egusphere-2025-2325' Answers to reviewer comments revision2

Reviewer #1:

Authors are neglecting the fact (line 236-238) that radial translocation is a bi-directional process (e.g. Biddulph and Cory (1960), Kuroda et al. (2021)) and elements can be transported in the direction from heartwood to the sapwood as it was reported and simulated on oak trees by Jaozandry et al. (2024). This reference (already included in my previous assessment) demonstrated similar distribution of nutrient elements to Land et al. tree-ring Hg, i.e., low conc. in heartwood and high conc. in sapwood. Jaozandry et al. (2024) also attempted to model the level of translocation towards sapwood. This is something that is missing from the discussion and should be added.

Land et al.: We addressed this point in the manuscript and added a statement, that we finally do not know whether Hg translocation appears or not. The studies on element translocation in oaks mentioned by the review have all investigated nutrients or elements which occur within the cell in ionic form. Hg is a heavy metal which shows a strong affinity to form stable organic complex which are unlike to undergo translocation. However, we agree, that at least for a certain period some of the Hg is transported from the leaves into the septum. To our knowledge there is no published study which undoubtedly confirms that Hg in trees undergoes translocation or not. In general, the physiological response of trees (including conifers) to Hg and how it is stored in the tree is still largely unkown. Our data indicate a relationship between climate variables and tree ring Hg concentration, which we think is an important contribution, which should encourage future studies on tree internal Hg .

Presented Hg in oak tree rings is correlated with any variable that shows a linear increase or decrease over time. For instance, Hg concentrations in oak tree rings are highly correlated with ring age ($R^2 \approx 0.88$). Therefore, the increase in Hg concentrations toward the outer rings may also be primarily driven by physiological processes. This should be added into the discussion.

Land et al.: Has been added

The main issue is still the lack of evidence showing that the correlation between tree-ring mercury (Hg) concentrations and temperature and precipitation is causal. I do not understand why higher temperatures and precipitation would lead to increased Hg concentrations in oak tree rings. Even if oaks can maintain stomatal conductance under increasingly hot and dry summer conditions, it is expected to result in stable rather than increased Hg uptake.

Land et al.: We think we have already addressed this point in the manuscript. The idea is that generally increasingly warmer condition in favour the trees growth and therefore CO2 and Hg uptake (see manuscript)

Regarding the statement that some broad-leaved trees keep their stomata open during drought, I believe the statement should be more nuanced. For example, anisohydric trees, such as the sessile oak, keep their stomata open during moderate drought, but close them when the stress becomes too severe (Martinez-Sancho et al., 2017).

Land et al.: See answer above. We do think that it makes no sense to go more into detail and speculate here, because we do not know and don't have the data to evaluate under which conditions drought stress has become too severe in the past 100 years. This is an important point, but should be subject to detailed future studies.

More comments and remarks:

1. How was the sampling of soil done, it is not described in the methods.

Land et al.: We added the sampling and preparation method for the soil samples.

2. In figure 4 and in text of paragraph 355 – shaded high coal combustion area? Reference is missing… Is it German period of high coal combustion or European or World? Add reference please.

Land et al.: The use of data has been stated in section 2.6 in the Method section. The grey shaded are in Fig. 4 shows the combustion for Europe. Reference has been added.

3. it would be very helpful for orientation of reader, if sapwood/heartwood border would be somehow denoted in Fig.2 (or even in Fig. 3 and Fig. 5)

Land et al.: We mentioned the number of sapwood rings in the methods section.

References:

Biddulph, O., & Cory, R. (1960). Demonstration of two translocation mechanisms in studies of bidirectional movement. Plant Physiology, 35(5), 689.

Jaozandry, C. C., Leban, J. M., Legout, A., van der Heijden, G., Santenoise, P., Nourrisson, G., & Saint-André, L. (2024). Advances in assessing Ca, K, and Mn translocation in oak tree stems (Quercus spp.). Heliyon, 10(13).

Kuroda, K., Yamane, K., & Itoh, Y. (2021). In Planta Analysis of the Radial Movement of Minerals from Inside to Outside in the Trunks of Standing Japanese Cedar (Cryptomeria japonica D. Don) Trees at the Cellular Level. Forests, 12(2), 251. https://doi.org/10.3390/f12020251

Martínez-Sancho, Elisabet & Dorado Liñán, Isabel & Hacke, Uwe & Seidel, Hannes & Menzel, Annette. (2017). Contrasting Hydraulic Architectures of Scots Pine and Sessile Oak at Their Southernmost Distribution Limits. Frontiers in Plant Science. 8. 598. 10.3389/fpls.2017.00598.

Mae Sexauer Gustin, Sarrah M. Dunham-Cheatham, Jeffrey F. Harper, Won-Gyu Choi, Joel D. Blum, Marcus W. Johnson (2022). Investigation of the biochemical controls on mercury uptake and mobility in trees, Science of The Total Environment, Volume 851, Part 1, https://doi.org/10.1016/j.scitotenv.2022.158101.

Reviewer #2:

Line 144: “Air” must be capitalized.

Land et al.: Has been changed.

Lines 255-257: Can you provide a source for this sentence? (Sessile oak is very drought tolerant, forms a deep root system and holds a high water-use-efficiency compared to other oak species such as Red oak.)

Land et al.: We think, that it is not necessary to provide a source here, because it is standard knowledge and can be found in any forest literature.

Line 307: no comma before “that.”

Land et al.: Has been changed.

Lines 404-408: The sentence is much too long.

Land et al.: We shortened the sentence.

Line 416: “alter” instead of “alters.”

Land et al.: Has been changed.

Lines 258-261: This sentence does not sound good at all. Perhaps you could write: “However, we believe the Hg tree-ring records constructed here are chronologically robust, because...” instead of “However, we think that the Hg tree-ring records constructed here are chronologically robust, because...”

Land et al.: Has been changed.