Answer to reviewer 1

1) Please check Eqs (4) and (16). The advection term should be multiplied further by the porosity in Eq (4). α should be divided further by the porosity in Eq (16).
The equation (4) and (16) has been corrected.

2) How do the authors obtain the specific surface area in the present work? This was not introduced.
The expression to determine the specific surface area has been introduced (equation 10).

3) In Fig 3, why the inlet temperature was first higher then lower than the downstream temperature? It seems that some information is missing in the introduction of the experiment procedure.
The experimental setup is realized in the way that the inlet has a non-continuous injection (10 litres), so when the injection terminates the temperature registered by the first thermocouple becomes lower than the one registered by the last thermocouple.

4) To validate the present results, it is recommended to compare the results of the convectional heat transfer coefficient and effective thermal conductivity with the current.
Regarding the Nusselt number and the heat transfer coefficient, the experimental results have been compared with Wakao correlation (1979) and the experimental correlation between volumetric Nusselt number and Reynolds number found in Fu et al. (1998), Kamiut and Yee (2005), Ando et al. (2013). The relationship between the k_{eff}/k_f and Pe has been compared with the experimental results found by Levec and Carbonell (1985), Gunn and Price (1969), Pfancuch (1963), Ebach and White (1958).

5) In my opinion, the expression of v=q/n is obtained rigidly from the volume averaging theory. Thus, v should be taken as a known constant in the data processing, as well as β. Of course, the RMSE will be larger if so, but I think the experiment results are allowed to have larger errors. Please comment on this
We have preferred not to constrain the thermal convective velocity v to values v=q/n. Because, first of all n represents the value of total porosity and therefore the convective velocity for a conservative solute should be equal to $v = q/n_e$ where n_e represents the effective porosity; second the thermal convective velocity should be less than conservative solute velocity as reported in Bodvarssoon (1972), Oldenburg and Pruess (1998), Geiger et al. (2006). The first consideration is more relevant for M2, whereas the second consideration is more relevant for M1.

Answer to reviewer 2

1) The abstract part should be reduced to highlight the more important contents.

   The abstract has been reduced by removing the initial part and focusing only on the most important content

2) This paper focuses on the experimental study of forced convection heat transport in porous media. So many related works have been listed in introduction part. Compared to the existing methods and results, what is the main contributions of this paper? The authors should explicitly specify this.

   The main contributions of the paper have been highlighted by adding this paragraph in the conclusions: '*The main contribution of this study is to investigate on the optimal thermal energy storage of porous materials by analyzing how the grain size and the specific surface affect heat storage properties as well as heat transport in terms of macrodispersion phenomena, heat transfer between solid and fluid phases. This is relevant in order to optimize the efficiency of geothermal installations in aquifers.*'

3) Authors claimed that for M2 there is the existence of stagnant zones which reduce the amount of porosity that C1 NPGD Interactive comment Printer-friendly version Discussion paper contributes to fluid flow. Add more analysis for this.

   More analyses have been inserted by adding the following text: '*In other words, because the coarser material M_2 is less well sorted than the less coarse one M_1, not all pores of the former are actually interconnected. In geologic materials, based on the connectivity of pores, consequently, the void space can be divided into: interconnected pore, isolated pore, and blind pore (Hu & Huang). Only the pores that are well interconnected provide continuous channels for heat and mass transfer and fluid flow, while the pores that are not part of a continuous channel network do not contribute. These pores are known as noneffective pores, namely, they provide no space for fluid flow and heat transfer in reservoirs.*'

4) All the parameters should be explained. Some parts are hard to follow.

The unexplained parameters in equations 19), 20) and 21) have been explained. '*Where $PDF_0(x,t)$ represents the probability density function of the residence time without heat transfer between the solid and fluid phase. The parameter β (-) represents the ratio between the volume specific heat capacity of the solid phase and the fluid and and I_1 is the modified Bessel function of order 1.*

.'

5) Please highlight the importance of this experimental study. And clearly indicate what is the new question that is answered in this experimental study?

   The importance of the experimental study is the investigation on how hydrothermal properties such as grain size and the specific surface affect heat transport in terms of macrodispersion phenomena, heat transfer between solid and fluid phases and heat storage properties. It has been highlighted in text.

6) Add more words for Fig.3 and 4.

   The caption of Figg 3-4 has been modified into (adding more words): 'Temperature distribution for increasing Re values along the porous column filled with material M_1 (M_2). The two curves represent the inlet and the downstream temperature. Squares represent the experimental values, the continuous lines represent the simulated values.'

7) Authors indicated that "the behavior of two porous media having different grain sizes and specific surfaces has been observed." If possible, please provide snapshoot for this.

   A snapshot for the two geological materials having different grain sizes was provided in Figure 1. '*Samples of the materials used for the experiments with different average grain sizes dp. a) dp = 9.2 mm b) dp = 41.6 mm.*'

8) What kind of experimental data was acquired? How to interpret these experimental data? All these need to be clearly indicated.

   The acquired experimental data are: the instantaneous flow rates measured by an ultrasonic velocimeter (DOP3000 by Signal Processing) and the thermal breakthrough curves (BTCs) monitored by the seven thermocouples. The experimental data have been modeled by the analytical solution describing 1D heat transport in semi – infinite domain for instantaneous temperature injection. Moreover the dimensionless numbers Pe, k_{eff}/k_f, Nu and Da have been evaluated for the different values of Re. In order to highlight the performance of the heat transfer enhancement of the two different porous materials the ratio between the Nusselt number and the hydraulic head loss dh/dx has been calculated as function of the Peclet number.