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Interactive comment on "Carbon budgets for an irrigated intensively-grazed dairy pasture and an unirrigated winter-grazed pasture" *by* J. E. Hunt et al.

Anonymous Referee #2

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-Overall-

The article titled "Carbon budgets for an irrigated intensively-grazed dairy pasture and an unirrigated winter-grazed pasture" documents (1) how the annual NECB of the irrigated, intensively-managed pasture was quantified, (2) how it differed from that of an adjacent unirrigated pasture, (3) uncertainties of the annual NEP and NECB, and (4) how the management practices influenced both NEP and NECB. This research is important for assessing economic and environmental sustainability of the intensification of grazed grasslands in New Zealand. I think that this study can be an example of climate smart agriculture (http://www.fao.org/climate-smart-agriculture/72610/en/). In general, the manuscript is well written and the figures are nice presentations of the

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data. The experiment was well designed to quantify the NECB of pasture reliably. The topic will likely be of interest to the readers of OzFlux special issue in BG. After careful consideration of all points raised in this review, I am favorable to recommend publication of this study in BG.

-General comments-

1. I think the ultimate goal of this study is to answer questions regarding economic and environmental sustainability of intensification of grazed grasslands through application of irrigation and fertilisers. Economic and environmental sustainability and carbon (i.e., CO2 and CH4) uptake/emission of pasture are directly related to the concept of climate smart agriculture. Climate-smart agriculture promotes production systems that sustainably increase productivity, resilience (adaptation), reduces/removes GHGs (mitigation), and enhances achievement of national food security and development goals (http://www.fao.org/climate-smart-agriculture/72610/en/). Please consider including this concept in the introduction, and adding that the management practices in this study site can be an example of climate smart agriculture in the conclusions. My only concern is that irrigation is economically and environmentally sustainable practice for this grazed pasture.

2. The authors selected 0.12 m s-1 of sigma_w as the low turbulence filter threshold and the NEP was quantified using 0.12 m s-1 of sigma_w threshold. The lower threshold results in the lower proportion of gaps as well as the overestimation of NEP. The results from Fig. 8 can be expected without this kind of assessment. I think that the uncertainty should be assessed using the NEP only from the higher thresholds than 0.12 m s-1 of sigma_w (i.e., the dependency of the measured nighttime CO2 flux on sigma_w was negligible). Actually, the difference between the NEPs from 0.12 m s-1 and 0.15 m s-1 of sigma_w thresholds was relatively small. In that sense, the threshold-dependent uncertainty in this study can be overestimated.

-Specifics-

Line 8, page 5: What is “N”?

Line 21, page 8: The process-based gap-filling method of Barr et al. (2004) is important because its results are used for estimating the uncertainties from the gap-filling procedure. Therefore, please explain more details about the method.

Line 29, page 12: How did the authors get those numbers (i.e., 22 g C m-2 yr-1 and 38 g C m-2 yr-1 of the total uncertainties). Please explain the derivation.

Line 7, page 13: Please cite a reference for ‘5% of annual ET.’

Line 25, page 13: What is “SE”?

Line 14-19, page 17: Please briefly compare weather/climate of the site in this study with that in Ammann et al. (2007).

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