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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Analysis of coherent structures and atmosphere-canopy coupling strength during the CABINEX field campaign: implications for atmospheric chemistry" *by* A. L. Steiner et al.

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Response to Anonymous Referee #2

As noted in our response to Reviewer No. 1, we fully acknowledge that the coherent structure detection techniques presented in this manuscript are not novel nor were they intended to be. The new analysis presented in this paper is a side-by-side comparison of two different detection events at a specific field site with atmospheric chemistry measurements, and an analysis of canopy-atmosphere coupling using two sonic

anemometers within and above the canopy. Despite numerous flux studies at the University of Michigan Biological Station field site, a coherent structure analysis has yet to be performed in its history. Our results have implications for analysis of atmospheric chemistry gradients in this ACP Special Issue and the many other flux studies at this site. In response to both reviewers, we have revised the introduction section to clarify our intent and reasons for publication.

We appreciate the suggestion from the reviewer to include the time contribution, and we have revised Figure 7 and Section 4.3 to include this analysis. Our original definition of the flux contribution (equation 3) was weighted by the time of structures (tcoh) and the total time (t). We retain this definition in the revised manuscript and add an additional term of transport "efficiency" to provide information about the time contribution and efficacy of the coherent structures.

The revised text of the manuscript includes an explanation of the transport efficiency calculation, the efficiency calculations and statistics for heat and momentum transport, and the impact of this new calculation on our conclusions in section 4.3. Overall, we find that the transport efficiency for the wavelet method is greater than one, with even greater transport efficiencies of up to 2-3 for the Q-H method. As the reviewer notes, the latter may be an artifact of the method and we reiterate this point in the revised manuscript. However, this provides evidence that in both cases, the coherent structures are enhancing the normal flux transport and are an important mechanism for canopy-atmosphere exchange of trace gases. As such, understanding this mechanism is important for chemistry within and above the canopy.

We have modified the flux contribution section of the manuscript to include a time contribution component (see revised Section 4.3 and Figure 7). Contrary to the reviewer's expectations, the transport efficiency suggests that coherent structures are important in canopy-atmosphere exchange. Additionally, we have removed the clause from the title of the manuscript "Implications for atmospheric chemistry" as we agree with the reviewer that we do not explicitly address this in the manuscript. Subsequent manuscripts

will address the implications for mixing in the forest canopy (Bryan et al., in preparation for this ACP special issue).

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 21013, 2011.

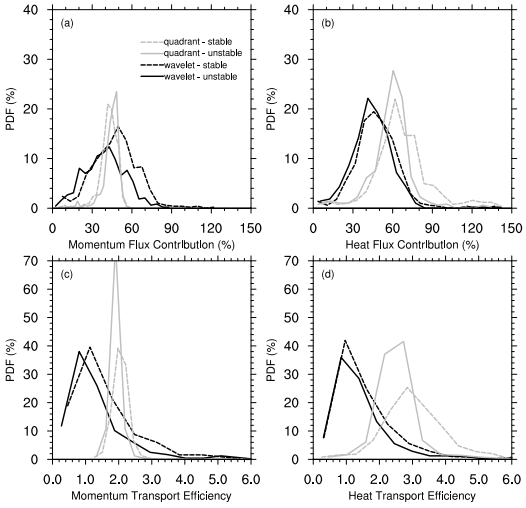

Fig. 1.