

Response to Reviewer Comments 1 (Responses in blue)

To investigate the presence of local thermal non-equilibrium (LTNE) effects during heat flow in porous media, in the present work, laboratory experiments systematically investigated heat transport by exposing water flow to temperature step inputs. The experiments were conducted at Darcy velocities ranging from 3 to 23 m/d through porous media comprising idealized spherical grains with diameters between 5 and 30 mm. This work is new and interesting, I think this paper can do well in the future. I have a few specific comments that I will list below in order to improve the current manuscript.

Thank you for pointing out the key messages and seeing the positive prospective in our manuscript. We will address all of your questions to improve our manuscript. Please find a detailed reply to each of your questions below.

Lines 68-74: Yes, there are very few experimental studies on LTNE in porous media, and in addition to the two studies mentioned by the authors, laboratory experimental studies have been conducted in the study of Shi et al. (2024) [DOI:10.1029/2024WR037382], and it is suggested that the authors refer to their experimental studies section for an introduction as well.

We agree that the newly published Shi et al. (2024) contributed to the laboratory experiment results and will incorporate their findings in our revised manuscript.

Line 163: “thermal conductivity” -> “thermal conductivities”

The word will be corrected in the revised manuscript.

Line 165: “specific heat capacity” -> “specific heat capacities”

The word will be corrected in the revised manuscript.

Line 173: “dispersion coefficient” should be changed to “thermal dispersion coefficient” as “dispersion coefficient” is a part of “thermal dispersion coefficient”.

This term will be corrected in the revised manuscript.

Eq. (14): Heinze (2024) [DOI: 10.1016/j.earscirev.2024.104730] provides a detailed overview of this relationship, and I would suggest that the authors could make appropriate references to the work of Heinze (2024) here. Just a suggestion:)

We agree and will incorporate the finding by Heinze (2024) especially the recent overview of Nusselt number in terms of heat transfer in porous aquifer.

Line 321: “In the study by Bandai et al. (2017), they revealed...”-> “Bandai et al. (2017) revealed...”.

We will revise this as suggested.

Lines 412-413: Please express this sentence in two sentences.

We will revise this as suggested.