

Yu et al. generated the first high-resolution (1 km) explicit maps of soil fungal and bacterial relative abundance based on a dataset with more than three thousand observations by PLFA method. Besides the more data points, I believe the non-linear map is more accurate than previous linear one. Overall, the MS conducted a good work on data collection, statistic analysis, results presentation, and mechanism interpretation. This map is important for microbial representation in Earth System Models together with previous global map of microbial biomass. Here, I just have the following two very minor comments on this study.

Response: *we appreciate the reviewer's positive comments on our study.*

P5 L157-161: The study used several global map layers of soil physical, chemical and nutrient properties, climate conditions, vegetative indices, radiation and topographic variables and anthropogenic covariates. Which dataset was used? I can not find the Supplementary Table 1 in the SUPPORTING ONLINE MATERIAL. If these 95 covariates were generated by the authors' previous works? If not, I suggest that the author should provide the references.

Response: *Nice catch on this point. In the revised manuscript, we provided the Supplementary Table 1 as an excel file. This Supplementary Table 1 clarifies the names of variables (layers), data source, original spatial resolution, types of variables of these 95 environmental variables used in this study.*

P11 L295 & P12 L318-320: The current dataset gathered in China, USA, and Europe. Therefore, besides tropical regions, more works was also needed in boreal forest and tundra, where are also sensitive to climate change.

Response: *In the revised manuscript, we follow the reviewer's suggestion to acknowledge the data gaps in boreal forest and tundra. We also clarify 'Boreal biome contains large amount of soil organic carbon which could be sensitive to global change (i.e., warming), whereby soil microbial community (i.e., total biomass or the relative abundance of soil fungi and bacteria) could play an essential role'.*

The manuscript studies the relative abundance of soil fungi and bacteria in top surface soil to improve predictions of soil organic matter turnover under current and future climate scenario. A strong non-linear response of fungal and bacterial abundance to environmental gradient like mean annual temperature (MAT) and net primary productivity (NPP) was observed. It has also used machine learning to link the variation in soil fungi and bacterial abundances to global variation in climate vegetation and soil variables. The article followed an earlier publication by He et al. (2020) but was more elaborate in its analysis using >3000 distinct observation of soil fungi and bacterial abundance and thus explains the entire output in a better detail, supported by elaborate statistical analysis.

Response: *we appreciate the reviewer's positive comments on our study.*

Having said that, it is noted that the datasets are mostly restricted to US, Europe and East Asia (Fig. 1a). Considering the fact that agricultural interventions affect the soil fungal diversity, it is desirable that other regions of the world including South west Australia, sub-Saharan Africa, Patagonia and central Asia is not considered. While probably, the authors cannot be faulted for this because of the lack of literature in the global science webs, they would do better to mention this gap in the manuscript. Obviously, authors have used a

stratified bootstrapping procedure (100 iterations) by randomly sampling 90% data with replacement. In any case, this gap in the report should be explained to the readers.

Response: we appreciate the reviewer's positive comments on our study and also concern on the data gaps. Indeed, the reviewer 1 has a similar concern of data gap. In the revised manuscript, we clarified 'Indeed, our datasets are mostly concentrated to US, Europe and East Asia, thus highlighting the data gaps at tropical and boreal biomes. Even for the temperate biome, there were data gaps in west Australia and central Asia. Because of the unbalanced sampling...'

Authors have mentioned high resolution (1 km). Should it not be km² if we consider grided map.

Response: Done.

I have a few editorial corrections for the authors to consider"

Line 42: Replace 'exchange' with 'cycling'

Response: Done.

Line 44 and elsewhere in the text: Replace 'decomposition;' with 'transformation'

Response: We tried to follow the reviewer's suggestion and found that it could be still better to use 'decomposition' which has been more widely used in literature.

Line 103: Replace 'these' with 'the'

Response: Done.

Line 227: Replace 'land' with 'soil'

Response: We tried to follow the reviewer's suggestion and found that it could be still better to use 'land' since it combines both aboveground – plants and soil.

Line 298: Replace 'potential' with 'potentially'

Response: Done.