We would like to thank the reviewers for their useful and productive comments that have helped us to improve the clarity and quality of the manuscript.

1) Most importantly, it is not clear that this approach is really beneficial. Whilst, this paper shows some improvements upon an existing inventory, it has many limitations in its method. There are alternative approaches, such as the assimiliation of satellite observations, that potentially offer vastly superior model surface fluxes without using the new inventory decribed in this paper. Given that this paper appears to try to show that the surface fluxes can be improved by using this approach, I would like to see the modelled surface fluxes of this approach compared to those of alternative approaches.

We simulate CO2 concentrations using different surface fluxes. Surface fluxes are estimated by many top town and bottom up approaches. The assimilation of satellite observations is one of the top down methods to improve the surface fluxes. The surface fluxes from dynamic Global Vegetation Models are estimated by another bottom up method. This paper focuses on the new evaluation method of regional CO2 observations to evaluate the observation-model differences of CO2. We introduce how to get the regional CO2 surface concentration, how to compare the observation-model differences using the regional CO2 surface concentration in detail. We show the usefulness of the regional CO2 surface concentrations as a new evaluation method by comparing two simulations with two different emission inventories. One emission inventory is the original surface fluxes in GEOS-Chem, only another result of all surface fluxes from different methods was selected to validate the usefulness of the regional CO2 surface concentration.

To make the overall picture of the paper more clear, we have deleted the sentence P2246, line 4 and added more explain about the regional CO2 concentrations. The texts from P2245 line 26 to P2246 line 26 (in the introduction) have been modified:

"Where and when atmospheric CO2 is absorbed by land ecosystems and oceans is a major issue for the global carbon cycle. Optimized estimates of surface sources and sinks have been produced by different ways. One is a top-down way. For example, CO_2 in the atmosphere is affected by surface fluxes. Information about regional carbon sources and sinks can be derived from variations in observed atmospheric CO2 concentrations via inverse modeling with atmospheric tracer transport models (Gurney et al., 2002). Another is a bottom-up way. For example, the land-atmosphere fluxes can be simulated by different Dynamic Global Vegetation Models(DGVMs) (Sitch et al., 2008). Terrestrial carbon cycle model Vegetation-Global-Atmosphere-Soil(VEGAS) is one of the DGVMs，which was developed to simulate the net land-atmosphere fluxes and described by Zeng(Zeng et al.,2003). The land-atmosphere flux simulated by VEGAS agrees well with the CO_2 growth rate observed at Mauna Loa both in terms of interannual amplitude and phase(Zeng et al.,2005).

The GEOS-Chem atmospheric transport model**……**Rodenbeck et al.2006.

However, one persistent problem in using model-observation comparisons for this goal relates to the issue of compatibility…..missing process in the model. **In this article we propose a new technique to evaluate the regional surface fluxes by comparing the regional CO2 concentration from model simulations with**

observations, rather than the difference at every single observational station. Several stations in one region were grouped according to the regional temporal characteristics of the seasonal cycle which have been derived from a new atmospheric CO_2 observation dataset from GLOBALVIEW-CO_2 2010. The averaged concentration of CO2 at all stations in one region represents the regional CO2 concentration in this region.

To validate the usefulness of the new evaluation method about regionally averaged CO2 concentrations, we compared two simulations using two different emission inventories with observations. One emission inventory is the original surface fluxes in GEOS-Chem, including the NEP from CASA. Another new emission inventory, including the land-atmosphere fluxes from VEGAS, was selected to reproduce CO2 concentrations in this study. The land-atmosphere fluxes from VEGAS were used in the GEOS-Chem model, replacing all the current inventories except anthropogenic emissions and ocean fluxes."

2) The results of this paper are very limited and biased by the number of observations in each region. It is almost meaningless to show results where there are few observations within a region, which is the case for many regions. Having said that, it is not your fault that there are few observations, and you should try to make use of what is available. The choice of region areas could be improved. While it is nice to show fluxes for the entire world, it is not practical or meaningful to do so with such few observations. It might be better to split the regions up into much smaller areas, for example Europe could be split up to have a region the size of Spain to Poland. Having a region this small would effectively reduce the sparseness of observations with a region and therefore make the model fluxes be more representative of the observations, making for a better comparison (even with few observations).

We grouped several observation stations in one region based on the seasonal cycle at each station in our study. The stations in one region were grouped based on the amplitudes and phases of seasonal cycle at each station. The average of CO2 at all stations in one region represents the regional CO2 concentrations. The ocean is split into 15 regions where there is at least one station with its seasonal cycle in one region. The amplitude and phase of the seasonal cycle of the regional CO2 concentration for one ocean region is different from that of the regional CO2 concentrations for another ocean region. We can't split the land regions based on the seasonal cycles of stations on the land because the phase of seasonal cycles for all stations on the land is similar, which minimum values appear in the autumn and the maximum values appear in the spring. So we use the land regions in the TransCom project. The magnitude of the amplitude of the seasonal cycles at stations in one land region may be different. To represent the regional CO2 concentration for land regions, the average of seasonal cycles for at least two stations with similar amplitudes were required in one land region. There are more than 2 stations with similar amplitudes of seasonal cycles in only 5 land regions. So the regional CO2 concentrations of these 5 land regions are used to evaluate the observation-model differences of CO2.

The section 3.1 has been modified to

"**We grouped several observation stations in one region based on the seasonal cycle at each station in our study. The average of CO2 at all stations in one region represents the regional CO2 concentration. The amplitude and phase of the seasonal cycle at each station in one group is similar, while the average amplitude and phase of the seasonal cycle for each group is different from that of other groups…**"

All stations on the land show similar seasonal cycles. The concentration of CO2 decreases during summer and autumn and increases during spring and winter. The difference between minimum and maximum values is greater than 6 ppm for most stations on the land. We can't split the land based on the seasonal cycles at stations on the land because the phase of seasonal cycles for all stations on the land is similar; for example, CO2 at all stations on the land decreases in autumn and increases in spring. The land was divided into 11 regions based on the TransCom land regions…. The stations in each land region were grouped. The magnitude of the amplitude of the seasonal cycles at different stations in one land region may be different. To represent the regional CO2 concentration for the land regions, the average of seasonal cycles at more than two stations with similar amplitudes were required in one land region. There are more than 2 stations with similar amplitudes of seasonal cycles in only 5 land regions (North America, Temperate North America, Eurasian boreal, Eurasian, Temperate and Europe). So the regional CO2 concentrations of these 5 land regions were used to evaluate the observation-model differences of CO2.

The amplitude and phase of seasonal cycles at stations on the ocean are different, for example, CO2 decreases in April for one region while in August for another region. The stations on the ocean were grouped based on the amplitude and phase of the seasonal cycle. The stations on the ocean were grouped into 15 groups and the ocean was divided into 15 regions in this study. The 11 ocean basis regions were chosen to approximate circulation features such as gyres and upwelling regions in TransCom study (Gurney et al.2002)."

Specific Comments:

P2244, Line 11: Remove the sentence "Using the group averaged measurements of CO2 reduces the noise of individual stations." This is not suprising if you average data.

We appreciate your advice, but the regionally averaged measurements are our major results for these regional CO2 concentrations. The stations with similar seasonal cycles in one region were grouped. The average of CO2 of the grouped stations represents the regional CO2 concentration in our study. The regional CO2 concentrations are a new evaluation method to evaluate the observation-model differences of CO2.

"In this article we group site observations of multiple stations according to atmospheric mixing regimes and surface characteristics. The regionally averaged values of CO2 concentration from model simulations and observations are used to evaluate the regional model results. Using the regionally averaged measurements of CO_2 reduces the noise of individual stations" have been modified to "**In this study**

several observation stations in one region were grouped based on the amplitude and phase of the seasonal cycle at each station. The average of CO2 at all stations in one region represents the regional CO2 concentrations of this region. The regional CO_2 concentration from model simulations and observations were used to evaluate the regional model results."

P2244, Line 15: Please state clearly which observations were used for evaluating the results.

This sentence has been modified to **"We compared the regional CO2 concentrations between model results with two biospheric fluxes from the model Carnegie-Ames-Stanford-Approach (CASA) and VEgetation-Global-Atmosphere-Soil (VEGAS) models, and used observations from GLOBALVIEW-CO_2 to evaluate the regional model results."**

P2244, Line 24: currently we really need to understand source and sinks of a regional scale globally, not a global scale.

"a global scale" is replaced with " a regional scale globally"

P2244, Line 26: Tans et al is a very old reference, there are many newer papers that could be used instead.

"(Tans et al.,1990)" is replaced with "(Ciais et al.,2010)"

Ciais P., Rayner,P., Chevallier F., Bousquet P., Logan, M., Peylin,p., Ramonet.M. Atmospheric inversions for estimating co_2 fluxes: Methods and perspectives. Climatic change, 103,69-92,2010.

P2245, Line 8: This is not true, the whole world has been measured on a global scale using satellites, for example SCIAMACHY and GOSAT.

We have deleted line 8-11.

P2245, Line 9: Not necessarily for surface fluxes, becomes well mixed away from boundary layer.

Please see our response above.

P2245, Line 15: Discussed where?

"has been discussed" has been changed to "has been discussed(Tans et al.,1989,1990)"

P2245, Line 16: what samples?

"The samples are grouped into latitude bands to derive the sources and sinks(Tans et al.,1989,1990)" has been changed to "**The air samples in flasks were grouped into latitude bands to aid determination of the sources and sinks(Tans et al.,1989)**"

P2245, Line 17: Either change to "previous studies have adjusted", or explain what inverse modelling is first, and then put "some inverse modelling studies"

"Some inverse technique researches adjust" has been modified to "**Previous studies have adjusted**"

P2246, Line 1: you need to introduce what GEOS-CHEM is.

The introduction of GEOS-Chem has been put earlier. Please see the response to the first comment.

The GEOS-Chem atmospheric transport model has been widely used in the assimilation of CO_2 and inverse of CO_2 flux. It has been used to evaluate the influence of reduced carbon emissions on the distribution of atmospheric CO_2 and described in early studies (Suntharalingam et al., 2004, 2005). The land-atmosphere fluxes in GEOS-Chem include monthly biomass burning CO2 emissions, annual inventory of biofuel burning 3-hourly Net Ecosystem Productivity(NEP) for 2000(Olsen, 2004), and annual climatology based on TransCom CO2 inversion results in Nassar et al.(2010).The differences between CO2 model simulation using surface fluxes and observations have been used to improve our understanding of the global surface fluxes. There were different methods to compare CO_2 model results and observations in earlier studies. The mean annual…Rodenbeck et al.,2006).

P2246, Line 8: the sentence "it is significant....." doesn't make sense.
We have removed this sentence. This paragraph has been modified. Please see the response to the first comment.
P2246, Line 9: Either explain inverse method or say using baysian theory and include a reference.
We have added a new sentence and a new reference. **"**Information about regional carbon sources and sinks can be derived from variations in observed atmospheric CO2 concentrations via inverse modeling with atmospheric tracer transport models (Gurney et al., 2002)" Please see the paragraph "Where and when…" in the response to the first comment.

P2246, Line 10: you mention emissions from fossil fuel and have referred to this on numerous occasions throughout the paper, however fossil fuel emissions is too vague and doesn't include other sources created by humans. Please use "anthropogenic emissions".
We have deleted this sentence. "Emissions from fossil fuel" in other places has been replaced with "anthropogenic emissions"

P2246, Line 15: This should really be put earlier when its introduced.
This sentence has been put earlier, see response to P2246, Line 1.

P2246, Line 20: Please give full name for 3-h NEP.
"3-h NEP" has been changed to "3-hourly Net Ecosystem Productivity (NEP)".Please see the response to P2246, Line 1.

P2246, Line 21: what do you mean? Is this for you rmodel as GEOS –Chem has been used for many purposes, and doesnt encessarily use that prior flux.
We have modified this sentence to " The land-atmosphere fluxes in GEOS-Chem include monthly biomass burning CO2 emissions, annual inventory of biofuel burning 3-hourly Net Ecosystem Productivity(NEP) for 2000(Olsen, 2004), and annual climatology based on TransCom CO2 inversion results in Nassar et al.(2010)." This

paragraph has been modified. Please see the response to the first comment and P2246, Line1.

P2246, Line 25: When for? And use proper reference.

Line 16-27 has been deleted. We had added new reference **"**the land-atmosphere fluxes can be simulated by different Dynamic Global Vegetation Models(DGVMs) (Sitch et al., 2008)." This paragraph has been modified. Please see the response to the first comment and P2246, Line1.

P2247, Line 6: make clear that CASA and VEGAS are separate.

"Section 4 …(VEGAS)" has been changed to "**Section 4 presents the differences between the modeled regional CO2 concentrations with fluxes from CASA and the modeled results with fluxes from VEGAS**."

P2247, Line 16: Remove the sentence "it can be downloaded...."

This sentence has been removed. We have modified it to "**This data product includes more than 300 extended records derived from observations made by 22 laboratories from 15 countries between the period January 1, 1979 to January 1, 2010. Data in the files with a seas qualifier that contain a statistical summary of the average seasonal pattern by month were used to analysis the seasonal cycle of the observation stations. Data in the files with an ext qualifier that contain synchronized smoothed values were compared with model results. Where there are several measurements at different altitudes for the same station we only use the lowest in altitude. This gives a total of 108 measurements that have been used."**

P2247, Line 22: Do we really need to know this? Consider removing.

This sentence has been removed

P2248, Line 7: You state that VEGAS is for land, how is this used for oceans?

The fluxes for ocean are not change. We changed the fluxes for land to compare the observation-model differences of CO2 in this study.

P2248, Line 8: Please include the source of data for observed precipitation and temperature.

"precipitation and temperature" has been modified**.** We have added more introduction about VEGAS based on a request from Reviewer 2 as following: **"It was run at 2.5° ×2.5° resolution and forced by precipitation and temperature, the seasonal climatologies of radiation, humidity, and wind speed. The driving data of precipitation for VEGAS come from a combination of the Climate Research Unit (CRU: New et al., 1999; Mitchell and Jones, 2005) data set for the period of 1901–1979 and the Xie and Arkin (1996) data set of 1980–2006 (which has been adjusted with the 1981– 2000 climatology of CRU data set). The surface air temperature driving data use the dataset from the NASA Goddard Institute for Space Studies (GISS) by Hansen et al. (1999), adjusted by CRU climatology of**

1961–1990.A fire module includes the effects of moisture availability, fuel loading, and plant functional types dependent resistance. Unique features of VEGAS include a vegetation height dependent maximum canopy which introduces a decadal timescale that can be important for feedback into climate variability and a decreasing temperature dependence of respiration from fast to slow soil pools. Specially, two lower soil pools have weaker temperature dependence of decomposition due to physical protection underground in VEGAS(Q10 value of 2.2 for the fast pool,1.35 for the intermediate pool, and 1.1 for the slow pool. The seasonal cycle of land-atmosphere fluxes from VEGAS is shown in Fig.1"

Mitchell, T. D. and Jones, P. D. An improved method of constructing a database of monthly climate observations and associated high-resolution grids. Int. J. Climatol. 25, 693–712,2005.

New, M., Hulme, M. and Jones, P. Representing twentiethcentury space–time climate variability. Part I: development of a 1961–90 mean monthly terrestrial climatology. J. Clim. 12, 829–856,1999.

Xie, P. and Arkin, P. A. Analyses of global monthly precipitation using gauge observations, satellite estimates, and numerical model predictions. J. Clim. 9, 840– 858,1996.

Hansen, J., Ruedy, R., Glascoe, J. and Sato, M. GISS analysis of surface temperature change. J. Geophys. Res. 104, 30997–31022,1999.

P2248, Line 9: Explain fully what NBP flux means.

"The monthly NBP flux as net land-atmosphere carbon exchange" has been changed to "The monthly land-atmosphere fluxes simulated by VEGAS"

P2248, Line 11: Explain fully what NEP flux means.

NEP is Net Ecosystem Productivity. See response to P2246 Line 20-25.

P2248, Line 14: For what time frames etc?

We have rewritten the paragraph. We have added some introduction about CASA based on the requirement of Reviewer 2.

"The CASA NEP output is used as NEE in GEOS-Chem. The comparisons of monthly land-atmosphere fluxes from VEGAS and CASA are concluded as Fig.1." have been modified to **"Monthly mean NEP fluxes for 2000 from CASA is constructed from Gross Primary Production (GPP) and ecosystem respiration (Re) (Olsen, 2004). Inputs to CASA included a 1990 monthly normalized difference vegetation index(NDVI) product derived from the NOAA/NASA Pathfinder data set, surface solar insolation(Bishop and Rossow,1991),mean temperature and precipitation from the period 1950 to 1980(Shea,1986)，soil texture(Zobler,1986) and a land cover classification based on NDVI(DeFries and Townshend,1994). The response of heterotrophic respiration to surface air temperature is described by using a Q10 function of 1.5(Raich and Potter,1995).The net global contribution from CASA is set to 0 Pg C/yr in order to represent terrestrial fluxes with no anthropogenic interference. The seasonal cycle of NEP from CASA is shown in Fig.1"**

Bishop, J.K.B., and Rossow,W.B.: Spatial and temporal variability of global surface solar irradiance, J. Geophys. Res., 96(C9), 16,839-16,858, 1991.

Shea, D.J., Climatological atlas: 1950-1979, Technical Note NCAR TN-269+STR, Nat. Cent. for

Atmos. Res., Boulder, Colo., 1986
Zobler, L.A.: World soil file for global climate modeling, NASA Tech. Memo., 87802, 32 pp., 1986.
DeFries, R.S., and Townshend, J.R.G.:NDVI-derived land cover classifications at a global scale,I nt. J. RemoteS ens.,1 5(17), 3567-3586, 1994.
Raich, J .W., and Potter, C.S.: Global patterns of carbon dioxide emissions from soils, Global Biogeochem cycles, 9 (1), 23-36, 1995.

P2248, Line 15: Poor grammar and needs quantifying.

Line 14-20 "The difference of spatial distribution is……Northern Africa." has been modified to **"Anthropogenic interferences such as biomass burning were specified as 2.96 Pg C/yr in GEOS-Chem. To account for the total annual sum of biospheric uptake and emission of CO2, the residual annual terrestrial exchange of inverse results from TransCom, a global total of -5.29 Pg C/yr, was included in the land-atmosphere fluxes (Nassar et al.2010). The seasonal cycle of total land-atmosphere fluxes used in GEOS-Chem is shown in Fig.1.**

We have moved the texts in Appendix to this place based on a request of the second reviewer.

The original CO_2 fluxes used in this study include 7.8 Pg C (anthropogenic emissions), -1.4 Pg C (net ocean-atmosphere fluxes),-2.3 Pg C (net land-atmosphere fluxes) for 2006. The original global annual net CO_2 flux for 2006 is 4.1Pg C. The new CO_2 fluxes used in this study include 7.8 PgC (anthropogenic emissions), -1.4PgC (net ocean-atmosphere fluxes),-1.9 Pg C (net land-atmosphere fluxes) for 2006. The new global annual net CO_2 flux for 2006 is 4.5 Pg C. There are also little differences between the total fluxes from other inversion results. JENA S99V3.2 data(3.78PgC) is available from http://www.bgc-jena.mpg.de/~christian.roedenbeck/download-CO2/;LSCE V1.0(3.43PgC) (Chevallier et al., 2010) is available from http://www.carboscope.eu/; Carbon Tracker -2009(4.15 PgC) is available from http://www.esrl.noaa.gov/gmd/ccgg/carbontracker/; and two inversion results (4.1Pg C, 4.7Pg C) are from (Feng et al., 2011;Nassar et al., 2011).

The land-atmosphere flux from VEGAS in January is 270 Tg C less than that from CASA. These differences are distributed over tropical land regions as shown in Fig.2. The fluxes from VEGAS are smaller than the original land-atmosphere flux in GEOS-Chem, especially from June to August（about 460 Tg C, 770 Tg C, and 180 Tg C, respectively）.The differences between the flux from VEGAS and that from CASA in July are distributed over the regions of Asia, temperate North America, and South America tropical (Fig.3), which reaches about 500 Tg C in total.

P2248, Line 15: Largest sinks of what?

See the above response. Sinks have been replaced with "the flux from VEGAS"

P2248, Line 17: What sources? Please specify.

See the response to Line 15. "sources" has been replaced with "the flux from VEGAS"

P2248, Line 18: By how much?

See the response to Line 15. We have added the value “270 Tg”

P2248, Line 24: By how much?

We have added the value “460Tg 770Tg 180 Tg”. “The sinks of VEGAS are smaller than the original results in GEOS-Chem especially from June to August” has been modified to “The fluxes from VEGAS are smaller than the original land-atmosphere fluxes in GEOS-Chem especially from June to August（about 460 Tg, 770Tg, and 180 Tg, respectively）”. Please see the response to Line 15.

P2249, Line 2: See earlier comment P2246, line 2.

Sorry, we can’t find comment P2246, line2.

P2249, Line 8: Give values for min and max.

Thanks for pointing this problem. “The minimum values of CO2 appears in summer and fall, and the maximum value appears in spring and winter.” has been modified to **“The concentration of CO2 decreases during summer and autumn and increases during spring and winter.**”

P2249, Line 13: Which two land regions?

This sentence has been rewritten. “The 11 TransCom land regions are used except the boundary of two land regions. The latitude is defined as the division for most two adjacent land regions in this work” has been modified to “We can’t split the land…differences of CO2”. Please see the response to the comment 2).

P2249, Line 16: “apparent” – please explain and quantify this.

We have rewritten this sentence. “The differences of seasonal pattern and amplitude of stations in Ocean regions are apparent” has been modified to “**The amplitude and phase of seasonal cycles at stations on the ocean are different, for example, CO2 decreases in April for one region while in August for another region.**”

P2249, Line 21: Explain why you say 72 sites – what are these?

There are 72 observation stations in the ocean region in total. “All 108 stations (see Table A1) are classified into 26 groups and 72 sites in 15 ocean regions” have been modified to **“There are 36 stations on the land and 72 stations on the ocean (see Table A1).These stations were classified into 26 groups.”**

P2249, Line 24: Aren’t seasonal patterns of stations already well known? Put this into the introduction.

Line 24-26 has been rewritten “**The seasonal cycles at all stations in 5 land regions are shown in Fig.5. The annual mean has been removed. The average minimal value for each region is smaller than -7 ppm(-11.5 ppm for North America Boreal(L1), -7.1 ppm for North America Temperate(L2), -10 ppm for Eurasian boreal(L7), -8.7 ppm for Eurasian Temperate(L8), -8.1 ppm for Europe(L11)**”

P2250, Line 4: Include a comment stating that photosynthesis and respiration depend on temperature and hence season.

We have added “**that vary in response to temperature and precipitation anomalies.**”

P2250, Line 17: What do these different amplitudes mean?

Different amplitudes of CO2 reflect the different magnitudes of the net fluxes.

P2250, Line 25: “it is helpful to distinguish when and where the sources and sinks

are" – isnt this what you want to find out though? This doesn't make any sense.
This sentence has been removed.
P2251, Line 2: Be consistent with the use of sites/stations thoughout the paper. It would be much easier to read if you always used the word station.
Line 2-9 has been rewritten. "**Generally there is an increase period and a decrease period for one seasonal cycle. While CO2 increases from April to June and from October to December for the South Pacific Tropics(O4). CO2 decreases from January to April and from August to October for the South Pacific Temperate(O5).**"
P2251, Line 3: You need to be more precise in the way you describe trends. Please remove all "special trend" comments in paper and give a short description of the trend and how it is different than other trends instead.
Please see response to P2252, line 2.
P2251, Line 3: "The minimum appears in September or October" . Please just state one month – this should be the month where the minimum of the average trend lies within.
Please see response to P2252, line 2.
P2251, Line 14: I don't like the term "chaos". Please change this to something meaningful, for example you could say that there is a large variation between stations between January and June. Please also quantify this and also state how much the co2 increases by in the second half of the year.
We have rewritten this sentence "**The concentrations of stations within the South Indian Ocean (O13) range from -1.5 ppm to 1.5 ppm during the first half year and show an increase(about 1ppm) in the second half year.**"
P2251, Line 15: Don't say without average pattern, instead just say there is only one station in each region, and these stations show different seasonal cycles. Maybe also comment on whether any meaningful conclusions can really be drawn from this.
We have rewritten this sentence. "**The South Atlantic was divided into 2 regions with different amplitudes. The minimum and maximum values are -0.9 ppm and 0.7 ppm for the Atlantic Tropics (O10), while they are -0.3 ppm and 0.3 ppm for the South Atlantic Temperate (O11)"**
P2252, Line 5: Please reference a paper explaining GEOS-Chem, rather than stating a website in the text.
We have deleted the website and add references (Suntharalingam et al., 2004, 2005).
P2252, Line 15: Please state very cleary what you actually did. In my view, it is very unclear for what period and spatial scale the model was ran for.
We have rewritten this sentence: "Our model simulation was initialized with a uniform global distribution of 375 ppm on 1 January 2004 and integrated forward to January 1st 2006 using the original emission inventory. The modeled CO2 distribution on January 1st 2006 was the initial concentration for two simulations with the original emission inventory (ori) and the new emission inventory (new) from January 1st 2006 to January 1st 2007. Both model simulations were run at a horizontal resolution of 2° latitude ×2.5° longitude."
P2252, Line 19: Again, change "patterns and amplitudes" to "cycles".

Changed accordingly.

P2252, Line 25: “The largest discrepancies for both runs appear in the region L11, which indicates there may be large uncertainties for co2 surface fluxes in Europe” – I am not at all convinced about this. Firstly, looking at the plots you can see that the difference between model results and observations is practically just as large for regions L7 and L8, i.e. the difference can be large for half of all land regions. Secondly, L7,L8 and L11 all have few and unevenly spatially distributed observations to compare against, whilst regions L1 and L2 have many observation stations distributed mostly over the whole regions. This can easily skew your data, and therefore the results are somewhat unreliable. This is well known to be a cause of large flux uncertainties.Thirdly, it is already well known that regions with few observations have large flux uncertainties and recent papers (some also using GEOS-Chem) have shown that the use of satellite observations can largely reduce these uncertainties, whilst ground based observations are limited.

This paper focuses on the new evaluation method of regional CO2 observations to evaluate the observation-model differences of CO2. The uncertainties of the two fluxes used in this study are evaluated by using the regional CO2 concentrations. We didn’t evaluate other fluxes that may be better in this paper. It is possible that the evaluation of all fluxes from different methods would be done in the future. This sentence have been modified to “**The largest differences(about 4 ppm in April) for both simulations appear in the region L11, which indicates there may be large uncertainties for these two CO_2 surface fluxes in Europe.**”

We also add a new paragraph to compare the results of other regions. “**The largest difference between the simulation with fluxes from VEGAS and observations is 2.8 ppm for the Northern America Boreal(L1), 2.9 ppm for Northern America Temperate(L2),3.1 ppm for Eurasian boreal(L7),3.5ppm for Eurasian Temperate (L8),4.3 ppm for Europe(L11),which is smaller than that of CASA(5.8 ppm,6.3ppm,14.5 ppm,10.9ppm,13.1ppm,respectively). The spread of the regional CO2 of Observations for each region is shown in Fig.7, which is determined by the concentrations of stations in the region.**

The root-mean-square difference (RMSE) between two simulations and observations for each station ranges from 0-2ppm. As shown in Fig.8, the largest RMSE between the simulations with fluxes from VEGAS and observations for regional CO2 concentrations is 0.2 ppm, which is smaller than the value with fluxes from CASA (0.4 ppm).”

We have added the error bar to represent the spread from the observations in our original Figure 7,8 (now Figures 7, 9). The numbers of observation stations and the range of observation concentrations can be reflected by the error bar.

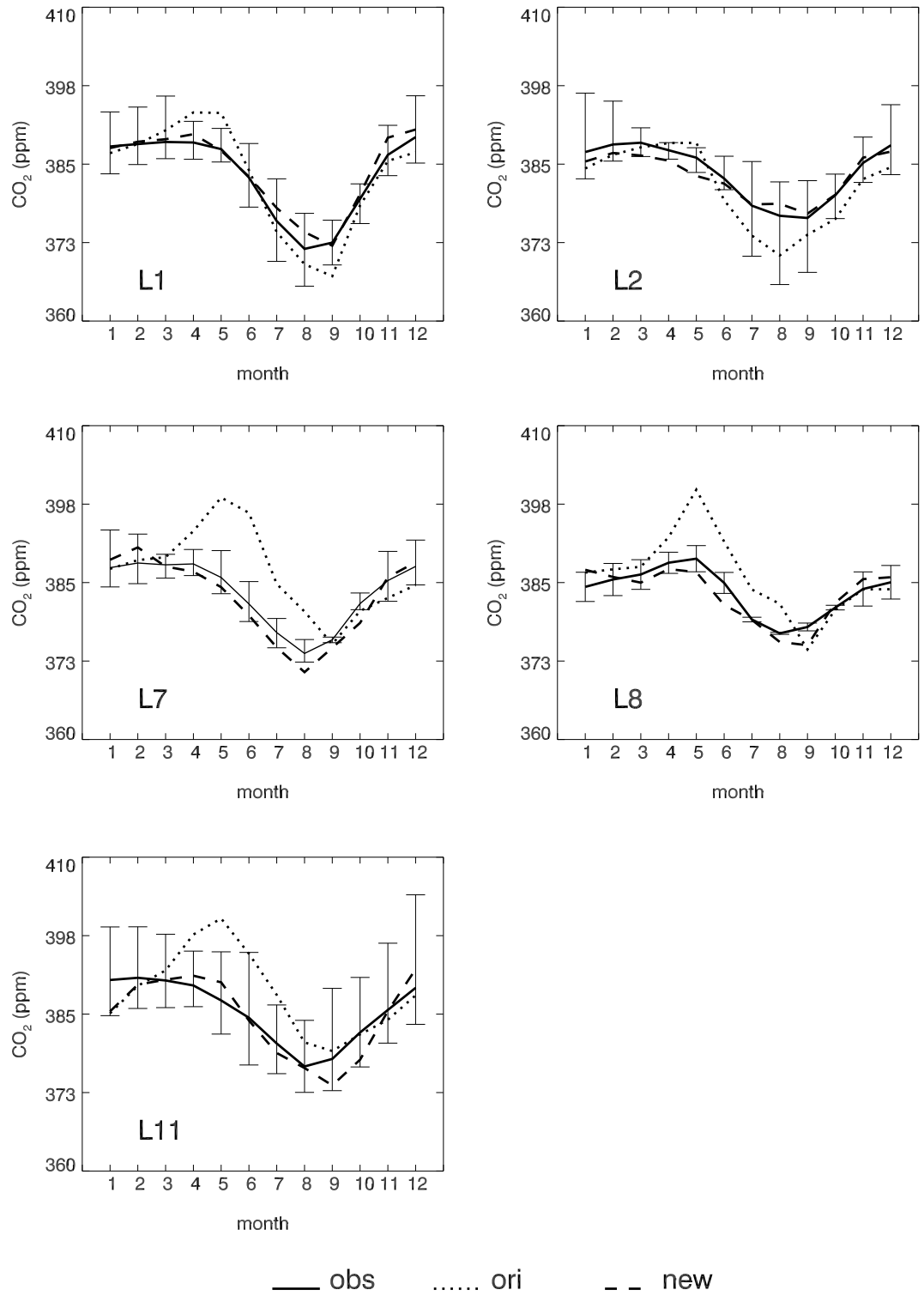

Fig. 7 Comparisons of regionally averaged values of CO_2 between model results from GEOS-Chem with original emission inventory(dotted line) and new emission inventory(dashed line) and GLOBALVIEW-CO_2(solid line) for 5 land regions (L1: Boreal North America, L2: Temperate North America, L7: Eurasian boreal, L8: Eurasian Temperate, L11: Europe) in 2006(5 regions are shown in Fig.4). The error bar represents the spread of the observations.

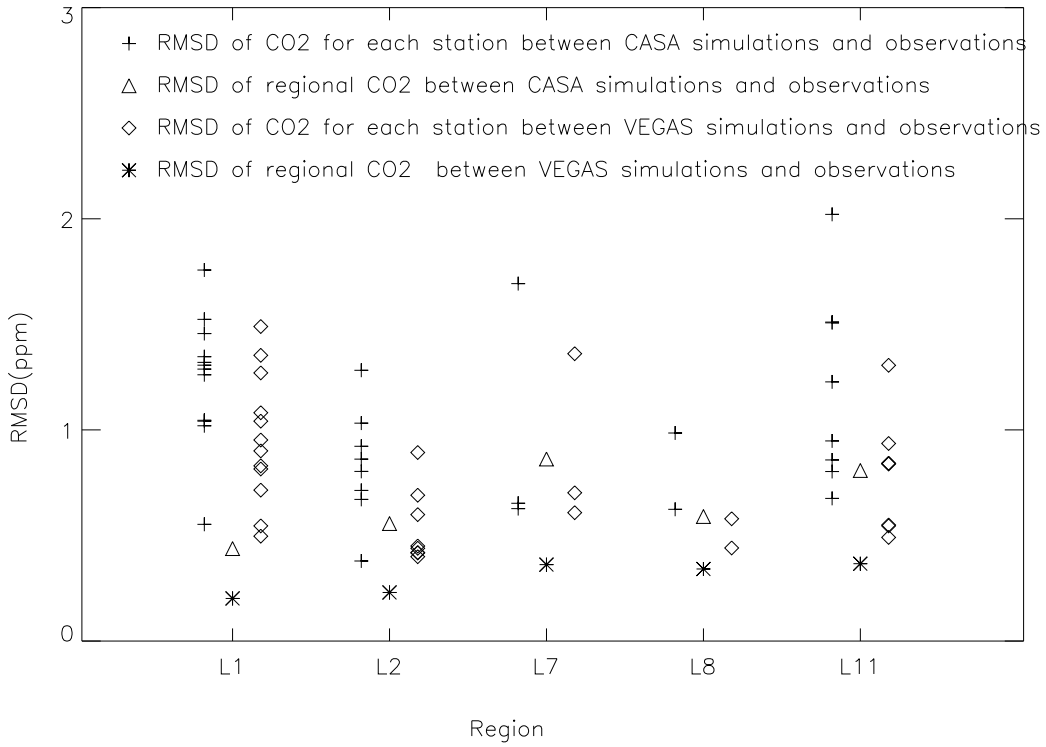

Fig. 8 Comparisons of RMSD of each station and regionally averaged values between model results and observations for 5 Land regions (L1: Boreal North America, L2: Temperate North America, L7: Eurasian boreal, L8: Eurasian Temperate, L11: Europe) in 2006. Each region is shown in Fig. 4. Triangle (Asterisk) denotes RMSD of regionally averaged values between model results using fluxes from CASA (VEGAS) and observations, cross (diamond) denotes RMSD of each station between model results using fluxes from CASA (VEGAS) and observations.

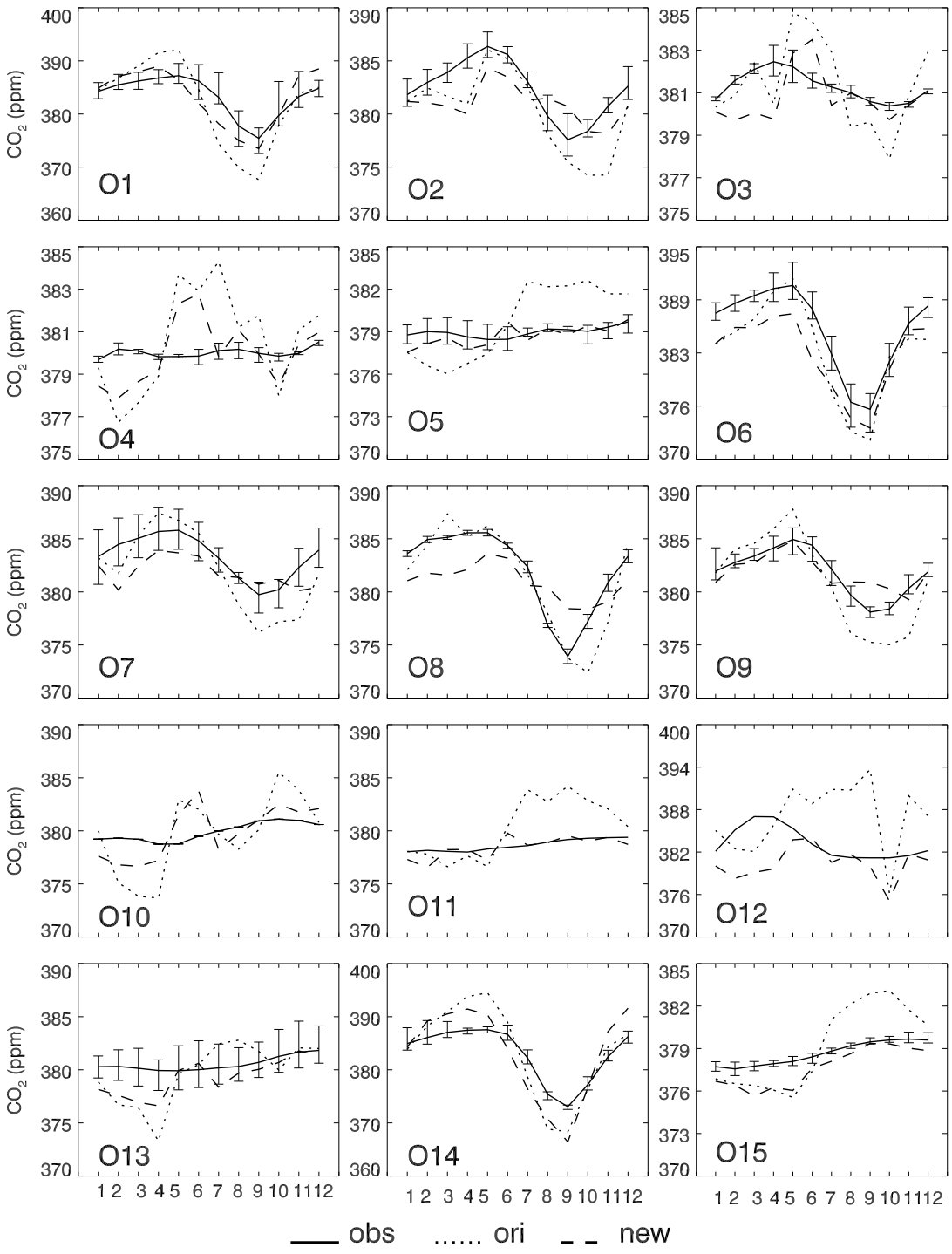

Fig.9 Comparisons of regionally averaged values of CO_2 between model results from GEOS-Chem with original emission inventory (dotted line) and new emission inventory(dashed line) and GLOBALVIEW-CO_2 (solid line) for 15 ocean regions in 2006(15 ocean regions are shown in Fig.4).The error bar represents the spread of the observations.

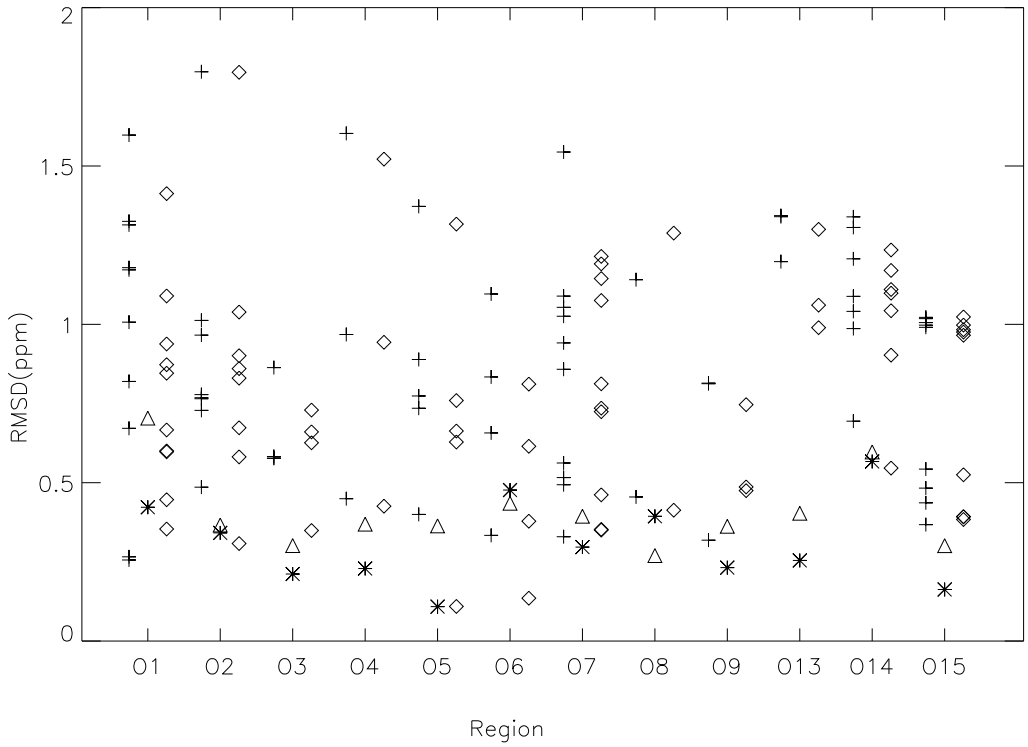

Fig. 10 Comparisons of RMSD at each station and regionally averaged values between model results and observations for the ocean regions in 2006. Each region is shown in Fig. 4. Triangle (Asterisk) denotes RMSD of regionally averaged values between model results using fluxes from CASA (VEGAS) and observations, cross (diamond) denotes RMSD of each station between model results using fluxes from CASA (VEGAS) and observations(See the legend in Fig.8).

P2253, Line 1: Please include values.

We have added values “about 0.3~6 ppm”

P2253, Line 5: “which suggests that more sinks in North America may be required for this period” - I have two issues with this statement. First, you should not say this. You should say that your model is overestimating the surface flux for this period. Secondly, there is also as large a difference, but for a longer duration, between june and September for region L1. Why do you only talk about november/december? I would consider june to september to be worse and this has a much bigger difference to the original inventories’ results.

Thanks. We have rewritten this paragraph “**The difference of the regional CO2 concentration between model results with the new emission inventory and observations is less than 2 ppm for North American boreal (L1) from January to June, which is smaller than 1% of observations. The difference is about 2 ppm in July, August, and December, which suggests that there are large uncertainties in North America for the new inventory during these periods**. **The difference between simulations with original emission inventory and observations reaches 6ppm from April to May.**”

P2253, Line 6: “good agreement” – this is subjective. Please include much more

quantification to back up your claims. Also I do not agree with L7 or L8 being in good agreement! These show large differences to the observations, as much as region L11.These are, however, much improved from the original inventories' results, so it would be good to talk about the improvement.

Thanks. We have rewritten this paragraph. **"The largest difference between the simulation with fluxes from VEGAS and observations is 2.8 ppm for the Northern America Boreal(L1), 2.9 ppm for the Northern America Temperate(L2),3.1 ppm for the Eurasian boreal(L7), 3.5ppm for the Eurasian Temperate (L8),4.3 ppm for Europe(L11),which is smaller than that of CASA(5.8 ppm,6.3ppm,14.5 ppm,10.9ppm,13.1ppm,respectively). The spread of the regional CO2 of observations for each region is shown with error bars, which is determined by the concentrations of stations in the region.**

The root-mean-square difference (RMSE) between two simulations with fluxes from VEGAS and CASA and observations for each station ranges from 0-2ppm. The RMSE between the simulations with fluxes from VEGAS and observations for regional CO2 concentrations is 0.2 ppm, which is smaller than the value with fluxes from CASA (0.4 ppm) as shown in Fig.9"

P2253, Line 10 and 11: It would be much clearer if you started the sentences with "In region 7..." and "In region 8...".

We have rewritten this paragraph. Please see above.

P2253, Line 19/20: Yes the ocean regions are influenced by land emissions, but the land is also influenced by ocean emissions.

The ocean emission isn't change. So we discuss the influence of land emissions on the ocean.

P2253, Line 23: "great improvements" – what improvements? How much by? You really need to explain things more and include more quantification.

We have rewritten this sentence. "**The difference between the simulations with the new inventory and observations ranges from 0.02 ppm to 2 ppm (0.7ppm to 4 ppm for the original inventory) for the South Pacific Temperate(O5) during 2006.**"

P2253, Line 24: "it can be deduced that the sources and sinks are improved in the South American Temperate though there is no direct observations in this region" –How is that deduced??? How can you prove this statement, when you do not even show any of the results for this region in the paper??? Given that this is stated in the ocean results section I can only assume you mean to suggest that the results in the ocean next to the region improve and therefore the land must too, but ocean and land do not behave the same so this can not be assumed, and these ocean regions do not dramatically improve either. If anything, this issue just highlights that the new inventory approach is very limited geographically.

We didn't change ocean fluxes. An increase in seasonal cycle of NEP fluxes from terrestrial ecosystems in the northern hemisphere could drive a decrease in the amplitude of the seasonal cycle of atmospheric CO2 at stations in the southern hemisphere(Randerson ,1997). We are not sure which land region contributes it. "It can be deduced that the sources and sinks are improved in the South American

Temperate though there is no direct observations in this region" has been modified to "**The regional CO2 concentration in the ocean could be improved through the improvement of the land fluxes.**"

P2253, Line 27: Please include some quantification, e.g. how big a difference? What time of year? Brief description of trend?

We have rewritten this sentence. "**The largest difference (about 8 ppm) for the simulation with the new inventory appears in April 2006 for the Indian Tropical (O12)..**"

P2253, Line 28: It is not a persisting decrease from April. It only decreases between April and June. Also, the minimum for model results is not April, but rather in September according to your plot.

We have rewritten this sentence. **It is a high value (about 387 ppm) for observations in April 2006, while the simulate result with new emission inventory is 379 ppm. Fluxes that contribute to the concentration of this region should be improved for this new emission inventory.**

P2254, Line 2: "very complex" – This does not actually tell me anything. Better to say that the seasonal cycle has a large variation for stations in this region. This just shows how poor the comparison is for some regions, since if one of the stations was removed then the model results would either match perfectly with the observations or would be completely opposite to observations, depending on which station would be removed. Thus, it just highlights that the comparison is only really valid where there are many observation stations within a region (such as regions L1 and L2).

This sentence has rewritten to "**The peak-to-trough amplitude of the regional CO2 concentration for this region is no more than 2ppm in 2006, while the spread of the observed concentrations in this region is larger than 2ppm for all months in 2006**."

P2254, Line 4: As mentioned previously, I do not think it is valid to compare ocean fluxes with land observations. The observations are highly influenced by local surface fluxes and very little by regional/global fluxes. Therefore it is not reasonable to compare land and ocean fluxes since they have very difference source/sink attributes.

The land fluxes are different and the ocean fluxes are the same for both emission inventories. The concentrations of the stations in the ocean region are changed because of the changes of the land fluxes. So we compare the concentrations in the ocean for two simulations with observations.

P2254, Line 7: "more sinks may be required" – You should not say this. Instead just say that your model is overestimating the fluxes and not accounting for observed sinks. Can you comment on what might be the cause of this?

Thanks. "More sinks may be required in this region or the surrounded land region" has been modified to "**It is necessary to improve the fluxes in this region or the surrounded land regions.**"

P2254, Line 8: "difficult to simulate" – Why is it difficult to simulate? Surely the model does not run any different in this region? It must be that the inventories are highly uncertain for this region.

We have rewritten this sentence. "**It's difficult to simulate the two increase phases**

and two decrease phases in the seasonal cycle of observations (Fig. 6) for the South Pacific Tropics (O4) and the South Pacific Temperate (O5). It could be effective for improving the fluxes in the ocean regions to match observations because the seasonal cycle simulated by the land fluxes are characterized by one increase and one decrease phase. ”

P2254, Line 11: This is potentially not true though, as assimilation techniques using an ensemble kalman filter could be used instead with higher surface flux uncertainty reductions.

We have deleted this sentence.

P2254, Line14: Comparisons to the root-mean-square difference – This whole section should be removed and should be incorporated into the previous sections where relevant.

We have removed the whole section into previous sections. Please see response to P2253, Line 6

P2255, Line 20: Appendix – this was confusing to read. Please separate into two paragraphs; one for the original inventory and one for the new inventory. Also, please reference the Appendix properly.

We have rewritten this paragraph. We have moved the texts in Appendix to Section 2.2(now Modeling the land carbon fluxes) based on a request of the second reviewer. Please see response to P2248,Line 15

Table A1: Try to get this to fit on a single page. Also give the table a better description, with more explaination of what the stations are, etc.

We have added the full name of the stations in the table, and the stations with more description have to be fit on more than one page.

station_name	Abbreviation	Longtitude	Latitude	Height	Group
Cold Bay,Alaska	cba_01D0	-162.72	55.2	25	01
Cape St.James,BC	csj_06D0	-131.02	51.93	89	01
…	…	…	…	…	…

Figures 2 and 3: Why do you only show just two months? It would be much more useful and justifiable to show a whole year (each month and yearly average) and each season (seasonal average).

The fluxes in these two months are the dominant contributor to the maximum or minimum CO2 concentrations of the seasonal cycles. The differences of these two months are representative.

Figures 5 to 9: Explain how these results were made briefly in the label, e.g. what year was the model ran for, what the observation stations are, etc.

Figure 5. We have added “**The stations within the region North American boreal (L1) are labeled with “L1” in the “Group” columns of Table A1. The way to find the stations in other regions is similar.**”

Figure 6. We have added “**The stations within the region North East Pacific (O1) are labeled with “O1” in the “Group” columns of Table A1. The way to find the stations in other regions is similar.**”

Figure 7,8 we have added “in 2006” at the end.

Figure 9(now Fig.10): Combine three plots into a single plot.

These plots were incorporated into the previous sections where relevant based on the suggestion of P2254, Line 14. One is put in the place where discuss the land. The other two ocean plots are combined and placed in Section 4.2

Technical Corrections:

P2244, Line 5: The sentence “Observations at a single site...” is too long. Consider splitting up the sentence so that it reads better.

We have modified to “**Observations at a single station reflect all underlying processes of various scales. These processes usually cannot be fully resolved by model simulations at the grid points nearest the station due to lack of spatial or temporal resolution or missing processes in the model.**”

P2244, Line 8: Remove the word “site”.

We have modified this sentence to “**In this study the stations in one region were grouped based on the amplitude and phase of the seasonal cycle at each station**”

P2244, Line 14: Change “uncertainties” to “uncertainty”.

Changed accordingly.

P2244, Line 15: Please change sentence to say “We compared the group averaged values between model results with biospheric fluxes from the Carnegie-Ames-Stanford-Approach (CASA) and Vegetation-Global-Atmosphere-Soil (VEGAS) models, and used observations to evaluate the regional model results.”

We have modified to “**We compared the regional CO2 concentrations between model results with biospheric fluxes from the Carnegie-Ames-Stanford-Approach (CASA) and VEgetation-Global-Atmosphere-Soil (VEGAS) models, and used observations to evaluate the regional model results**.”

P2244, Line 18: At the start of the sentence please change to “The results”.

Changed accordingly.

P2244, Line 18: Change “the modelling” to “the modelled” or “modelling”

We have modified this sentence to “**The results show the largest difference of the regionally averaged values between simulations with fluxes from VEGAS and observations are less than 5 ppm for Northern America Boreal, Northern America Temperate, Eurasian boreal, Eurasian Temperate and Europe, which is smaller than the largest difference between CASA simulations and observations (more than 5 ppm).** ”

P2244, Line 19: consider rephrasing.

Please see our response above.

P2245, Line 11: rephrase i.e. CO2 in the atmosphere is affected by surface fluxes. Do not like the word “unbribable”.

We have modified it to “**CO_2 in the atmosphere is affected by surface fluxes**”

P2245, Line 17: Change “derive” to “aid determination of”

Changed accordingly.

P2245, Line 22: put a comma after however
Changed accordingly.
P2245, Line 25: Change to “points nearest to the site due to the lack of”.
We have modified it to “points nearest to the station due to the lack of”
P2245, Line 26: change “in models” to “ the model”
Changed accordingly.
P2245, Line 26: change “proposed” to “propose”
Changed accordingly.
P2245, Line 27: Change “checking” to “comparing”
Changed accordingly.
P2246, Line 2: Consider rephrasing, e.g. “regional temporal characteristics of the seasonal cycle which have been”.
We have modified it to “**Several stations in one region were grouped according to the regional temporal characteristics of the seasonal cycle which have been derived from a new atmospheric CO_2 observation dataset from GLOBALVIEW-CO_2 2010**”
P2246, Line 4: Change “difference of” to “difference between”
Changed accordingly.
P2246, Line 6: Add “located” at the end of the sentence.
Changed accordingly.
P2246, Line 7: Replace “the CO2 emissions of fossil fuels are” with “ atmospheric CO2 is”
Changed accordingly.
P2246, Line 8: Change to “the global carbon cycle”
Changed accordingly.
P2246, Line 12: Change “sink are produced” to “sinks have been produced” and remove “some”
Changed accordingly.
P2246, Line 13: Change to “The GEOS-Chem”. And Change “inverse” to “estimation”
Changed accordingly.
P2246, Line 14: Change “it was used” to “it has been used”.
Changed accordingly.
P2246, Line 16: Change to “ Nassar et al”.
Changed accordingly.
P2246, Line 20: Remove “balanced”.
Changed accordingly.
P2246, Line 23: Needs rephrasing.
We have written this sentence to “**The land-atmosphere fluxes in GEOS-Chem include monthly biomass burning CO2 emissions, annual inventory of biofuel burning 3-hourly Net Ecosystem Productivity(NEP) for 2000(Olsen, 2004), and annual climatology based on TransCom CO2 inversion results in Nassar et al.(2010)”. The land-atmosphere flux can be simulated by different Dynamic Global Vegetation Models(DGVMs)(Sitch et al.,2008). Terrestrial carbon cycle**

model Vegetation-Global-Atmosphere-Soil(VEGAS) is one of the DGVMs(Zeng et al.,2003). The land-atmosphere flux simulated by VEGAS agrees well with the CO_2 growth rate observed at Mauna Loa both in terms of interannual amplitude and phase(Zeng et al.,2005)" based on a request from the second reviewer.

P2246, Line 28: Change to "the VEGAS model was developed".

Changed accordingly.

P2247, Line 1: Change "is introduced into GEOS-Chem model to replace" to "are used in the GEOS-Chem model, replacing"

Changed accordingly.

P2247, Line 3: Replace "of this paper" with "describes the grouping of"

Changed accordingly.

P2247, Line 4: Change to "demonstrates".

Changed accordingly.

P2247, Line 10: Replace "an update" with "a".

Changed accordingly.

P2247, Line 17: Replace "update" with "data product".

Changed accordingly.

P2247, Line 18: Change to "observations".

Changed accordingly.

P2247, Line 19: Replace "the data product includes extended records for the period" with "between".

Changed accordingly.

P2247, Line 20: Change sentence to "where there are several measurements at different altitudes for the same site we only use the lowest in altitude. This gives a total of 108 measurements that have been used."

Changed accordingly.

P2248, Line 1: Change to "the net ecosystem exchange (NEE) is simulated by the DGVMs and equals the heterotrophic respiration (RH) subtracted from the net primary productivity (NPP)."

This sentence has been changed to "The net ecosystem exchange (NEE) is simulated by land models and equals the heterotrophic respiration (RH) subtracted from the net primary productivity (NPP)."

P2248, Line 4: Change to "the DGVMs".

Changed accordingly.

P2248, Line 16: Change "CASA about" to "CASA by about".

We have modified this paragraph. Please see our response to P2248, Line 15.

P2248, Line 20: Change "is shown" to "are shown".

We have modified this paragraph. Please see our response to P2248, Line 14-15.

P2248, Line 22: Change "and is replaced" to ", and are replaced".

We have modified this paragraph. Please see our response to P2248, Line 14-15.

P2248, Line 23: Change "work" to "study".

Changed accordingly.

P2248, Line 23: Remove the word "obviously".

Changed accordingly.

P2248, Line 24: Include a comma after GEOS-Chem.
Changed accordingly.
P2248, Line 24: Change “is in” to “are shown”.
We have deleted Appendix A.
P2249, Line 4: Change to “the seasonal”.
Changed accordingly.
P2249, Line 8: Change “groups in” to “groups on”.
Changed accordingly.
P2249, Line 9: Change “fall” to “autumn”.
Changed accordingly.
P2249, Line 10: Change “much more” to “greater”. And change “stations in” to “stations on”.
Changed accordingly.
P2249, Line 11: Change to “the TransCom3”.
Changed accordingly.
P2249, Line 15: Change “of seasonal pattern and amplitude” to “in the seasonal cycle”.
Changed accordingly.
P2249, Line 15 and 19: Change “Ocean” to “ocean”.
Changed accordingly.
P2249, Line 19: Remove “then”.
Changed accordingly.
P2249, Line 20: Replace “grouped to” with “grouped into”.
Changed accordingly.
P2249, Line 21: Replace “the map” with “a map”. Also change “sites” to “stations” – be consistent.
Changed accordingly.
P2249, Line 24-26: Remove, as repeat of earlier section.
We have removed this sentence.
P2250, Line 5: Change to “studies have shown the seasonal cycle of atmospheric CO2....”
Changed accordingly.
P2250, Line 6: Make reference an example i.e. (e.g. Randerson et al, 1997).
Changed accordingly.
P2250, Line 6: Replace “of the magnitude for the amplitude, minimum values, maximum values” to “in seasonal amplitude”.
Changed accordingly.
P2250, Line 18: Change “o1,o6 is” to “o1 and o6 are”.
Changed accordingly.
P2250, Line 19: Change to “amplitude of groups O2 and O7 are much less than that of other northern regions.
Changed accordingly.
P2250, Line 21: Replace “typically decreases moving southward” with “is less in the southern hemosphere”.

Changed accordingly.

P2250, Line 23: Start a new paragraph after the reference.

We have deleted these sentence based on a request from the second reviewer.

P2250, Line 28: Replace “trend” with “cycles of CO2 measured at”.

Changed accordingly

P2251, Line 1: Change “the seasonal patterns” to “the CO2 seasonal cycle”.

Changed accordingly

P2251, Line 2: Change “sites in South Pacific” to “stations within the South Pacific”.

We have rewritten these sentences based on a request from the second reviewer.

Generally there is an increase period and a decrease period for one seasonal cycle. While CO2 increases from April to June and from October to December for the South Pacific Tropics(O4). CO2 decreases from January to April and from August to October for the South Pacific Temperate(O5).

P2251, Line 5: Change “locate in South Pacific” to “located in the South Pacific”

We have modified this sentence. Please see response above.

P2251, Line 7: Change “minimal” to “minimum”.

Please see our response above

P2251, Line 10: Replace “patterns” with “cycles”.

Changed accordingly

P2251, Line 11: Replace “pattern” with “cycles”.

Changed accordingly

P2251, Line 12: Replace “pattern” with “seasonal cycle”

Changed accordingly

P2251, Line 13: Change “North Indian Ocean O12” to “North Indian Ocean (group O12)”.

Changed accordingly

P2251, Line 14: Change “South Indian Ocean O13” to “the South Indian Ocean (group O13)”.

Changed accordingly

P2251, Line 15: Change “(O10, O11)” to “(O11 and O11)”.

Changed accordingly

P2251, Line 17: Change “The concentrations of CO2 of stations in ocean” to “The concentrations of CO2 at stations in the ocean”.

Changed accordingly

P2251, Line 19: Change to “(for groups O4, O5, O10, O11 and O15)”.

Changed accordingly

P2251, Line 22: Add “Inversely, “ to the start of the sentence.

Changed accordingly

P2251, Line 22 and 23: Replace “austral” with southern hemispheric.

Changed accordingly

P2251, Line 23: Change “in the south” to “south”.

Changed accordingly

P2251, Line 26: Replace “obvious” with “an”.

Line 26-end has been modified based on a request from the second reviewer. **An**

increase of the seasonal cycle for Southern Ocean occurs in September, while the seasonal anomalies of CO2 in the northern hemisphere are negative at the same time. The two seasonal cycles of the Southern Ocean (O15) and the northern hemisphere are out of phase. Northern hemisphere terrestrial ecosystems contribute substantially to the seasonal cycle at many stations in the southern hemisphere, because of lags in transport and nonoverlapping growing seasons, some components from the northern and southern are out of phase with one another, thus an increase in seasonal cycle of NEP fluxes from terrestrial in the northern hemisphere could drive a decrease in the amplitude of the seasonal cycle of atmospheric CO2 at stations in the southern hemisphere(Randerson et al.(1997))

P2251, Line 27: Remove rest of paragraph after the word February, and replace with "February, showing the seasonal cycle to be consistent for both hemispheres."

Please see our response above

P2252, Line 12: Change "detail" to "detailed".

Changed accordingly

P2252, Line 13: Poor english grammar in the sentence "375 ppm for 1 January 2004 is set for a starting point of spin-up". Please change to something like "the model was ran using 375 ppm for the 1 January 2004 as a starting point".

We have modified "375 ppm…..(real line in Figs.7,8)" to "**Our model simulation was initialized with a uniform global distribution of 375 ppm on 1 January 2004 and integrated forward to January 1st 2006 using the original emission inventory. The modeled CO2 distribution on January 1st 2006 was the initial concentration for two simulations with the original emission inventory (ori) and the new emission inventory(new) from January 1st 2006 to January 1st 2007. Both model simulations were run at a horizontal resolution of 2° latitude ×2.5° longitude. Figure 7 and 9 show differences between the model results with the original inventory and the results with the new inventory during 2006.**"

P2252, Line 15: Start sentence with "Figure 7 and 8 show..." and state what year and region(s)/global scale the model was ran for, and then say what the results are. Also, you can then remove the text in brackets from the sentence.

We have rewritten this sentence. Please see our response above.

P2252, Line 19: Change sentence to say "CO2 seasonal cycles were simulated by the model with original and new emission inventories.

Changed accordingly

P2252, Line 20: Replace "discrepancy between model" with "difference between the model".

Changed accordingly

P2252, Line 21-25: Replace "runs" with "simulations" and "discrepancy" with "difference".

Changed accordingly

P2253, Line 1: Replace "discrepancy" with "difference".

Changed accordingly

P2253, Line 14: Start sentence with "For South America, Africa and Australia..." and

change “scacity of” to “there are too few”.
Changed accordingly
P2253, Line 17: Change “model” to “models”.
Changed accordingly
P2253, Line 27: Change “for Indian Tropical” to “for the Indian Tropical region”.
Changed accordingly
P2254, Line 6: Change “still large bias” to “still a large bias”.
Changed accordingly
P2254, Line 9: Change “obviously” to “clear”.
We have deleted this sentence based on a request from the second reviewer.
P2254, Line 10: Change “are needed” to “need”.
We have deleted this sentence based on a request from the second reviewer.
P2254, Line 11: Replace “will be” with “can be”.
Changed accordingly
P2255, Line 1: Change “sites” to “observation stations”.
Changed accordingly
P2255, Line 2: Replace “observations” with “measured CO2”.
Changed accordingly
P2255, Line 2: Change “The group averaged measurement values of CO2 concentration” to “the group averaged values”.
We have modified to “the regionally averaged values” based on a request from the second reviewer.
P2255, Line 12: Remove the sentence “this implies possible ....”.
Changed accordingly
Figures 5 to 8: Replace “real line” with “solid line”.
Changed accordingly