

Referee #1:

Comment 1: This manuscript about the ability of green roof to act as carbon sink is very important topic. There are available such eddy or chamber investigations from different fields (forests, peatlands) but in some reason there is a lack of such researches about green roofs, which are great opportunity in city environment to improve air quality. Present research is also unique investigation because of its very long period and have therefore clear importance for readers. The text is clear to understand and all findings are correctly explained. All necessary details about measurements and results are given. All my questions are already answered in the article. I am very satisfied with this manuscript. Therefore generally, in my opinion, the present form is acceptable.

Dear Referee #1,

we thank you for your comments and the review of our manuscript, in which you were highlighting the importance of our manuscript for the scientific community and the uniqueness of the long-term observations.

Comment 2: When water availability is very low during hot spring and summer, there is lower carbon assimilation by green roof plants. Are there any solutions to a situation where the temperature is ideal but there is no water? One possibility is irrigation but on such a large roof it is complicated. It could be a future topic to investigate whether irrigation helps maintain carbon sequestration efficiency.

As we have mentioned in our manuscript, water availability plays an essential role in carbon assimilation. During phases with low water availability, irrigation is a possible solution, but like you mentioned, water consumption would be high given the size of the green roof. In our manuscript we already discussed a sustainable irrigation strategy, i.e. automated and rainwater-based, that can be used to optimise ecosystem services. For the given roof we did look into the effects of green roof irrigation with regard to the reduction of urban excess heat/sensible heat flux (Heusinger et al., 2018). However, as you mentioned, this is still a topic for future investigations.

Comment 3: As the authors write, there are now solar panels on the roof. Are there any plans to study the interaction between a green roof and panels? The effect of shading from panels on plants?

The effect of the implementation of solar panels on the green roof and its plant community is an interesting research question that could be the subject of a future publication. We have submitted a research proposal to study PV green roof interactions in more detail.

Comment 4: If you could do a similar large roof survey, what would you do differently? For example, use other plant species besides Sedums.

Carbon assimilation varies across plant species and the composition of the plant community on the green roof. Hence, as we have mentioned in our manuscript, it would be interesting to investigate whether our findings can be transferred to other extensive green roofs with different plant communities. At the moment we conduct eddy-covariance observations on an even larger green roof in southern Germany, to analyse transferability of findings and processes.

Comment 5: The formatting and language use throughout the article are correct. No technical errors were found. Also, all references which are used in the text are also showed in the part References.

Thank you.

References for comment to Referee #1:

Heusinger, J., Sailor, D.J., Weber, S., 2018. Modeling the reduction of urban excess heat by green roofs with respect to different irrigation scenarios. *Building and Environment* ,131, 174–183.
<https://doi.org/10.1016/j.buildenv.2018.01.003>