

## ***Interactive comment on “Effects of climate variability and functional changes on the interannual variation of the carbon balance in a temperate deciduous forest” by J. Wu et al.***

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We thank reviewer #1 (R#1) for their comments and support of using data driven analysis based on long-term ecosystem monitoring. While the data analysis method we applied is based on the methods of Richardson et al. (2007), we made specific modifications that we believe improved the method. Richardson et al. (2007) discussed in the paper that their approach did not account for the seasonal variation in the ecosystem state (see “Limitations of the model”) as the parameters were estimated at an annual time step. We resolved this issue by using a moving window approach for parameter

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estimation, therefore allowing the model to capture the seasonal patterns of functional change. The model fitting clearly improved. Therefore, we consider this as an important method development.

Our study did not set out to describe the mechanisms that determine the inter-annual variability in ecosystem functional state but to demonstrate its importance in determining ecosystem carbon balance. We must admit that we have perhaps been misleading in our speculation upon the potential mechanisms. To understand the fundamental mechanisms is very interesting. This is also challenging and probably goes beyond the capacity of the statistical modeling, as the functional change was controlled by the interactions among multiple factors through various pathways, which took place at different time scales. We accept, in light of this criticism from you and other sources that we need to reduce the degree of speculation on mechanisms and concentrate more on the novelty of this work itself.

The main objective of this study was to evaluate to what extent and at which temporal scale, climate variability and functional change affected the carbon fluxes. We have performed the analysis with focus on answering these questions. We hold the opinion that this study has vastly improved our understanding of the carbon dynamics at this site. While the importance of functional changes for deciduous forests is known, few studies have comprehensively quantified this. A special interesting aspect of this flux dataset is the trend of increasing carbon uptake. A previous study (Pilegaard et al. 2011) investigated the influence of extended carbon uptake periods and increased maximum photosynthetic capacity at June, but did not explore the interactions with the climate. This study went a step further and distinguished the relative impact of climatic and different biotic factors. We agree with the comments of R#1 that the method could be applied in multiple sites to explore the ecosystem behavior over larger spatial scales, to identify e.g. which type of ecosystem is more sensitivity towards functional change.

In response to the ‘quick question’: the IAV is determined around the observed mean, not around the de-trended flux.

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Reference: Pilegaard, K., Ibrom, A., Courtney, M. S., Hummelshøj, P., and Jensen, N. O.: Increasing net CO<sub>2</sub> uptake by a Danish beech forest during the period from 1996 to 2009, *Agr. Forest Meteorol.*, 151, 934–946, 2011.

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