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Biogeosciences Discussions

Interactive comment on "Soil respiration at mean annual temperature predicts annual total across vegetation types and biomes" *by* M. Bahn et al.

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Bahn et al. report that an annual estimate of soil respiration can be generated simply by measuring soil respiration at the mean annual temperature for a siteâĂŤor by also using a correction for water availability for water-limited sites. This clever idea could greatly simplify annual estimates and expand the data on annual soil respiration dramatically. Since soil respiration is usually the major source of respiratory loss and is also the most difficult component to measure to estimate total belowground carbon flux (Giardina and Ryan, 2002), such simplification would be incredibly helpful.

The relationship presumably derives from a fairly simple sinusoidal pattern of respiration throughout the year, and a fairly simple relationship of respiration and temperature. It should be possible to derive the scaling coefficient from these facts by first principles

(see Ågren and Axelsson, 1980).

The analysis done in the current manuscript (regression across sites) is incorrect for the question asked. A cross-site regression assesses if a relationship holds between the two variables across sites, not how good the relationship is at any individual site. Lots of cross site predictions work across sites, but not for an individual site (for example, Gower et al., 1996; Litton et al., 2007). Some reasons for this lack of utility for an individual site include (1) the gradient across sites obscures important within-site variability and (2) the cross-site relationship has a different response than that of the population of organisms at an individual site. In this case, the proposed method is being promoted exactly for such a site–specific use. I'm not a statistician, but I believe that the correct analysis would be a paired t-test between predicted and observed, perhaps stratified by two or three flux levels. This analysis would generate a mean difference between modeled and observed together with an uncertainty for that mean difference. I would also want to know the range in absolute and relative error for estimating an annual flux this way before I decided to use it. The more accurate the method could be shown for an individual site, the more likely it will be used.

I could not understand how the model for the Monte Carlo simulation worked, but seeing such a biased pattern (all of the variability on the high side of the relationship) suggests something not quite correct is happening. There are several sites in the data set where a site-specific multi-year analysis could be conducted, and such an analysis would strengthen the paper. I'm also wondering how the paper would suggest dealing with diurnal variability.

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Litton, C.M., Ryan, M.G., Raich, J.W., 2007. Carbon allocation in forest ecosystems. Global Change Biol. 13, 2089-2109.

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