Anonymous Referee #2
Received and published: 4th November 2015
We would like to thank the referee for their time and valuable comments, which we respond to below. The referee's comments are shown in *italics* whilst our response is in normal blue type. We acknowledge that the referee has some major criticism of our experimental set up, analysis of the data and of the manuscript. We hope that by providing a detailed description of our planned changes we can address these concerns resulting in a substantially improved revised manuscript.

Referee's comment
This manuscript attempts to quantify effects of thinning on CO2 exchange in deciduous forest canopy by analyzing one eddy-covariance tower with different wind directions. The authors argue that the effects of thinning on the carbon balance were not significant. The subject of this study will be of interest to scientific community because previous studies on impacts of thinning on carbon balance have been done in coniferous forests. However, I cannot confirm that the conclusions of this manuscript were drawn correctly because only one tower is located at the border between thinned and un-thinned sectors, which makes us difficult to test statistical significance and to properly interpret physical implications. Sufficient data and thorough investigation are needed more. I will not bring up specific issues and please consider major concerns below for giving more solid evidences to this study.

Author's response
We are pleased to note that the referee has commented that this study will be of interest to the scientific community and welcome this. Whilst we understand the referee's concern that about the interpretation of EC data split by wind sector, from only one tower, we would like to draw attention to the fact that this technique has been used successfully in previously published studies (e.g. Parmentier et al ., 2011).

Referee's comment
1. It is misleading to discuss to differences of climatic conditions such as downward solar radiation, air temperature, wind and humidity between thinned and un-thinned sectors. For example, downward solar radiation should be same at these two sectors because the un-thinned and thinned sector are not hundreds kilometer away. Thinning management cannot make impacts on downward solar radiation! People may want to know changes in albedo and outgoing longwave radiation, and so net radiation more. But I am not quite sure physical meanings of radiative fluxes from radiometer close to the boundary of the thinned and un-thinned sectors.

Author's response
With respect, we think this referee has misunderstood the presentation and discussion of the met data (e.g. Fig 2), which was separated according to when the wind was from either the E or W sector. We did not say that these differences were *because* of the thinning, but tried to make it clear that the differences in conditions *associated* with different wind directions (and therefore other weather conditions) will have affected the fluxes and needed to be taken into account. This is why we examined NEE response curves to light intensity and temperature sensitivity of respiration, rather than simply compare fluxes across time. The other referee did not have this problem, but we will try to make the revised ms clearer.

Referee's comment
2. The first issue is going to another issue. The different solar radiation between the two sectors indicates that solar radiation has been sampled on different time between thinned and un-thinned sectors. Let me show one example. 1) Flat and homogeneous surface without any disturbance like thinning. 2) Air temperature was higher on the first day than the second day because of different synoptic condition. 3) Main wind comes from the east on the first day but from the west on the second day. 4) If we compare air temperature between the east and west sectors, air temperature in the east sector is higher than the west sector. 5) Absolutely, thinning does not make this difference. We need clear discrimination on these kinds of different from thinning effects but I am quite sure if one tower measurement can resolve this issue.

Author's response
This point illustrates the referee's confusion noted in the previous point; we clearly stated that the different conditions are because of changing wind directions. We agree with the referee that thinning does not alter the meteorological conditions that the forest is exposed to, but the conditions *do* change with wind direction. We believe the existing ms was clear on this, but will seek to revise it to reduce the risk of misinterpretation.

Referee's comment
3. The first and second issues are moving to another issue. The authors said that data retrieval rate is only 30%, indicating that 70% missing data are filled by the marginal distribution sampling (MDS). MDS is looking for the observed NEE values of similar climatic conditions. Therefore, if more than 2/3 data are missed, MDS feel difficulties in finding the similar climatic conditions and will extend the time windows to find the similar climatic conditions. In this case, we expect that uncertainties in the gap-filled data increase dramatically. Furthermore, the gap-filled data strongly depends on climatic conditions which is related to the second issue above. How can the authors quantify these uncertainties and their impacts on data interpretation for the thinned and un-thinned sectors?

Author's response
The referee's concern about the use of gap filled data and the uncertainty associated with this method was also highlighted by Referee #1. We acknowledge this weakness, and as stated in our response to Referee #1 in our revised manuscript we will adopt their recommendation (1) and remove all reference to the gap filled data including the integrated annual sums. Furthermore, we will restructure the paper with a greater emphasis on the seasonal average fluxes, which we will include more information about the uncertainty in these values.

Referee's comment
4. All interpretations of the authors are not based on solid statistical test. All figures and tables do not have any statistical test results (e.g., p value). For example, Figure 6 shows light response curves before and after the thinning management. But this figure only shows fitted curves without any error range and p-value. In addition to uncertainties in the measurements itself and data processing, it is difficult to say any difference or similarity with strong confidence.

Author's response
Referee #1 also pointed out the present lack of statistical evaluation. Where possible we will provide more detail about the statistical analysis and significance tests that have been carried out. Specifically, we will address the issue highlighted relating to Fig. 6, by providing more detail of the uncertainties in these parameters and updating the figure accordingly.

Referee's comment
5. With the current experimental design, it is impossible to quantify changes in radiative fluxes, soil temperature and soil moisture, which are critical information on the thinning effects on carbon cycle.

Author's response
It is true that we did not measure soil temperature / soil moisture at different locations within the forest and we agree that these variables are major determinants of the C cycle. However, we were not seeking to measure how these changing 'internal' (within-stand) factors affect the C cycle, but relating the observed C fluxes to the 'external' driving weather factors of Ta (at 26m) and incoming Srad.

Referee's comment
6. How can we separate disturbance by caterpillar from thinning management?

Author's response
We do not understand this comment. We did not try to separate caterpillar disturbance from thinning effects. The intensity of caterpillar activity varies year to year, as do particular combinations of weather conditions and this is superimposed on any other disturbances such as thinning. We only sought to point that when the leaf area is reduced by caterpillar feeding, this could have made the C fluxes more sensitive to the reductions in leaf area caused by thinning.

Reference

Parmentier, F. J. W., J. van Huissteden, M. K. van der Molen, A. J. Dolman, G. Schaepman-Strub, S. A. Karsanaev, and T. C. Maximov (2011), Spatial and temporal dynamics in eddy covariance observations of methane fluxes at a tundra site in northeastern Siberia, J. Geophys. Res., 116, G03016, doi:10.1029/2010JG001637.