

## ***Interactive comment on “Effects of cloudiness on carbon dioxide exchange over an irrigated maize cropland in northwestern China” by B. C. Zhang et al.***

### **Anonymous Referee #2**

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#### General comments

The study is about the impacts of clouds via diffuse radiation on Net ecosystem exchange (NEE) on a maize cropland. Additionally, the authors look at effects of temperature and VPD, under various Clearness index (CI), on carbon uptake.

Most of the recent literature on measured effects of diffuse radiation on photosynthesis has been concentrated on forest ecosystems, with few studies looking at grasslands and even fewer studies looking at croplands. The relevance of this study lies on the fact that it provides an analysis of effects of diffuse radiation on a C4 cropland.

The authors use NEE derived from eddy correlation measurements and parallel mea-  
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surements of meteorology to produce various response curves under cloudy and clear sky conditions. Some of the plots lack the regression line that was fitted to the data set (figures 2, 5, and 6), so it is difficult to know if there is any statistical difference between these lines (i.e. for instance the VPD effect). Key plots such as GPP or NEE against CI need to be added. Additionally, it would be good to have separate plots for different CI groups. i.e. response of GPP to radiation for high, low and intermediate values of CI (see Dengel and Grace, 2010).

Response of photosynthesis to VPD and T: Simple plots of GPP against VPD and T (for different CI) could be very useful to see at which point photosynthesis starts decreasing with increasing VPD and T. It seems that photosynthesis does not reach its optimum value under the measured conditions.

This study looks at an irrigated cropland, however the authors do not mention what the effect of irrigation on their results is. Additionally, the obtained results could be put into context with results from other studies on croplands (i.e. Niyogi et al. (2004) had croplands on their study), also, is there any difference with a C3 cropland?

Overall, additional exploration of the data would be necessary to confirm the stated conclusions of this work. Also, the study would benefit from additional analysis that included stomatal conductance, Light use efficiency (LUE) and water use efficiency (WUE) under various CI conditions. Finally, this paper would benefit greatly from an overall improved level of English.

#### Specific comments

Page 1672, Site description, what are the mean temperature and precipitation during the growing season? , this could be relevant to add here.

Page 1672, line 16, the fetch is mentioned, but what is the footprint of the system?

Page 1672, ine 21, measurements of soil parameters are mentioned here, is this used on this paper?

Page 1674, lines 4-6, again a lot of information given on data that is not used on this paper, such as soil temperatures and soil moisture.

Page 1674, Equation 6, how did you estimate  $S_f$  i.e. the total diffuse radiation received by horizontal plane on the Earth surface?

Page 1675, lines 1-3, and in other places too: -How do you define clear and cloudy sky? , is it based on CI, or diffuse fraction? Which ranges?

-How many days are included in Figure 1.

Page 1675, lines 11-13, Does it make much of a difference to use a polynomial equation rather than the usual asymptotic response  $NEE = A_{max} * Radiation / (b + Radiation)$ ? Parameters from this type of curve have some physiological meaning, such as  $A_{max}$  and  $A_{max}/b$  (light use efficiency). If it was possible, it would be interesting to use this type of equation to be able to compare  $A_{max}$ , and  $A_{max}/B$  for cloudy and clear sky conditions. For instance, is Light use efficiency higher under cloudy & overcast conditions than under clear sky conditions?

-It would be useful to see a plot of NEE or GEP against CI, to show where GEP is maximum. Page 1675, line 15, on Figure 2. What are the statistics of those curves, i.e.  $R^2$ , are those regressions significant, number of points used? What are equations?

Page 1676, lines 1-2, If the authors are talking about NEE here, then you need to mention the whole plant respiration and heterotrophic respiration (i.e. ecosystem respiration). Response to temperature and VPD, Page 1676, lines 1-9 (figs 5 and 6). Again, are these regressions significant?, what are the p-values and  $R^2$  or simply under the measured conditions (irrigated) has not reached the threshold temperature and VPD values at which photosynthesis starts decreasing with increasing VPD and T. It would be useful to see just GPP against VPD (for high, low and intermediate CI) and GPP against air Temperature (also for various CI values).

Page 1676, lines 12-13, to make this point clear, a plot of GPP against CI would be

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more useful. And stay clear to the reader what you mean by cloudy or clear sky conditions in terms of CI values.

Page 1676, lines 9-20. This is not very clear at all.

Page 1677, lines 6-7. What is optical temperature? Or do you mean optimal temperature?

Page 1677, line 15. The authors mentioned the important role of stomata regulating CO<sub>2</sub> exchange. However they have made no attempt to show what  $G_s$  is doing. It would be really valuable for this paper to show how  $G_s$  is varying with CI, T and VPD, to help understand what GPP is doing.

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