function) to represent the relationship between temperature and SR for de-trending. We feel that using a commonly used equation is better, simpler and easier to understand for a wider readership than applying a different and more complex approach to de-trend high temporal resolution time series. We believe that using a different approach to de-trend will make the interpretation of what is left (i.e. the residual time series or de-trended time series) and the results only more difficult to interpret. We recognize that different approaches can be done but we kept consistency with a recently published protocol by Vargas et al. 2011 (in press, New Phytologist).

We now clarified this goal of this analysis in the revised M&M section, which is not to fully understand the effect of temperature but to remove the daily oscillations of the time series due to diurnal changes in temperature, enabling to then interpret the residual relationships. We believe that if the diurnal and long-term autocorrelations between two times series (i.e., GPP and SR) are not removed we will be resolving for confounded results. Several studies have addressed this issue previously to avoid confounded interpretation of parameters and relationships, i.e. Davidson et al., GCB (1998); Mahecha et al., Science (2010).

The issue of soil temperature vs. soil depth effects affecting SR: We agree that we need to be careful to use the "proper soil temperature depth" but to determine which is this ‘best’ depth is very difficult indeed and justifies another paper in itself (which we are currently planning in collaboration with the M. Reichstein group). The way we decided to do the current analysis was to find the depth of maximum correlation with total SR. Although this is arbitrary, it is the most appropriate temperature depth available to de-trend diurnal CO2 flux variations. Thus, we agree that there is room for improvement and we now acknowledge this in the revised manuscript in connection with the need to explore where the production of CO2 is done in the soil (see Vargas et al., 2010, Ecological Applications). However, at this point it is not possible as the goal of the current manuscript is to understand the partitioning of the total SR fluxes and temporal dynamics/correlations of different flux contributions. A next step is certainly to understand the production in the soil of each one of those flux components and this dataset offers the possibility to explore the issues of the need to measure where these fluxes are produced and which are the biophysical controls for each one; we now include this argument in the new section ‘limitations and future research considerations and applications’.

Interactive comment on Biogeosciences Discuss., 8, 3155, 2011.