Reviewer 2:

Title

The use of the term ‘ecosystem exchange in two major plant functional types’ doesn’t make sense to me. A plant functional type characterizes a plant and not a land-cover. An ecosystem exchange in a plant doesn’t make sense. Please help me to understand this wording.

The term, functional type, describes biotic components of ecosystem that perform the same function and can be used to a grouping of the species on the basis that they use the same resource (Gitay and Noble, 1997). Thus, plant functional type can characterize a land-cover as a concept of community and can be used to represent the GDK site (i.e., broadleaf deciduous forest). However, despite the dominance of the rice paddies at the HFK site, it may be inappropriate to use the term due to its mosaic patches of landscape with several other plant functional types. To incorporate the reviewer’s point, we modified the title as “Influence of the Asian Monsoon on net ecosystem carbon exchange in two major ecosystems in Korea”

H. Gitay and I.R. Noble, 1997*:* What are functional types and how should we seek them. In *Plant Functional Types: their Relevance to Ecosystem Properties and Global Change* (Edited by T.M. Smith, H.H. Shugart, and F.I. Woodward). IGBP Book Series No.1, Cambridge University Press, Cambridge, UK.

Abstract

Consider (10280,2 and 10282,9): The use of the phrase feedback loop doesn’t fit the usual meaning (see common definitions feedback and feedback loop). A feedback loop happens in a system of elements and processes that are interconnected. The carbon balance doesn’t affect precipitation, does it? I can’t see circularity.

We remove the word “loop” as suggested.

Reword (10280,2): ‘Eddy covariance fluxes’ are turbulent fluxes, measured with the eddy covariance method.

We modified the sentence as “we examined CO_2 fluxes using eddy covariance method”

Introduction

Reword (10281,4): The Asian continent ‘consists of ‘ – ‘is covered’ or hosts but not ‘consists of’

Reworded as suggested.

Replace (10281,10): ‘on’ by ‘for’

Replaced with “for”. (P.2 L.8)

Make clear that this study is based on exactly the same sites as Kwon et al. (2009) used.
We now have clearly indicated it as: “the two KoFlux tower sites reported in Kwon et al. (2009)” in the introduction (P.4 L.14-15)

Describe the new objectives and focus on them. At the moment the conclusions are very similar to what was already published for that site.
We have restated our objectives (as below) and revised the summary and conclusion accordingly.

P.4 L.12-20 “Our objectives are to identify the repeatability of the mid-season depression in NEE observed by Kwon et al. (2009) and to further scrutinize its cause, effect, and interannual variability by using multi-year observations in the same KoFlux tower sites reported in Kwon et al. (2009). Our hypothesis is that the driving mechanism of the observed mid-season depression of NEE is different for these two ecosystems. For the GDK forest site, natural disturbance (e.g., Changma and typhoons) is the major cause whereas human disturbance (e.g., two-crop rotation) is dominant for the HFK farmland site. In order to verify the hypothesis, we conducted the analysis of the relationship among *GPP*, *RE*, and *NEE*, and environmental conditions.

Explain (10283,15+):Why has measured data been excluded? What was the difference in coverage? And why has the measured data not at least be compared with the data from the other years?
As indicated in the text, for the years excluded from our analysis, the data retrieval rates for both flux and meteorological data were extremely low (< 40% before quality control). To minimize the artifact of excessive gap-filling, we have decided not to include the years when the rate of data retrieval was lower than 40% (particularly during the monsoon period). To incorporate the reviewer’s point, we have added a sentence, i.e. “The years with data retrieval rate of <40% (i.e., 2004 and 2005 for the GDK site and 2005 and 2007 for the HFK site) were excluded from our analysis to minimize the artifact of excessive gap-filling.” (P.4 L.23-24 – P.5 L.1)

Methods
a) Comment on (10283,23) GDK complex terrain - what is the extension of the fetch? b) How do you deal with advection in calm nights? c) Which averaging time did you use to define the sectorial rotation angles?

a) The extension of the fetch is about 1 km depending on the prevailing wind direction. (P.5 L8-9)

b) We applied the method of van Gorse et al. (2007) during calm conditions when advection is relatively negligible. The vertical and horizontal advections at the GDK site were not small in size but their signs were opposite, thereby approximately canceling each other out (Hong et al., 2008). We made an assumption that the advection effect is negligible at the site, which of course is subject to further scrutiny. Text revised to incorporate the reviewer's point (P.7 L.16-20).

c) The averaging time for the sectorial rotation angles was at least 3 weeks of half-hourly data.

Correct (10284,7): The term footprint has a different meaning than just surrounding area.
Corrected.

Correct: (10284,10): 'covering with'
Corrected.

Explain (10284,11): What is the nature of the terrain around the tower? The same as that of the entire region?
Text revised to incorporate the reviewer's comments. (P.5 L.15-18)

(10286,14): Why didn't you use the profile system to calculate the storage change?
The profile system was only available at the GDK site and no additional CO_2 concentration measurements were available at the HFK site. To calculate a storage term following by Papale *et al*. (2006) with consistency of data selection and processing, we used CO_2 concentration data from LI-7500 for both sites. This information was originally written in the text; 10286, 14-18.

(10286,21): a) Compare the different approaches and b) quantify the systematic bias caused by the choice of the approach in your study. c) The temperature of what (air, soil, vegetation) did you use to extrapolate from night to day? d) Give the values and accuracy of the parameters of the temperature response functions. e) Please justify, why you used 20 days for the one site and 32 for the other?
a) We compared the two approaches and presented the results in Hong *et al.* (2009). Since the u* threshold method is well known, van Gorsel's method is described in the text (10286, 21-30 to 10287, 1), and we have referred Hong et al. (2009), it may not be necessary to readdress the comparison of the two methods here.

b) Again, quantification of the bias was presented in Hong *et al.* (2009), which was briefly explained in our manuscript (see 10287, L.10-15).

c) Air temperature was used to extrapolate from night to day and we revised text (P.8 L.17)

d) To avoid several known problems in estimating RE, we applied the method suggested by Reichstein *et al.* (2005), which permits seasonally varying temperature sensitivity. Our analysis shows that E_0 and R_{ref} in the Llyod and Taylor equation were around 100 K and 2~4 μmol m^{-2} s^{-1}, respectively.

e) The two different window sizes have been decided based on the spectra of air temperature and they are corresponding to the location of spectral gaps between the second and third peaks in the spectra of air temperature (see P.8 L19-21).

What is the difference between the 'Energy budget closure' and the 'energy balance ratio'? How was Rn measured? Let us be consistent and use only one here. Can we?
Changed the term, 'energy budget closure' to 'energy balance.'

Rn was measured using a net radiometer (CNR1). Description of other meteorological measurements was not included in the text because of the redundancy presented in Lee *et al.* (2007) and Kwon *et al.* (2009).

Has the Burba Correction been applied? If not, why? What is the associated uncertainty?
We did consider the Burba correction but the magnitude of the correction was small (<3%). Hence, we decided not to apply.

Results
Explain (10289,7-8): a) What do you mean with 'consistent' rainfall (uniform?) b) Why is the rainfall the reason for reduced PAI? What about storms?
a) We changed "consistent" to "continuous". (P.11 L.8)

b) The heavy rains did not accompany with storms. The heavy rainfall broke tree branches and uprooted tree where the ground became soft, resulting in the reduction of PAI. (P.11 L.9-10)

Explain (10289,9): How did you correct the maximum summer PAI with the winter PAI?

The maximum LAI was calculated by subtracting the winter PAI (which is almost constant) from the maximum summer PAI. We have revised the text to add an explanation. (P.11 L.11-12).

Reword (10290,4): It's not the peak (=maximum value) that has this contribution to the annual sum.
Changed "peaks" to "portions".

Correct (10290,23): Theses
Corrected.

Extend(Fig. 6): Could you graphically indicate management activities in the Figure?
We added the information of management activities in Fig. 5 as suggested. And the original Fig. 6 (which presented the cumulative NEE) was removed in the revised manuscript.

Discussion
Clarify (10291,15): It sounds, as if you assume that reduced Rg is the direct reason for reduced GPP and NEE during Changma. Which evidence do you have for this? Which other factors could be relevant but aren't for what reason?
Our statements were not based on assumptions but were based on our analyses of the relationships among GPP, RE, and NEE, and environmental conditions during the summer monsoon period. We have not presented them in the original manuscript because of potential glut of figures. To incorporate both reviewers' suggestions, we now have added some of these analyses in the results and discussion section (P.17 –18 & Fig. 8) and revised the manuscript.
In short, during the summer monsoon period, the mid-season depression was generated mainly due to the decrease in *GPP* by R_g not due to the increase in *RE* by T_a at the GDK site.

Reword (10291,18-19) " In 2008, the weakened mid-season depression brought the forest back to a moderate carbon sink."
Reworded as "The weakened mid-season depression in 2008 resulted in the forest ecosystem to be a moderate carbon sink." (P.16 L.3-4)

Clarify (10292,10-13): What did Aubinet find out and how was it related to your findings?
Aubinet *et al*. (2009) indicated the significance of intercropping and farmers' interventions on a carbon loss in a cropland with rotation cycle and as a result, the cropland with the 4-year rotation of crops became a small carbon source. At the HFK site, the observed mid-season

depression was resulted from management practice (i.e., crop rotation). These sentences have been added in the revised manuscript to incorporate the reviewer's comment (P.16 L.10-14).

Analyse (10293,5-20): I miss a more rigid analysis. Why can't you just simply show, if there is an effect of temperature on RE and how big the effect of reduced Rg on GPP is? The same with soil water, LAI / storm etc.? The gap filling is of course an important point. In the methods section it was said that the gap filling associated error has been estimated. What do these results tell on the error due to lack of data during rainy periods? At the end of this discussion the reader would rather expect a ranking of the effects based on data analysis than only a list of possible explanations.
This has been taken care of, as indicated above.

Correct (10293, 24) 'or' -> 'for'
Corrected.

Insert (10294,4) 'diameter' before growth.
Inserted.

Shift (10295, 8-10) This can not be part of the summary, because it wasn't mentioned before. It would certainly fit better to the discussion part that compares the results from the two sites with other sites. Maybe together with this the low NEE can be discussed in terms of disturbance or fertility?
We moved the sentence, as suggested.

Which conclusions can you draw from your study beyond the ones Kwon et al. (2009) was already able to draw?
This has been taken care of. See the reply below.

Sharpen conclusions from your study (10295,11-19): These sentences are too general and not clearly related to your study. What did your study actually tell, e.g., about land water interactions etc.? Which impact would the projected shifts in Asian monsoon have on the carbon cycle according to your study?

We rewrote the conclusion by incorporating the reviewer's comment as below.
In summary,

1) the mid-season depression was reproduced at both forest and farmland sites during the

three year study period.

2) for the deciduous forest site, the mid-season depression at the forest was associated with natural disturbances (i.e., the Asian summer monsoon, typhoons), whereas in the farmland, it was associated with human disturbance (i.e., two-crop rotation) at the farmland site. The different sources of disturbance resulted in the different timing of the mid-season depression (i.e., the Asian monsoon in late June to July at the forest and the harvest and rice planting in late May to mid June at the farmland).
3) during the summer monsoon period, the mid-season depression was generated mainly due to the decrease in *GPP* by R_g not due to the increase in *RE* by T_a at the GDK site.
4) temporal variability of the mid-season depression (i.e., timing and patterns) was strongly dependent on that of the Asian summer monsoon, suggesting the impact of the Asia summer monsoon on carbon dynamics should be further quantified in time-frequency domain.
5) the mid-season depression caused by the summer monsoon was almost negligible at the HFK site. This may have been associated with the diverse mosaic patches of farmland vegetation, which provide resilience to natural disturbance and/or human intervention may have also contributed through adaptive management such as drainage and irrigations to cope with natural disturbances..
6) the projected shift in the Asian monsoon (e.g., the extended length and an increase of precipitation; Kripalani *et al*., 2007) will result in decreased Rg and lower net ecosystem carbon uptake in East Asia. (e.g., Yang and Wang, 2000;).
7) difficulties in predicting the variation of global carbon cycle lie in uncertainty at local and regional scales. The results in this study refine our understanding of regional details of carbon exchange and their modeling in the Asian monsoon region.

We very much appreciate the review's critical yet constructive comments, allowing us to sharpen our focus and improve our manuscript. Thank you.