

Reply to Referee #2

TITLE: Seasonal variations in carbon dioxide exchange in an alpine wetland meadow on the Qinghai-Tibetan Plateau

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I agree with Referee #1, that it is better to accept this paper after the editor's comments have been properly addressed and the English writing has been significantly improved.

My former comments:

1. Please do regression analysis at monthly time steps to highlight the seasonal variations.

The authors response:

The figure2 have shown the seasonal variations of Reco on monthly steps, the figure4&5 have shown the seasonal variations of GPP on monthly steps, and the figure11 have shown the Seasonal pattern of daily total gross primary production (GPP), net ecosystem exchange (NEE), and ecosystem respiration (Reco) over the course of the alpine wetland meadow from 1 January 2004 to the end of the year 2006. Thus we sorry for haven't added those figures.

I don't think this response addresses my question. This paper focuses on "seasonal variations in ... " (see its title). Monthly analysis is important because of the pronounced spectral gap on the time scale of a month. Please read *Agricultural Forest Meteorology*, 107, 1-27 and *Global Change Biology*, 15, 1962-1981.

The regression analyses at monthly time steps have added as table 3 and table 4.

2. Please figure out the major factor(s) control the seasonal variations of C fluxes (GPP, NEP and Reco).

The authors response:

The constraint of major factors have been plotted as fig6, 7, 8, et al, so to avoid the cumbersome, we sorry for haven't added those figures.

Fig.s 6-8 are almost nothing to do with this comment. Please do one single-factor regression analysis followed by residuals regression analysis with other factors or do multi-linear regression analysis to address this question.

The major factor(s) control the seasonal variations of C fluxes (GPP, NEP and Reco) have been preformed in table.5.

My new comments:

1. In section 2.4, the definition of F_c is not clear and the authors didn't mention how to calculate NEE. For instance, the authors didn't consider the storage term. Please clarify. And the authors never mentioned how about the biases in monthly and annual C flux estimation...

In the section 2.4, we added the calculation of NEE as follows:

NEE (net ecosystem production as CO_2 uptake, i.e., NEE) was calculated from the sum of the eddy covariance flux, F_c and the storage term (F_s). As mentioned above, the F_c is sum of

EC-measured flux and F_s is the flux associated with the change in storage in CO_2 in the layer below the level of CO_2 flux measurement and the values of F_s were obtained by integrating the change in CO_2 concentration through the air layer up to the heights of the eddy covariance sensors (Suyker and Verma, 2001). For in the study site the storage term F_s was smaller more than F_c , and the daily calculate values tend to zero so the F_s was neglected in the calculated of NEE.

The biases of the C flux have added in the table.3.

2. Fig.1's caption: ...1-day sunning means...please check it is 1-day? If so, it doesn't make sense that 1-day running average on daily values!

The caption of fig.1 have been revised as "Seasonal variability of (a) photosynthetically active radiation (PPFD), (b) average daily air temperature (T_a), (c) soil temperature at the depth of 5 and 40 cm (T_s), (d) vapor pressure deficit (VPD), and (e) daily total precipitation (PPT). The lines are plotted from January 1."

3. P9013L20:

The exponential function given in Eq. (2) described very well the relationship between Reco and soil temperature at 5-cm depth.

I have comment on this in my first round review. I asked the authors to give a table to list the statistics analysis parameters, such as p, r^2 and n (summer of samples), etc. instead of using words "very well". Unfortunately, the authors decline my request. Again,

I still think it is worth to do.

The R^2 were added in the figure.6.

Illustration of sentences with English problem or not clear:

P9006L15:

The sentence "Yearly average GPP, Reco, and NEE (which were 575.7, 676.8 and 101.1gCm⁻², respectively, for 2004 year, and 682.9, 726.4 and 44.0gCm⁻² for 2005 year, and 630.97, 808.2 and 173.2gCm⁻² for 2006 year) values indicated that the alpine wetland meadow was a moderately important source of CO₂." reads oddly, at less not smoothly. It is not "yearly average" but "annual sums" or "annual total"?...Please re-state

The sentence was restated as:

*Annual **total** GPP were 575.7, 682.9, and 630.97 gCm⁻² in 2004, 2005, 2006, respectively, similar to the R_{eco} were 676.8, 726.4, 808.2 gCm⁻², and the NEE were 101.1, 44.0 and 173.2 gCm⁻².*

P9006Ls22-23:

"And the cumulative NEE data indicated that the alpine wetland meadow is a source of atmospheric CO₂ during the study years. CO₂ emissions are large on elevated microclimatology areas on the meadow floor regardless of temperature." You may change "is" to "was" and "are" to "were" as you used past tense in previous and after sentences (e.g. in L16 this page, which were...; in L25, "occurred" ... etc.). Please keep a consistent style through the paper.

The "is" have been revised as "was", and the next sentence have been deleted

We have checked through the paper and revised those mistakes.

P9008Ls1-22:

“the aims of this study were to” “are”...

Please check this kind errors other where. Similar to Referee #1, that I do not have time to modify your English, but I will illustrate some sentences with English problems.

It has been revised.

P9009L3:

Measurements were conducted in an alpine wetland meadow at the Haibei Research Station, Chinese Academy of Sciences, in Qinghai, China (37_350 N, 101_200 E, 3250ma.s.l.) from October 2003 to December 2006.

The sentence have been revised as : The experimental site was located in the vicinity of the Haibei Research Station, Chinese Academy of Sciences, in Qinghai, China (37°35'N, 101°20'E, 3250 m above sea level),and the measurement were conducted during October 2003 to December 2006.

P9009L6:

This wetland is characterized by nonpatterned, hummock-hollow terrain, with hummocks representing 40%, hollows 55%, and other features 5% of the landscape. “Landscape” is not a rigorous ward in term of spatial scale...Please give a more certain scale, e.g. Flux footprint area (size) or how big area (how many km²), or ecosystem...

We added the scale of the ecosystem: it covers about 6 kilometers

P9009L6:

This wetland is characterized by nonpatterned, hummock-hollow terrain, with hummocks representing 40%, hollows 55%, and other features 5% of the landscape. The catchment was flooded at an average water depth of 30cm during the growing season.

It has revised.

P9009L19:

The aboveground biomass increases from May to August and reaches a maximum in late July or August, becoming senescent in early October.

The sentence has been deleted.

P9010L3:

Wind speed, sonic virtual temperature, and CO₂ and H₂O concentrations were sampled at a rate of 10 Hz.

It has been revised.

P9010L13:

The regression line slopes showed small differences, within 1%, between corrected and uncorrected fluxes.--> analysis?

The analysis has been added: The regression line slopes (slope=0.99, r²=0.53)showed small differences, within 1%, between corrected and uncorrected fluxes.

P9011L10:

There is a good agreement between half-hourly values of turbulent (H+LE) and radiative (Rn+G) fluxes. G is not “radiative” energy.

It has been revised as : An examination of the energy budget closure indicated: (H +

$LE = 0.74 * (R_n + G) - 22.45, r^2 = 0.94$, where H and LE are the flux of sensible heat and latent heat, respectively.

P9011L13:

The slope of regression line is 0.74 with an intercept of 22.45 W m⁻² and a correlation coefficient, r^2 , of 0.94. The r^2 is not a correlation coefficient but r is. The r^2 is called as the coefficient of determination.

It has been revised as above correction.

P9011L17:

We were not trying to specify a particular cause for the imbalance because several possibilities may be involved in the lack of energy closure (for details see Wilson et al., 2002).

The sentence has been deleted.

P9011L22:

Missing Reco values were extrapolated by using exponential regression Eq. 2) between measured nighttime Reco with strong turbulence ($u > 0.1 \text{ ms}^{-1}$, Aubinet et al., 2000; Lloyd, 2006), and soil temperature at 5-cm depth. under well-mixed conditions...with soil...

It has been revised.

P9013L16:

Maximum Leaf Area Index (LAI) tracked green biomass and ranged about 3.9 m² m⁻² in 2005.

It has been revised as "Maximum Leaf Area Index (LAI) followed the similar trend of green biomass and reached 3.9 m² m⁻² in 2005."

P9013L19:

A specific response curve for every month of the growing period was developed (Fig. 2) for 2004, 2005, and 2006.

It has been revised as "Fig.2 shows the specific response curve of the growing period at monthly step (Fig. 2) for 2004, 2005, and 2006."

P9034, Caption of Fig.2:

Fig. 2. Response of ecosystem respiration (Reco) to change in soil temperature at the depth of 5 cm during growing season. Data were from 2004 to 2006 season, and half-hourly during high turbulence conditions ($u > 0.1 \text{ ms}^{-1}$).

under ...conditions! So do for Fig.3.

The caption of revised as "Response of ecosystem respiration (R_{eco}) to change in soil temperature at the depth of 5 cm during growing season. Data were half-hourly under high turbulence conditions ($u^ > 0.1 \text{ ms}^{-1}$) from 2004 to 2006." So as fig.3 were revised*

P9014L1:

Those values were clearly lower than the R10 values observed during the growing season (Fig. 2),...

It has been revised as “*it is clearly lower than the R_{10} values observed during the growing season*”

P9014L3:

The annual R_{10} was 3.05, 2.98, and 3.24 $\mu\text{molCm}^{-2} \text{ s}^{-1}$ for 2004, 2005, and 2006, whereas the values for annual active energy (E_a) were 50093.43, 61084.73, and 44743.5 J mol^{-1} , respectively. Thus, the temperature dependence was higher in 2004 and 2006 than in 2005.

annual averaged...?

It has been revised as annual averaged

P9014L8:

Figure 4 shows the relationship between GPP and PPFD from May to September. The values of GPP responded exponentially to PPFD during July and August, but the light response was linear in May, June, and September.

And please re-write caption of Fig. 4.

It has been revised.

P9014L21:

Quantum yield values measured in the alpine wetland were higher than the values reported in Zhao et al. (2006). ...that...

It has been revised as “Quantum yield values of the alpine wetland were higher than the values of the alpine shrubland meadow, which is located in the vicinity of the study site (0.0056 and 0.0082 for July and August respectively) (Zhao et al. (2006).”

I stopped here for English checking.....Please ask for a native English speaker to help improve it!