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Biogeosciences Discussions

Interactive comment on "Ideas and perspectives: Tree-atmosphere interaction responds to water-related stem variations" *by* Tim van Emmerik et al.

Anonymous Referee #2

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This manuscript applies a novel, low cost, field-durable method to examine an oft-oversimplified process in land surface models: the momentum transfer between the atmosphere and tree canopies. Its major contributions include (1) being the first to achieve in situ measurement of tree-atmosphere momentum transfer, and (2) finding significant fine-scale spatial variability (individual tree) and coarser-scale temporal variability (over weeks and seasons) in tree-atmosphere momentum transfer. Considering the high spatiotemporal variability observed, it would have been nice to see some back-of-the-envelope estimate of its relevance to related processes, like those mentioned in the introduction (i.e., transfer of water, heat or gasses). But, such an estimate is not necessary. This method, dataset and analysis would be of high interest to the geo-

science community with some revision:

*Why does the title and abstract focus solely on "water-related stem variations"? The authors discuss the potential effect of leaf mass variations late in the manuscript - leaves are not mentioned until P9, L11. Additional factors may affect the measurement (sway) and derived momentum transfer, like mechanical properties (i.e., elasticity), wind conditions and the distribution of canopy mass.

*Where is an introduction of tree water deficit? The manuscript would benefit from (1) an explicit definition in the introduction and (2) description of the magnitude of typical mass changes resulting from variability in internal tree water content.

*What other mechanical properties vary with tree water deficit? And, what else exerts a temporally varying influence on atmosphere-tree momentum transfer?

*Why is the effect of leaf fall and growth not discussed in the introduction? The effect of leaf state on tree mass has long been a major part of the discussion about accelerometer-based methods for tree monitoring (i.e., Selker et al., 2011, AGU abstract H11G-1155).

*Can section 3.4. discuss potential factors causing interspecific differences in momentum transfer? The relationships in Figure 6 did not appear to explain much interspecific variability. Are there other interspecific differences in leaf type/distribution (maybe simply LAI), or branch size/distribution (maybe simply SAI), or LAI:SAI, stem elasticity, etc?

*What are the potential sources of error in the sway measurements? For example, what is the impact of erratic or sustained winds impeding "free" tree sway on the analysis?

Minor edits:

*P1, L12: Do you mean "Land-atmosphere interactions influence meteorological *processes* and hydrological. . ."

*P1, L18-20 pretty much repeats L14-16. I suggest deleting L18-20.

*P2, L6-9: Can you please break-up the long line of citations. Specifically, I recommend placing each study beside the term indicating which study used, for example, dwarf species? Juvenile crowns? Etc.?

*P2, L26-27: The hypothesis in the introduction appears to be that "momentum transfer . . . [is] in response to water-related stem variations [i.e., water deficit induced mass changes]." But, P9, L10-11 broadens this hypothesis to include "water content or leaf fall." I suggest including a statement like, "water content, leaf fall, or other mass changes" in the original hypothesis.

*P2, L28: Change to "momentum transfer *varies* more than often assumed"

*P3, Table 1: Why was a range of wood density values provided for only one species (S. micranthum) but not for the others? Zanne et al. (2009) provides a range for others. For example: G. glabra (0.32-0.94), E. coriacea (0.70-1.13), D. odorata (0.66-1.09), P. anomala (0.31-0.81), and M. scleriphylla (0.40-0.58). This range shows that, e.g., E. coriacea and D. odorata are not that different in density – despite the table indicating one is "intermediate" and the other is "high" density.

*P3, Table 1 and elsewhere: I believe that "Dypterix" should be "Dipteryx"

*P4, L4: Change to "measure the largest signal *that* can be measured,"

*P4, L12: Please remove references to manuscripts under review. The accelerometer details in one or two of the recently-published papers is surely enough to direct readers.

*Figure 6: In my opinion, the height and diameter relationships, being statistically insignificant, don't merit description in the results. Thus, P11, L12-13 could be deleted.

*P12, L3-4: "leaf flush or fall" is not a "water variation" – sure, water is a part of it, but this statement, as is, is inaccurate.

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