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***Interactive comment on “Estimating carbon
dioxide fluxes from temperate mountain
grasslands using broad-band vegetation indices”
by G. Wohlfahrt et al.***

G. Wohlfahrt et al.

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Reviewer: This paper provides a statistical analysis of the relations between NEE and related variables (GPP, light response parameters, ecosystem respiration) with ground-based vegetation index for two temperate grassland sites. It is well written and technically well designed, the figures are clear and useful, citations are relevant. One may argue that the does not contribute much to the current understanding. Indeed, it does not address the broadband / narrow band issues, since the two kinds of data were not acquired over the same years.

Reply: While it is true that we are not able to directly compare narrow-band with broad-

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band NDVI/SR because these have been measured in different years, we feel that this does not constitute a major drawback of the present study. First, this comparison has been done before by others with favourable results (see discussion). Second, the comparison itself is of less interest to our study, but rather we are interested in the ability of broad-band vegetation indices as opposed to their narrow-band counterparts to estimate CO₂ fluxes. Provided that the underlying relationship between vegetation indices and CO₂ fluxes does not change between years, for which we do not have an indication from the two-year data set of Neustift, this goal can be achieved with measurements in differing years.

Reviewer: In addition, narrow bands would be suited to obtain clean satellite data or to derive well defined properties of the canopy, as Wohlfahrt et al recognize, which is not the scope of the paper. The study does not address either mechanistic understanding of radiation regime in plant canopies or plant physiology.

Reply: Correct – this is again not the scope of the paper and we discuss this in the paper.

Reviewer: Last, it does not address the differences noted between the two grassland sites, which would have helped to obtain general results.

Reply: This is a consequences of the proposed approach and we honestly discuss these issues.

Reviewer: Rather, the authors honestly say in their discussion section that much of the results were expected: strong links between NDVI and assimilation, and Reco with other variables, like temperature. The results presented in the paper may be of interest for gap-filling techniques. Although it contains rather expected results, the paper honestly contributes to the world-wide effort to relate eddy covariance CO₂ fluxes to micro-meteorological variables, pointing possible use of routine radiation data in gap-filling techniques. Therefore I recommend publication in Biogeosciences with minor revisions. In order to increase the impact of the paper, I would recommend to strengthen

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the light- response curve paragraph by estimating absorbed PAR and discuss light-use efficiency based on absorbed PAR rather than incoming radiation.

Reply: We do discuss the light-use efficiency, even on an absorbed PAR-basis. However, absorbed PAR is not among the best predictors and is thus not used anymore in the following analysis.

Reviewer: Also, to really demonstrate the interest of ground-based NDVI data for gap-filling, the authors may want to perform some tests with their dataset and provide an estimation of the accuracy of the NDVI-based method compare to existing methods (fits, bins etc.).

Reply: We have been thinking about this during the preparation of the manuscript, but decided not to go into the direction of gap-filling because this would be an exercise (paper) on its own. Mostly, because in order to demonstrate the ability of the proposed approach, an analysis based on synthetic data (i.e. without gaps) with different number, distribution and lengths of artificial gaps would be needed. The synthetic data set would need to be created with an independent method, e.g. neural networks. Because we feel that this would go far beyond the scope of our study, we have thought about ways to show how powerful the proposed approach is and will come up with a short gap-filling exercise shown in a new Fig. 7 and corresponding text.

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