Author reply to the review by Referee #1 of the manuscript:

"On the impact of atmospheric waves on fluxes and turbulence statistics during nighttime conditions: a case study"

by Durden et al.

We would like to thank the reviewer for the thorough assessment of the manuscript and thoughtful suggestions for improvements. We revised the structure of the manuscript to make the data selection process more evident, separate the discussion of the results from the conclusions, and address any redundancy. The quality of the figures will be improved by providing them in postscript format for publication.

General comments

The reviewer's main critics are addressed in order:

1. **Poor stochastic relevance**:

   The data selection section was revised the quantitative analysis of large amplitude "wave-like" events now ranges from 22 April, 2009 to 31 March, 2010. The 3 to 30 min boundaries were chosen to limit the overlap of turbulence and waves as indicated by the Brunt-Vaisala frequency indicating wave periods must be larger than 1.5 minutes to sustain themselves, and to focus on waves less than the typical averaging period (30 min.), since Nappo et al, 2008 suggested waves longer than the averaging period did not affect the calculations. Strict criteria were used to determine the wave event due to the nature of detecting the waves, the normal distribution of wave cycle means only the peaks pass the threshold and the frequency is small. Even with the strict conditions, large amplitude wave-like events were found to occur on 31% of the nights assessed. The two nights were chosen to represent two different boundary layer conditions, one quiescent and one turbulent. This study is meant to be a preliminary study, it is agreed that further more rigorous climatological study is needed. However, the data analyzed will be extended to several nights.

2. **Descriptive nature of the interpretation/ results**:

   A discussion of quadrature is added to the manuscript to describe the analysis of wave motions and a Brunt-Vaisala frequency is given for the two cases presented. Also, we replaced the bulk Richardson number with the gradient Richardson number. The authors felt that this level of technical details regarding the particularities of the wave identification may be outside the scope of a Biogeosciences.

3. **Poor definition of motions analyzed**:

The wave motions were analyzed using a microbarograph. We used the phase relationship of w and T to determine the wave-like event was indeed indicative of a gravity wave. The other phenomena were mentioned to highlight the complexity of the nocturnal boundary layer and to emphasize care when detecting wave events. We will remove mention of the other phenomena from manuscript to reduce the ambiguity. The microbarograph outfitted with a static disk yields static pressure fluctuations, the signal with the least noise to detect waves. In older studies, it was common practice to bury the microbarographs to reduce dynamic pressure fluctuations. We are not trying to use the microbarograph as a predictor of turbulence on the tower, but rather just for identification of the wave. The impact of the wave on eddy-covariance data at each level is then assessed separately. The nights chosen were nights where the wave signal was resolved in the sonic anemometer data at all levels on the tower. The waves may not propagate to all heights on the tower for all cases. These cases were chosen to assess the findings of Viana et al, 2009, who claimed that the wave grew in amplitude at higher altitude, suggesting the possibility of a larger impact on flux calculations.

4. **Overinflated interpretation of the results**:

The authors believe this preliminary study may provide the stepping stone to further research on this topic. We clarified in the text that primarily turbulence statistics and turbulent fluxes were impacted, not laying claim that seasonal fluxes are impacted. We state on p. 5152 line 24-27 "Our study assesses the magnitude of the overestimation (inflation) in turbulence statistics and errors in turbulent flux calculations (hereafter any reference to fluxes refers to turbulent fluxes) on two nights in contrasting atmospheric conditions". We proceeded to use fluxes in reference to strictly turbulent fluxes throughout the rest of the text. We will change all the instances of fluxes to turbulent fluxes. However, the results of this study and work by van Gorsel et al., 2010, Viana et al., 2009, and Zeri and Sa, 2011 suggest that more exhaustive analysis should be performed to determine the impact of "blindly" calculating 30 min flux averages in the presence of large amplitude waves. We the authors also wish to highlight the contribution of the work to modeling efforts, where characterizing true turbulent components and indicating wave implications could produce more robust parameterizations.