

Response to Community Comments 1 (Responses in blue)

General comments

Good theoretical research that can be improved addressing the specific comments below.

Thank you for your effort in reading our work and providing comments that point out descriptions to be improved. We will consider your comments carefully and provide further clarifications on the revised manuscript. Please find detailed replies below.

Specific comments

Line 23 “Accurately describing heat transport in porous media has long been a focus in both engineering and science”. Insert recent review papers on heat transport in geological media since the sentence is not backed-up by references.

- Review of discrete fracture network characterization for geothermal energy extraction. Frontiers in Earth Science, 11, p.1328397

- Review of geothermal energy resources, development, and applications in China: Current status and prospects. Energy, 93, pp.466-483

Thank you for suggesting related references. We will include them in our work as suggested.

Line 27. Specify low enthalpy geothermal systems?

The geothermal systems of our interest for the research are the systems, which utilize groundwater, such as groundwater heat pump (GWHP) systems and aquifer thermal energy storage (ATES) systems. We will clarify this in our revised manuscript.

Line 78. The aim is clear, but please specify the 3 to 4 objectives of your research by using numbers (e.g., i, ii and iii).

We will revise our sentences to clarify the objectives of this research.

Line 153. “Porous media” provide more detail on the material that you used to create the porous material that approximate the geological media in your analogue.

In this study, porous media was represented by packed glass beads in a vertical column, as it is described in Fig. 1. We will refine our formulation.

Lines 308-424. Provide more detail on the validity of your analogue experiment that is at small scale. Much smaller than the aquifer. This point can be addressed here or in the introduction.

Understanding LTNE effects starts from the grain scale. By detecting LTNE effects which are caused by temperature difference between fluid in pores and solid as grains, thermal disequilibrium caused by LTNE can be determined. As this phenomenon is ambiguous and occurs together with hydromechanical dispersion effects at larger scale, the experiments at the small scale provides the information on heat transfer between fluid and solid phases. The results in this study can provide insights for the significance of LTNE effects at larger scales. We will clarify this in our revised manuscript.

Lines 308-424. Provide more detail on the validity of your analogue research taking into account that porous aquifers (typically siliciclastic) are very heterogeneous. This point can be done here or in the introduction.

The experiments in this study aimed to evaluate LTNE effects at the grain scale under varied flow velocities. Although the relation between LTNE effects and each grain size was revealed in this study, this finding would contribute as a fundamental knowledge to understanding of LTNE effects in heterogeneous porous media for future research. We will clarify this in our revised manuscript.

Figures

Figure 1a. Insert the spatial scale.

The spatial scale will be included in the revised manuscript.

Figure 1d. Insert the spatial scale.

The spatial scale will be included in the revised manuscript.

Figures 3, 5 and 8. Room to make the figures larger.

The figures will be enlarged in our revised manuscript.