An accurate quantification of the greenhouse gas emissions in urban ecosystems relies in the use of multiple techniques according to the particular conditions and needs of the city. Eddy covariance (EC) flux towers have demonstrated to be valuable tools to evaluate fluxes of greenhouse gases. With a proper selection of the footprint they can cover extents of similar size of a complete neighbourhood and help to verify the accuracy of emissions estimated by other techniques.
In this context, Ueayama and Ando instrumented three flux towers in the Japanese city of Sakai during a period of time not indicated in the manuscript with the aim of characterizing the CO2 flux from five different land covers. They used the collected data to extrapolate the observed fluxes to the whole city based on the planar fraction of the green cover.

Thank you very much for your understanding of our research background, careful editing and very useful comments. We have revised our manuscript based on the reviewers' comments. The study period is one year at 2015, and we have add this information in the revised manuscript. All revisions are marked as red in the revised manuscript.

Assuming that such approach is appropriate to quantify the total emission from a city, it is not clear how such extrapolation was possible without a comprehensive land-use analysis of the three monitored sites. The manuscript does not provide basic information on the land-use, urban morphology, trees characteristics, vehicular traffic, etc. It is not clear, even, how the observed footprints were estimated without information on the height of the roughness elements buildings and trees).

The upscaling approach that we used is based on a recent synthesis using eddy covariance data from various cities (Nordbo et al., 2012), where green fraction is a single scaling index explaining spatial variabilities in urban fluxes. Our data and analyses supports their findings and adds possible applicability of this method for estimating fluxes within the city. We agree that upscaling the eddy covariance fluxes into city-scale had considerable uncertainties. Thus, we have added limitation and possible improvement of our approach in discussion section.

We have added information of mean and maximum building and tree heights in the method section. The building and tree heights were used for estimating zero-plane displacement height, which was used in the footprint model. Those information have added in the revised manuscript. Traffic count and gas consumption data were shown in the manuscript, to explain the temporal variabilities in CO_2 fluxes, although the cities-scale traffic and gas consumption data were unfortunately publically available. Tree characteristics for the urban park were complicated with various species, such as *Quercus*, *Prunus*, *Cerasus*; there were no dominant species in the park. Consequently, we cannot list those species in the manuscript.

Based on the poor description of the methodology, apparently two towers do not meet the basic EC requirement of mounting the instruments within the inertial sublayer. The authors do not present any material to validate the measurements. The description of the data postprocessing is ambiguous. The data quality assurance is not clear. The authors did not consider the criteria of stationarity neither evaluated the turbulence characteristics.

Yes, the description for our study sites was insufficient, and we have added further site information including site characteristics and post processing (we have answered in detail at answers for the specific comments below). We believe that the measurements in SAC were conducted within the inertial sublayer by following reasons. Although the mean building height of SAC was 10.7 ± 3.1 m, building heights was highly skewed in low buildings, resulting in that it was difficult for interpreting the arithmetic mean. The mean building height of buildings greater than 20 m, which occupy 33% of total building area, were 36 m. Those tall buildings should prevent the flux measurements at lower heights, because CO_2 sources, such as gas engines for air conditioner, were often located at roof of tall buildings. For OPU, the measurements were conducted at the roughness sublayer; the mean height of buildings and trees for the upwind directions were 10.3 m and 13.1 m respectively. We have added those limitations in the revised manuscript in the final paragraph in the discussion section.

We also checked the general flow statistics: e.g., σw/u* at neutral conditions were 1.3 for SAC, 1.5 for OPU, and 1.3 for IZM; σu/u* at neutral conditions were 2.6 for SAC, 2.6 for OPU, and 3.2 for IZM, which did not strongly differ with those examined at bare soils (Kaimal and Finnigan, 1994), urban (Högström et al., 1982), or a forest (Ueyama et al., 2014). We have added this information in the method section as "A stationary test, integral turbulence test, and higher moment test were applied, since flow statistics did not strongly differ with ideal surfaces (Kaimal and Finnigan, 1994); σ_w/u_* at neutral conditions were 1.3 for SAC, 1.5 for OPU, and 1.3 for IZM; σ_u/u_* at neutral conditions were 2.6 for SAC, 2.6 for OPU, and 3.2 for IZM, where σ_w and σ_u are the standard deviation of vertical and horizontal wind velocities.".

The discussion of the results is pretty qualitative. The results are not solid. Some of their observations are "surprising". For example, they report larger emissions in summer than in winter as a *consequence of a major consumption of natural gas for air conditioning. This observation is opposite to all previous studies based on EC in Japan and other mid-latitude cities in the world. This reviewer understand that domestic heating in Japan is by individual heaters. Indeed, they represent an important emission source, but during winter. Air conditioning is also conducted by individual units, but they do not burn fossil fuels. Do buildings in Sakai, perhaps, need to generate their own electricity?*

Thank you for pointing out the issues. Yes, our discussion for CO_2 emissions for summer was insufficient. High CO_2 emissions in summer could be a unique nature of dense urban built-up in Japanese big cities in recent years. As you know, unclear power plants are no longer available in most of Japanese cities after the Fukushima nuclear disaster at 2011 by public opinion. Consequently, gas-based air conditioners are increasing currently for industrial and commercial buildings expect residences. We have added this discussion in the revised manuscript as "The prevalence rate of gas- powered air conditioners is approximately 20% of non-residential buildings, based on an assessment by the Japan Gas Association. An example of gas consumption in summer was shown in Figure S1. The water vapor flux in the summer months also significantly increased above a mean daily air temperature of 17°C (T. Ando, unpublished data), suggesting gas consumption by air conditioners. Kanda et al. (1997) also measured the high water vapor flux in a summer at an urban center, Tokyo, and suggested that gas consumption associated with cooling towers. In contrast to residences, tall buildings often used gas-based air conditioners, including the Sakai city office and buildings at OPU; especially after the Fukushima nuclear disaster at 2011, nuclear power plants for the study area did not operate. Consequently, gas-based air conditioners increased (Agency for Natural Resources and Energy, 2015).". For supporting the discussion, we showed the gas consumption data (Figure S1), where summer gas consumption was higher than those in winter.

The authors did not follow the basic assumptions of the EC method. A complete understanding of the theory behind is not evident, neither of the advantages and limitations of its application over urban surfaces. The approaches used to explain and extrapolate the observed fluxes are simplistic.

We agree that our eddy covariance measurements contained some uncertainties, and have added a new paragraph showing our limitation as "Inherent limitations associated with the eddy covariance method at the urban environment must be reduced and quantified in future studies. The measurements height at SAC was more than ten times higher than the mean building height, although reducing the height was restricted due to sporadic tall buildings. This could induce underestimates of nighttime fluxes (Oke, 2006), and thus the annual emission could be underestimated. CO_2 storage within the building was not considered in our study, but must be important in late afternoon and early morning (Vogt et al., 2006). In contrast, the measurements height at OPU was within the roughness sublayer (1.2 to 1.6 times the mean building and tree heights), and thus fluxes were influenced by localized near fields (Oke, 2006). Separating wind sectors using the footprint analysis may suffer uncertainties when advection was trigged by wind shifts.".

Our analysis and scaling method might be too simple, although the simple scaling was previously examined at the global scale (Nordbo et al., 2012). We believe that our results could progress current urban fluxes studies by showing temporal and spatial variabilities in CO_2 fluxes at dense built-up urban center, rural area, and urban park within a single city with available data of traffic, gas consumption, and GIS.

The work presented here does not meet the scientific requirements to be considered by any peer-reviewed journal.

We agree that our measurements and analyses contains uncertainties based on the complexity of the urban system. Yet, we still believe that the locations of SAC and IZM were the best location for estimating the eddy fluxes within our city, although the measurements were not conducted at a perfectly ideal location. Owing to current available number of eddy flux data at urban areas, we believe that our data and results should contribute urban flux studies for charactering dense urban built-up, urban park, and rural landscapes for a mid-latitude city, and meet the current standard of the urban flux studies. For clarifying the measurement sites, data processing, and limitations, we have fully revised our manuscript based on the reviewers' comments.

Specific comments (page/line)

1/13 vegetation activities?

We have changed the term to "photosynthetic uptake".

1/14-16 This statement needs an explanation. It is opposite to flux data reported by many previous studies in mid-latitude cities.

As described in answer for the general comments, we have added further discussion in the revised manuscript as the answer in the general comment.

1/20-21 This statement is different to the accepted consensus that eddy covariance flux towers are just a tool among others to evaluate urban emissions. The method has advantages and limitations. Multiple methods are needed to quantify emissions for a comprehensive climate change mitigation assessment.

We agree that the statement was not valid, and have revised the sentence as "A network of eddy covariance measurements is useful for characterizing spatial and temporal variations in net CO_2 fluxes from urban areas. Multiple methods would be required for evaluating rationale behind the fluxes and overcoming the limitations in future.".

1/27 Inventories of what?

The global inventories that we cited are based on combination of point source database, statistics for national and regional CO_2 emission, and satellite remote sensing (Oda and Maksyutov); we have added the information in the revised manuscript.

2/9 What is the difference between an urban park and an urban forest?

The urban park is a mixture of managed trees, grassland, and human architectures and used for human recreation, whereas urban forest in the literature is a forest in a city and was not used for human recreation.

2/10 Results : : : None result is discussed in this paragraph.

We have added sentences for knowledge from those previous researches as "These results indicated that cities emits a considerable amount of CO_2 into the atmosphere associated with human activities, such as vehicle traffic and household heating in the wintertime. Even in urban parks, CO_2 was emitted to the atmosphere due to human activities (Kordowski and Kuttler, 2010). Magnitude of CO_2 emissions and its temporal variabilities depended on the cities, associated with type of contributed human activities under different climate conditions (Järvi et al., 2012; Moriwaki et al., 2006; Velasco et al., 2016; Ward et al., 2013, 2015), and role of urban vegetation (Awal et al., 2010; Kordowski and Kuttler, 2010; Peters and McFadeen, 2012; Ward et al., 2015), showing considerable heterogeneities.".

2/12-13 The role of vegetation in the CO2 exchange depends on the landscape characteristics and anthropogenic activities. In urban districts, all studies based on eddy covariance flux measurements have found that vehicular traffic and domestic heating are the main contributors. Depending on the *extension of the green areas and trees characteristics, urban vegetation may be relevant.*

We agree that vegetation was not control the spatial variabilities in CO_2 flux. We have revised the sentence as "Multi-site eddy covariance towers were used to synthesize the data and showed that vegetation fraction was the index explaining spatial variability in annual CO_2 emissions (Nordbo et al., 2012; Velasco and Roth, 2010; Ward et al., 2015)". For temporal variabilities, our results was consistent with previous studies, where traffic count and gas consumption were the major factors controlling CO_2 fluxes.

2/13 It is not correct to affirm that vegetation fraction and anthropogenic activities are correlated. Those studies analyzed the correlation between the planar fraction of green space and CO2 flux in residential neighborhoods. The biogenic component (vegetation + soil), human respiration, vehicular traffic and domestic consumption of fossil fuels have been reported as the main contributors for that particular type of urban land-use.

We agree that term of "correlation" was invalid, and has revised by referring the statement in Nordbo et al (2012) as "because vegetation fraction possibly has many factors determining CO_2 emission: greater vegetative fraction relates a lesser road and population density (Nordbo et al., 2012)".

2/23 Define moderate urban area.

We have added the definition of moderate urban area in this study in section for data analysis as "Here, we defined the moderate urban as green fraction of 27%, which was double compared with those at dense urban built up (Table 1).".

3/4 Table 1 does not provide information on the characteristics of the monitored sites.

We truly apologize that Table 1 was missing and Table 2 was accidentaly shown as Table 1 in the manuscript. The table 1 shows the surface cover fraction within the footprint as follow, and have been added in the revised mansucirpt.

Table 1. Landcover fraction within daytime flux footprint. Landcover classification was conducted using the Digital Map 5000 for the Kinki region in 2008 by the Geospatial Information Authority of Japan, and the green space fraction was based on a green census by the government of Sakai City. Because the landcover classification and green space are different data sources, the sum of each faction often exceeds 100%. The daytime flux footprint was calculated using the analytical footprint model (Kormann and Meixner, 2000), and median values in 2015 were classified for sixteen direction (Fig. 1).

	SAC west	SAC east	OPU	IZM park	IZM rural
	%	%	%	%	%
Residence	27	9	9	1	15
Commercial, industrial, and public offi	34	38	69	6	15
Road	27	29	10	3	6
Green space	14	27	44	72	62

3/16 What does the category of others include? It is the second largest component.

We have added the sentences for showing in detail as "The landcover of the park consists of 51% trees, 15% grassland, and 34% other, such as ponds, buildings, pavement, and bare ground. No vehicle traffic was allowed in the park except parking.".

3/21 Ancient tumulus?

We have changed the word of "ancient tumulus" to "kofun (the ancient burial mound)". Kofun is the ancient burial mound; the tombs of kings. Around and within the study area, there are a lot of kofun, including a kofun for Emperor Nintoku, which is the biggest tomb mound in Japan. The large keyhole-shaped kofun was shown in Fig. 1 for south of SAC and west of OPU.

3/26-27 It means that that the instruments were mounted at 127 m above the ground, 12 times the average height of the roughness elements (i.e. buildings). Were the instruments mounted within the inertial sublayer? Fluxes obtained from very tall towers (>100 m) may not be representative of the urban landscape. Tall towers may reach above the top of the collapsing boundary layer at night, causing difficulties in interpreting the flux data.

We believe that the measurements at SAC was within the inertial sublayer, especially in daytime. Owing to the nature of the building structure, measurements at lower height may be restricted due to sporadically distributed tall buildings. We have added the sentence for the tall buildings in the revised manuscript as "The area is a densely built-up urban area with a mean building height of 10.7 ± 3.1 m. Since the distributions of building heights were highly skewed in low-height buildings, the mean building height greater than 20 m was 36 m, which occupied 33% of the total building area.". But, we agree the reviewers' suggestion for uncertainties in nighttime measurement, and have added the limitation in the final paragraph in the discussion section as "The measurements height at SAC was more than ten times higher than the mean building height, although reducing the height was restricted due to sporadic tall buildings. This could induce underestimates of nighttime fluxes (Oke, 2006), and thus the annual emission could be underestimated.".

3/28 Avoid grey literature.

We have removed the grey literature.

3/31-32 The inertial sublayer is usually located at a height of 2-4 times the mean height of the buildings. Instruments mounted at 2 m over a building of 16.2 m are clearly not placed within such layer.

We agree that the measurement height of OPU was low, based on the fact that the mean building and tree height were 9.1 m and 13.1 m, respectively, indicating that measured height is 1.2 to 1.7 times the mean tree/building heights. Consequently, the measurements height were within the roughness sublayer, and must be influenced by sink/source distributions of the surface. We have added the site characteristics in the method section as "The mean and maximum tree height was 13.1 ± 2.9 m and 19 m, respectively, and the mean and maximum building height are 9.1 ± 2.9 m and 15 m, respectively.", and have added sentences for this limitation in the final paragraph in the discussion section as "In contrast, the measurements height at OPU was within the roughness sublayer (1.2 to 1.7 times the mean building and tree heights), and thus fluxes were influenced by localized near fields (Oke, 2006).".

4/11-12 The manuscript does not provide any material to support this observation.

Thank you for pointing out the important issues. We have added the statistics as "(RMSE = 2.18 μmol m^{-2} s^{-1}; F_{open} = 1.00 * F_{closed} - 0.03 μmol m^{-2} s^{-1}; R^2 = 0.84; F_{open} and F_{closed} represent CO_2 fluxes by the open and closed paths)".

4/21 No trend removal was applied, why?

To avoid possible underestimation of low-frequency flux contributions (Aubinet et al., 2003; Moncrieff et al., 2004), we did not apply trend removal.

4/29 If no filtering based on u was applied, was the stationarity criteria used? (see Aubinet et al.*

Advances in Ecological Research 30, 113-175, 2000).

As shown in an answer for the comment in *5/1-8*, we applied common stationary criteria (Appendix B in Ueyama et al., 2012) based on the instationary test, integral turbulent test, and high order moment (Foken and Wichura, 1996; Vickers and Mahart. 1997) for both daytime and nighttime. We check no dependence of nighttime CO_2 flux to u*, which was consistent with previous urban studies (e.g., Liu et al., 2012).

4/29 Was the flux storage below the towers during night time considered?

We considered the storage terms for IZM, but did not consider the storage term in this study due to difficulty estimating spatially representative storage fluxes. We agree that mentioning the uncertainties associated with storage was important and have added the sentences in the revised manuscript in the method section as "The storage term was added to the turbulent fluxes for the vegetative site (IZM), whereas the storage was not considered for urban sites (SAC and OPU) . The storage term for IZM was estimated based on CO_2 concentrations at the height of the eddy covariance measurement", and have added possible uncertainties in the final paragraph in the discussion section as "CO_2 storage within the building was not considered in our study, but must be important in late afternoon and early morning (Vogt et al., 2006).".

5/1-8 The data quality assurance is poorly described.

The quality assurance used in this study are based on our previous study (Appendix B in Ueyama et al., 2012). First, we removed data that did not meet stationary condition based on a method of Foken and Wichura (1996), where half-hourly data were subdivided into 6 hour, and then covariance was calculated for each 5-minute data. If difference between mean of covariance for the subdivided classes and half-hourly covariance was greater than 40% of half-hourly covariance, data was rejected as instationary. Then, we applied integral turbulent test, where turbulent intensity was greater than 50% for IZM and 200% for SAC and OPU those predicted by the similarity theory. According to the high moment test (Vickers and Mahrt. 1997), we removed data when the absolute value of skewness was greater than 3.6 or when the value of kurtosis was greater than 14.4. Those information has been added in the revised manuscript.

5/15 The percentages of data coverage are useless if the total measurement period for each tower is *not provided.*

We have added the total measurement period as "we formed five flux datasets from measurements at the three sites in the year of 2015 for SAC and OPU and in the period from February 2015 to January 2016 in IZM".

5/18 CO2 sequestration or carbon capture are common terms to talk about negative fluxes. Assimilatory flux is not a common term in the community of urban climatologists.

Since the terms "CO_2 sequestration" and "carbon capture" were often used for net flux instead of the gross fluxes, we have revised the term from "the assimilatory fluxes" to "gross photosynthetic flux", which would be objective.

5/18 Are there no trees at the SAC sites?

The green fraction of SAC west and east were 14% and 27%, respectively. We have added a new Table 1, which was missing in the previous manuscript.

5/19 What does the biological signal consider? Does it include the soil respiration contribution?

We have revised the sentence to "apparent daytime uptake were measured".

6/5 This reviewer does not consider such a simplistic approach can solve, even roughly, the potential role of vegetation in the urban CO2 flux. Weissert et al. Urban Climate 8, 100-125, 2014 provide a comprehensive review of methods to quantify the potential carbon sequestration by urban vegetation. Check also the approaches followed by Velasco et al. Atmos. Chem. Phys. 13, 10185-10202, 2013 and Ward et al. Atmos. Chem. Phys. 13, 4645-4666, 2013 to evaluate the urban vegetation contribution.

We agree that our analysis for mitigation was simplistic. Since the analysis for the mitigation did not directly influence the conclusion of our paper, we have removed all sentences related to mitigation for this analysis.

6/14 Biomass density is the important parameter to investigate (see Velasco et al. Landscape and Urban Planning 148, 99-107, 2016).

Our upscaling is based on a previous synthesis of urban eddy covariance network at the global scale (Nordbo et al., 2012), where green fraction was found to be a simple index to explain the urban CO_2 fluxes at various cities. Here, we re-examined their hypothesis and found that green fraction was also useful in our city, suggesting that the proposed method by Nordbo et al. (2012) could be valid. Since Velasco et al. (2016) compared CO_2 fluxes at Singapore and Mexico, and suggested that vegetation density was potentially important to explain the differences. Since climate and vegetation type among two regions are much different, the suggestion for the importance of vegetation density may not be conclusive. Furthermore, because spatial distributions in vegetation density could not be easily available at most cities, we believe that the simple method proposed by Nordbo et al. (2012) had a potential to be examined at various cities; and thus, we first examined the method in this study. We agree that increasing number of explanatory variable might improve the scaling, and have added future improvement in discussion as "Other environmental variables, such as biomass density (Velasco et al., 2016), might improve the scaling CO_2 fluxes at various cities.".

7/15 CO2 contributions from tombs? Do you suggest that corpses capture carbon?

We have revised the term to "kofun", as explained above.

7/18 Are statistically different the weekly variations? Any difference between fluxes on Saturdays and Sundays?

Thank you for pointing out the important issue. We have conducted the F test and T test, and found that weekly variations were statistically significant in SAC east in addition to SAC west and OPU, whereas those for IZM park and IZM rural were insignificant. We have revised the sentence as follows "On average, CO_2 emissions on weekdays were approximately 50% greater than emissions on weekends and holidays ($p < 0.01$) at the west SAC and OPU sites, even though the weekday CO_2 flux at the east SAC was 10% higher than the fluxes on holidays ($p < 0.01$).", and have added the standard deviation in Figure 5. The difference between Saturdays and Sundays are insignificant, which could be shown in Figure 5.

7/25 Table 2 was not included in the manuscript.

We apologize that previous manuscript lost Table 1 and Table 2 was shown as Table 1. We have revised showing both Table 1 and 2.

7/29-31 This sentence contradicts the previous statement that vegetation is correlated with anthropogenic activities (2/15).

In previous manuscript, our intent was that mitigations by direct CO_2 uptake by vegetation was limited; and then, green fraction could be an index explaining the intensity of human activities rather than an index explaining direct vegetative CO_2 uptake. As above mentioned, in the revised manuscript, analysis of the mitigation has been removed because the analysis was weak.

7/31 A comparison with flux data reported by Hirano et al. SOLA 11, 100-113, 2015 and Moriwaki and Kanda Journal of Applied Meteorology 43, 1700-1710, 2004 for two residential neighborhoods of Tokyo is needed.

We have revised the discussion as "The annual emissions rate in our urban center was comparable to that of the densely populated residential area in Yoyogi, Tokyo (4.3 kg C m^{-2} yr^{-1}, Hirano et al., 2015), and Kugahara, Tokyo (3.4 kg C m^{-2} yr^{-1}, Moriwaki and Kanda, 2004).".

8/7-9 A proper comparison should consider differences on the urban morphology, climatology, population density, anthropogenic activities, etc.

We have added sentences in the first paragraph in the discussion section for describing urban morphology and population density as "CO_2 emission in our city was lower than those measured at urban centers: a dense urban built-up in London (12.7 g C m^{-2} y^{-1}; Ward et al., 2015), historical city center in Florence (8.3 g C m^{-2} y^{-1}; Gioli et al., 2012), and residential area of south central Vancouver (6.7 g C m^{-2} y^{-1}; Christen et al., 2012). The annual emissions in our city were also lower than previous cities that had a similar population density; there were only two cities whose population was higher than our city, but the annual emissions in our city was 7th in the global synthesis (Fig. 12b in Ward et al., 2015).".

8/11 Be consistent with the use of units.

Thank you for mentioning the units; we have revised the unit by using "C" instead of "CO_2" for the annual balance.

8/20 Such slopes cannot be appreciated in Fig. 4.

We have recheck the statistics and found that the slope for SAC west was insignificant. We have revised the sentence as "These values are comparable to those obtained in our city: -0.37 g C m^{-2} d^{-1} °C $^{-1}$ for all SAC (p = 0.03) and -0.27 g C m^{-2} d^{-1} °C $^{-1}$ for east SAC (p < 0.01) when mean air temperatures were less than 15°C (Fig. 4), even though an insignificant correlation was obtained for west SAC.".

8/20-21 The green dots in Fig 4(b) show a clear variation with temperature, at least in the 10-35 degC range.

Thank you for mentioning this. We have added the sentence describing the rate in the result section as "In the urban park and rural area, CO_2 emissions decreased as temperatures increased above 15°C: -0.27 g C m^{-2} d^{-1} °C $^{-1}$ for IZM park (p < 0.01) and -0.13 g C m^{-2} d^{-1} °C $^{-1}$ for IZM rural (p < 0.01) when mean air temperatures were greater than 15°C (Fig. 4).".

9/10 Migration of urban emissions to urban parks?

We have revised the sentence as "The urban park acted as a net annual CO_2 source despite of abundant vegetation.".

9/20-21 Indeed, a comprehensive partitioning of the CO2 flux as a function of the upcoming wind direction may be useful to understand differences according to the surface characteristics. However, such partitioning may suffer of severe uncertainties due to advection issues triggered by wind shifts during the averaging periods.

We agree that the methods had uncertainties associated with advection, and have added a sentence in the final paragraph in the discussion section showing our limitations as "Separating wind sectors using the footprint analysis may suffer uncertainties when advection was trigged by wind shifts.".

9/29 Green fraction as an index of human activities?

We have revised the sentence as the reviewers' suggestion.

10/2-3 This is a reason why eddy covariance flux towers cannot solve by themselves the puzzle of the greenhouse gas emissions in urban ecosystems.

We believe that it is not necessary to be consistent among the eddy covariance-based regional flux and inventory-based ones, because those are totally different; eddy covariance estimated time-variant net fluxes including vegetation uptake and human CO_2 emission without point source emissions, such as power plant, whereas inventory-based estimates included point source emissions that were located outside cities. Thus, estimates of annual gross emissions would be impossible using eddy covariance approach; we do not want to estimate gross emissions in this study. However, upscaling the eddy covariance data would be able to provide the spatial variability of net CO_2 fluxes, which could be useful for other research fields, such as regional atmospheric inversion if we can added the point source emissions. Inter-comparison among upscaling eddy covariance estimates and inventories will improve understanding CO_2 emissions and exchanges in the urban system, which is our direction in future. In this study, we would like to present the upscaling method proposed by the global synthesis (Nordbo et al., 2012) could be applicable for estimating fluxes within a single city. We agree that such upscaling suffered considerable uncertainties, and thus we have added further discussion for limitation in the revised manuscript as "Since our simple method potentially contained uncertainties associated with limited number of one-year eddy covariance sites, and only consideration of green fraction, the estimates should be improved with further eddy covariance sites and additional environmental variables for explaining CO_2 fluxes".

10/3-4 Such comparison should consider the extrapolated flux after subtracting the "biological" component.

As described above answer, we intended to simply show differences among the methods associated with the nature of two estimates, rather than to estimate gross emissions by the upscaling. It is valid to know how magnitude differ among two estimates: one consider point source emissions that was located outside the city, but not consider the biological uptake, which could be used for other research fields.

References:

Aubinet, M., Clement, R. C., Elbers, J. A., Foken, T., Grelle, A.and co-authors. 2003. Methodology for data acquisition, storage, and treatment. In: Fluxes of Carbon, Water and Energy of European Forests (ed. R. Valentini), Springer-Verlag, Berlin, pp. 9-35.

Högström, U., Bergstoröm, H., Alexandersson, H., 1982. Turbulence characteristics in a near neutrally stratified urban atmosphere. Boundary Layer Meteorol. 23, 449-472.

Järvi, L., Nordbo, A., Riikonen, A., Moilanen, J., Nikinmaa, E., Vesala, T., 2012. Seasonal and annual variation of carbon dioxide surface fluxes in Helsinki, Finland, in 2006-2010. Atmos. Chem. Phys., 12, 8475-8489.

Kaimal, J.C., Finnigan, J.J., 1994. Atmospheric Boundary Layer Flows, 289pp., Oxford Univ. Press, New York.

Liu, H.Z., Feng, J.W., Vesala, T., 2012. Four-year (2006-2009) eddy covariance measurements of CO_2 flux over an urban area in Beijing. Atmos. Chem. Phys., 12, 7881-7892.

Moncrieff, J., Clement, R., Finnigan, J. and Meyers, T. 2004. Averaging, detrending, and filtering of eddy covariance time series. In: Handbook of Micrometeorology: A Guide for Surface Flux Measurement and Analysis (eds. X. Lee, W. Massman and B. Law), Kluwer Academic Publishers, Dordrecht, pp. 7-31.

Nordbo, A., Järvi, L., Haapanala, S., Wood, C. R., Vesala, T., 2012. Fraction of natural area as main predictor of net CO_2 emissions from cities. Goephys. Res. Lett. 39, doi:10.1029/2012GL053087.

Ueyama, M., Hirata, R., Mano, M., Hamotani, K., Harazono, Y., Hirano, T., Miyata, A., Takagi, K., Takahashi, Y., 2012. Influences of various calculation options on heat, water and carbon fluxes determined by open- and closed-path eddy covariance methods. Tellus 64B, 19048, doi.org/10.3402/tellusb.v64i0.19048.

Ueyama, M., Takanashi, S., Takahashi, Y., 2014. Inferring methane fluxes at a larch forest using Lagrangian, Eulerian, and hybrid inverse models. J. Geophys., Res. Biogeosciences, doi.10.1002/2014JG002716.

Wilson, K., Goldstein, A., Falge, E., Aubinet, M., Baldocchi, D. and co-authors. 2002. Energy balance closure at FLUXNET sites. Agric. Forest Meteorol. 113, 223-243.