Correction to: Impact of Size Distribution of Cell Model on the Effective Thermal Conductivity of Saturated Porous Media

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The author discovered that the temperature gradient expression involved an approximation in the cell model adopted in the original version [1] after its publication. This approximation resulted in an additional “ $\ln$ ” term in the effective thermal conductivity. After using the exact expression for the temperature gradient, the cell model was the same as the classical Maxwell model [2]. In majority of thermal conductivity and porosity combinations, the cell model adopted in [1] is close to the Maxwell model. In a certain small range of combinations, the additional term could cause unexpected results [3]. However, the setup of the cell model is physically sound. Based on this new understanding, the starting model in [1] should be the Maxwell model. As a result of better understanding, some equations and results in [1] should be updated. In particular, Eq. 2 in [1] should be:

$$\frac{k_e}{k_f} = \frac{2A + (A + 3)y^3}{(A + 3)y^3 - A} \quad (1)$$

Correspondingly, Eq. 21 in [1] should be:

$$\frac{k_{eff}}{k_f} = \int_a^b \frac{2A + (A + 3)y^3}{(A + 3)y^3 - A} f_{TZ}(y) dy \quad (2)$$

The results presented in [1] can then be updated using the more accurate formulas in Eqs. 1 and 2. While limiting extreme of $a=1$ was used in most figures in

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[1] to examine the maximum potential of pore size distribution impact, it should be clarified that the a value in Fig. 3 of [1] was $a = 1 + \varepsilon [(1 - \varepsilon)^{-1/3} - 1]$, which means $(a - 1) / [(1 - \varepsilon)^{-1/3} - 1] = \varepsilon$. In other words, the normalized starting value of y was directly related to the porosity. After updating the results in Fig. 3 in [1], the root mean square errors (RMSEs) of model predictions compared to the experimental data are 2.1526, 1.8545, 1.4055, and 1.1990 for the uniform size cell model, $CS = -0.5657$, $CS = 0.0$, and $CS = 0.5657$, respectively. In general, the model under-predicts the experimental results. The k_f value used in Fig. 3 in [1] was from Fig. 8 in [4]. While quantitative results in Fig. 4 in [1] are slightly changed after updating, the main conclusions in [1] remain true. After updating Fig. 5 in [1], the RMSEs of the uniform cell model, negative skewness model ($CS = -0.5657$), zero skewness model ($CS = 0$) and positive skewness model ($CS = 0.5657$) are 1.3316, 0.8153, 1.5096 and 2.3214, respectively, which means the negative skewness model has the smallest RMSE. The discussion and conclusions associated with Fig. 6 in [1] remain true although quantitative values have changed slightly after updating. In summary, the main discussion points and conclusions in [1] remain true after updating the results based on the accurate starting model.

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