Responses to the Editor:

Thank you very much for your significant and useful comments on the paper "O_2:CO_2 exchange ratio for net turbulent flux observed in an Urban Area of Tokyo, Japan and its application to an evaluation of anthropogenic CO_2 emissions" by Ishidoya et al. We have revised the manuscript, considering your comments and suggestions. Details of our revision are as follows;

1) Concerning the treatment of urban fluxes, issues about proper QAQC treatment of eddy covariance fluxes have been raised. It is noted that (depending on the application) eddy covariance fluxes should generally be filtered according to several well established criteria (e.g. stationarity, u*, stabilitiy). An appropriate method can for example be found in Lee et al. Handbook of Micrometeorology (ISBN 978-1-4020-2265-4). Chapter 9. Foken et al., Post field data quality control.

Lines 115-116: The sentences have been added to describe the QAQC treatment of eddy covariance fluxes. Measurement runs with good quality were selected based on the flag calculated in Eddypro software. We used the runs with flag 0 - 2 those are at least suitable for general analysis such as annual budgets.

2) Another important issue for urban flux calculations is the treatment of sonic anemometer rotation (e.g. planar fit, or double rotation depending on the application). These rotations can be quite sector dependent in urban areas (see for example https://www.atmos-meas-tech-discuss.net/amt-2019-272/amt-2019-272.pdf). It should be noted which rotation was used, and whether it was applied sector dependent.

Line 114: We used "double rotation" in the flux calculation. The words "by using the double rotation algorithm" have been added to the sentence.

3) Flux footprint: Neftel et al. based their footprint model on Horst and Weil, and evaluated the footprint model specifically for grassland, which has a completely different surface characteristic than an urban landcover. While there is currently no true parameterization for the urban roughness layer, an updated footprint model by Kljun et al. (https://www.geosci-model-dev.net/8/3695/2015/), that was developed for tall canopies, would perhaps give a better representation of the urban flux footprint.

As you pointed out, the model of Kljun et al. (2015) could be more appropriate. However, we consider the model of Neftel et al. (2008) is also applicable in the present study due to two technical reasons; 1) the turbulent sensors were installed at about 5 times higher than the mean building height, as added in the text (Lines 111-112). Therefore, our turbulent measurements were taken outside the roughness sublayer which is about 2 times higher than the canopy height (Cheng and Castro, 2002). The model of Neftel et al. could be valid in this situation. 2) We used the footprint model to capture roughly the source area of flux. If we have attempted detailed analysis like Christen et al. (2011), which made emission modeling with the footprint model, the model of Kljun et al. should be better. We calculated the ratio of greens in the footprint, however the ratio was very small value and the variation due to model type would also be small.

References

Cheng H, Castro IP (2002) Near wall flow over urban-like roughness. Bound Layer Meteorol 104:229–259.

Christen, A., et al. (2011). Validation of modeled carbon-dioxide emissions from an urban neighborhood with direct eddy-covariance measurements. Atmospheric Environment, 45(33), 6057– 6069. https://doi.org/10.1016/j.atmosenv.2011.07.040.