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Interactive comment on "Uncertainty analysis of eddy covariance CO_2 flux measurements for different EC tower distances using an extended two-tower approach" *by* H. Post et al.

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This manuscript reports on an interesting study to estimate flux tower random sampling error from a set of towers sampling a similar landscape located near each other at a range of distances. In particular, the authors show the reliability of estimating error decreases as a function of distance (both in the case of too close leading to footprint overlap and too far leading to differing environmental conditions), but this can be improved by applying a systematic difference correction and filtering for weather conditions. In principle, the paper is sound and generally worthwhile to public in Biogeosciences. I do suggest a few revisions to make the paper more generalizable and more useful for

the eddy covariance carbon cycle flux tower community.

Major

1. Some more justification of why this approach is needed should be included. For an individual tower that wants to estimate error, I suspect the raw 10 Hz observations are accessible while a second tower is not. I think the authors can justify this however, as testing the reliability of the two tower approach is still warranted. Many larger flux tower syntheses rely on previously report two or one tower error metrics for estimating flux tower random error. The authors might want to compare their results with the earlier two-tower or model-tower or single tower based approaches and update some of the constants (for example the slope and offset) used in those. For example, I believe the Richardson paper includes an equation (linear fit) of NEE to error magnitude. How do the slopes and offsets compare? It's possible this is already there, and I missed it, in which case, emphasize it.

2. Similarly it might be interesting to estimate, given the criteria discovered here on maximum possible distance that is reliable and role of filtering corrections and estimate what % of towers in the current Fluxnet database could be amenable to such a paired tower analysis? A related interesting question, is, can the slope/offsets derived here be directly applied to any tower (as is done in some model-data assimilation work now)?

Minor

P 11945 Line 14 Systematic errors are considered to remain constant for set of environmental conditions. This is confusing. u* is an environmental condition, right? Systematic error increases with low u*. Maybe a little rewording is needed.

P 11946 Line 21 I don't think of instrumentation issues as "errors" but rather precision or sensitivity. Random error from instrument noise is not an error in the instrument per se. A true instrument error (bad calibration, bad laser) would lead to a systematic error.

P 11946 Line 23 Some random errors can be corrected, given the list here. Flux

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footprint heterogeneity can be corrected some by using estimates of land cover and debasing techniques (such as Metzger et al., 2013). Also not sure how footprint error can actually be computed from the raw 10 Hz alone - i.e., the Mauder/Foken TK3 approach estimate of random error tells you mainly how variable the covariance is with time. It's unclear how that would incorporate flux footprint error.

P 11955 Is SFD correction before or after u* filtering?

P 11959 Line 16 If noise and stochastic errors are truly a sigma and are independent, shouldn't they be added in quadrature? Though Mauder et al (2013) is published, some more details on what the exact nature of each noise computation is might help in understanding the characteristics. Just a sentence on each.

Table 2 - though it may make it messy, also a metric of the range of uncertainty estimates for each method and distance should be included. Also discussion of difference between night and day would help interpret other points made in the results (maybe a separate table or supplement?)

Figure 5 - it appears from here that the reliability of the approach in terms of distance is different for night and day (when the slope changes significant occurs at different distances, as does the r^2). Is that a correct interpretation? If so, some discussion may be needed on why the paired tower approach works differently in day vs night.

Interactive comment on Biogeosciences Discuss., 11, 11943, 2014.