# CORRIGENDUM

## The boundary correction for the Rayleigh–Darcy problem: limitations of the Brinkman equation

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I questioned the validity of the use of the Brinkman equation in the bulk of a porous medium, rather than in a boundary layer, in the Rayleigh–Darcy problem. I now realize that a boundary layer inevitably arises when the Brinkman equation is used. This can be seen from the simple form given in (2.1). If $L$ is the characteristic length-scale of the problem, then the ratio of the magnitude of the Laplacian resistance term to the Darcy resistance term is $(\tilde{\mu}/\mu)\,(K/L^2)$. Since $\tilde{\mu}/\mu$ is approximately unity and $K/L^2$ is small if $L$ is a macroscopic length, the Laplacian term is small in the bulk of the medium. The Brinkman equation then reduces to the Darcy equation. Near a no-slip boundary, the appropriate $L$ is the pore size, and $K/L^2$ is of order unity; there must be a boundary layer of thickness $K^{\frac{1}{2}}$ at a rigid wall bounding the medium. Unpublished analyses of a spin-up problem (by myself) and of the Rayleigh–Darcy problem (by B. C. Chandrasekhara, K. S. Bhanumathy and A. R. Hanumanthappa), show explicitly how such a boundary layer arises.

It is now evident to me that the inaccurate value of the critical Rayleigh number obtained by Rudraiah, Veerappa & Balachandra Rao (1980) is a result of the fact that their one-term Galerkin approximation is inadequate to deal with the boundary layer.