

Authors' reply to referee comments

We would like to express our gratitude to Referee #2 for their thorough efforts in reviewing our manuscript – thank you! We have considered the comments and will be addressing each of them in the sections below.

With kind regards,

Esko Karvinen and the co-authors

Referee #2

Karvinen et al. conducted a field measurement over three consecutive growing seasons to examine soil respiration CO₂ fluxes and SOC stocks at four measurement sites in Helsinki. The authors conclude that the observed variation in soil temperature alone was not enough to cause variation in soil respiration rates between the studied green space types, perhaps because the soil moisture conditions were uniform, therefore, irrigation could potentially be a key factor in altering the soil respiration dynamics. The manuscript is well-prepared and easy to follow, and the topic is interesting and important.

The mechanisms leading to the varying soil respiration are very complex, for example, in addition to soil temperature and moisture, soil pH and P, K, SOC, and SON are also important, and these soil factors change across different seasons. Rather than total SOC, DOC (dissolved organic carbon) could be more closely related to soil respiration. Besides, the microbial community is key to soil respiration, however, it is not considered in this study. So, I recommend more analysis related to the variation in soil respiration.

REPLY: We thank the referee for their comment and insight into the topic. We strongly agree on the complexity of soil respiration as a phenomenon and do openly acknowledge that we have not considered all possibly influencing factors in our analyses both due to practical limitations in our field designs and as a result of intentionally focusing this study on the effects of soil temperature, moisture, and SOC. To highlight this in the revised manuscript, we have included remarks of discussion on potential underlying factors, that were not in the focus of this study but could have influenced the results, throughout the text whenever necessary. We appreciate the suggestion to study DOC and the role of the microbial community but, unfortunately, lack such data from our measurement sites. Nevertheless, we have included those aspects among the future research directions outlined in the Discussion of the revised manuscript.

As per the referee's request, we conducted some additional analysis with the available data by calculating the mean soil respiration (R_{GF}) fluxes at

the measurement sites separately for each study year and comparing them to the variables in our soil sample dataset (i.e. SOC and SON content and stock, soil density, P, K, pH, and soil particle size classes) to look for any significant correlations. The procedure is documented in the Material and methods and Results sections of the revised manuscript, and the outcome of the additional analysis is discussed in the Discussion.