We thank Toshiyuki Bandai and an anonymous reviewer, for the time and the comments for the second review. We considered all of the comments carefully and applied changes in our manuscript. To highlight the nature of our replies we use a traffic light system indicating agreement with the reviewer marked in ==green==, partial agreement in ==yellow== and objections in ==red==. Our responses and the changes made in our manuscript are written in blue. The line number refers to the line in the track-changes version of the revised manuscript.

Response to referee #3: Toshiyuki Bandai

This is the second review of the manuscript. The authors addressed most of the concerns raised in the previous review. Regarding the use of LTNE models, the authors tested another type of LTNE models (D-C) in the response to the reviewers. While the fitting of the D-C model could be improved if the model is fitted to the experimental data independently from the LTE and LTNE_CS models, this discussion would not affect the conclusion of the paper, so I am satisfied with the current analysis. Nevertheless, it would be good to mention how the current choice of the LTNE model differs from the experimental setup (e.g., non-uniform heat transfer coefficient etc.). Therefore, I recommend the publication of the manuscript with minor changes.

Thank you for your second review and helpful comments. Considering your suggestions, ==we have revised== our manuscript including the additional discussion on the LTNE model in line 438-439:

"Additionally, the LTNE model is limited to describe heat transfer between fluid and solid phases by a constant heat transfer coefficient hsf without spatially distinguishing the phases and grain sizes."

Here are minor comments (the line numbers are the one in the manuscript without track changes).

Units: note that there should not be a space between a number and C (degrees). Also, make sure to have a space between m-1 and K-1.

==We agree== with the correction and revised our manuscript in Table 2 & lines (97, 99, 109, 140, 144, 146, 147, 201, 218, 346, 347, 448, 449, 450, 452, 454 and 455).

14: multiple "temperature"

==We agree== with the correction and revised the sentence in line 14.

30: unnecessary period before the parenthesis

==We agree== with the correction and revised our manuscript in line 30.

80: ";" is more appropriate than '.' to list 1) to 3). Like "... effects; and 3) interpretation ..."

==We agree== with the correction and revised the sentence in lines (82 and 83).

198: "." Should be ',' after each phase"

==We agree== with the correction and revised our manuscript in line 198.

230: It is still not clear which parameters were optimized (readers can interpret in many ways). Could you please list all the parameters to be estimated for clarify?

that the clarification is missing. We have revised the sentence in line 230-231:

"Optimization for the best fitting parameters, such as the effective thermal conductivity of the porous media λ_b and the heat transfer coefficient h_{sf}, was conducted using the Powell method from the SciPy package within the Python programming environment."

246: With this sentence, I am not sure if the normalization was conducted by the temperature difference between the initial and final temperatures as indicated in the response to the reviewers. If the authors followed the normalization as in Eq. 6, "divided by the final temperature" should be "divided by the temperature difference between the initial and final temperatures". Could you check how the experimental data were analyzed?

that the expression regarding the data normalization in the sentence can be confusing. It was written to describe data normalization, which is done by subtracting the initial temperature and then dividing it by the temperature already subtracted by the initial temperature, meaning the temperature difference between the initial and final temperatures. We revised sentence to clarify this in line 247:

"The temperature records of the fluid and solid phases were normalized for each sensor in a time series by subtracting the initial temperature and being divided by the temperature difference between the initial and final temperatures (equilibrated temperature at the tails of the BTCs) from the temperature measurement."

491: model > models

with the correction and revised it as suggested in line 493.

Fig 8: CS is not defined in the manuscript.

that it is placed without definition. We have deleted "CS" in Fig. 8 in our revised manuscript.

Additionally, we have revised Fig. 5 by correcting the grain size and replica number.