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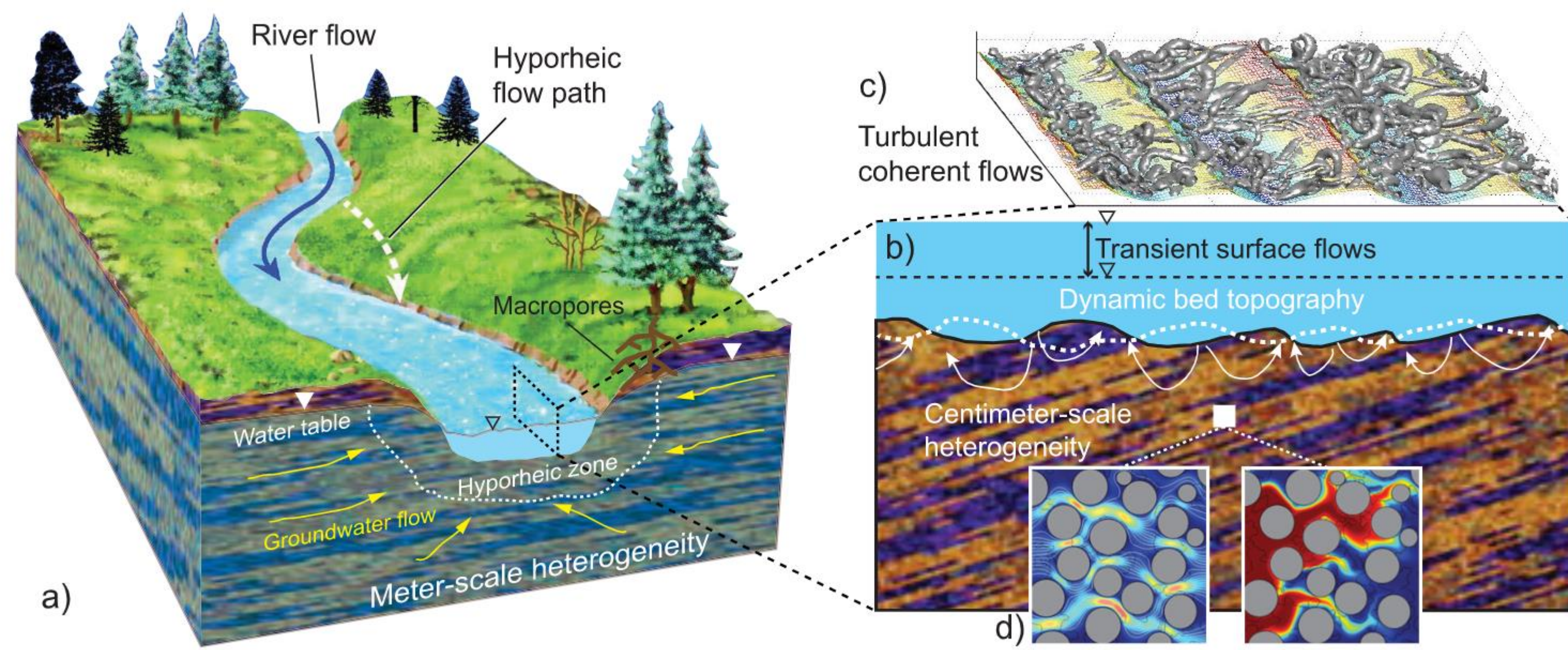
Application of Lattice Boltzmann Method in Pore-scale Characterisation of Flow Dynamics in Three-Dimensional Porous Media

M. Vasheghani Farahani, M. Mousavi Nezhad

Porous Material and Processes Modelling Research Group, School of Engineering, University of Warwick, UK

Motivation

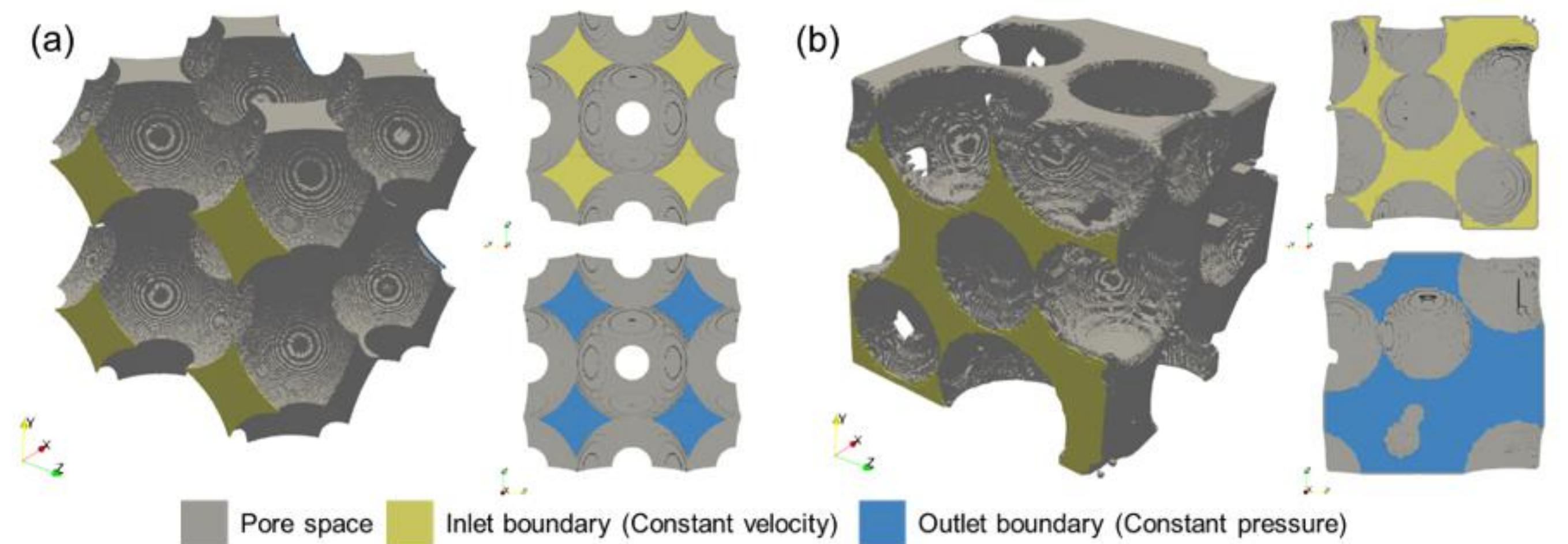
Local flow dynamics can significantly influence transport phenomena such as solute transport and mixing in the hyporheic zone. It is essential to investigate flow through porous structures at pore level to understand key governing factors influencing the flow and associated transport phenomena.



Hester et al. (2017). The importance and challenge of hyporheic mixing, Water Resour. Res., 53, 3565–3575

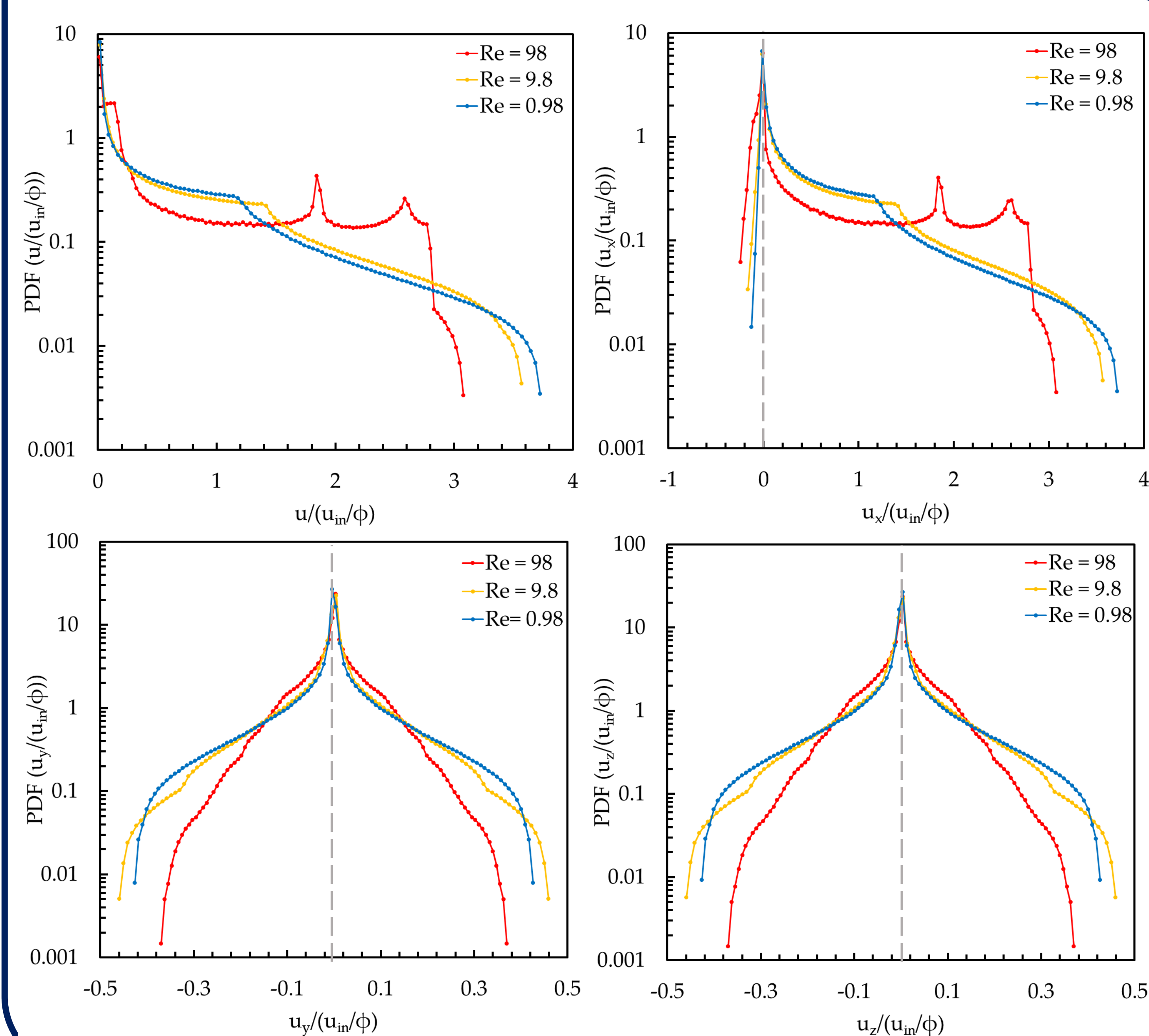
What are the main objectives?

- Analysis of the effect of Re on the flow properties in SC- and randomly-packed porous media
- Investigation of the effect of porous media idealisation on the flow characteristics

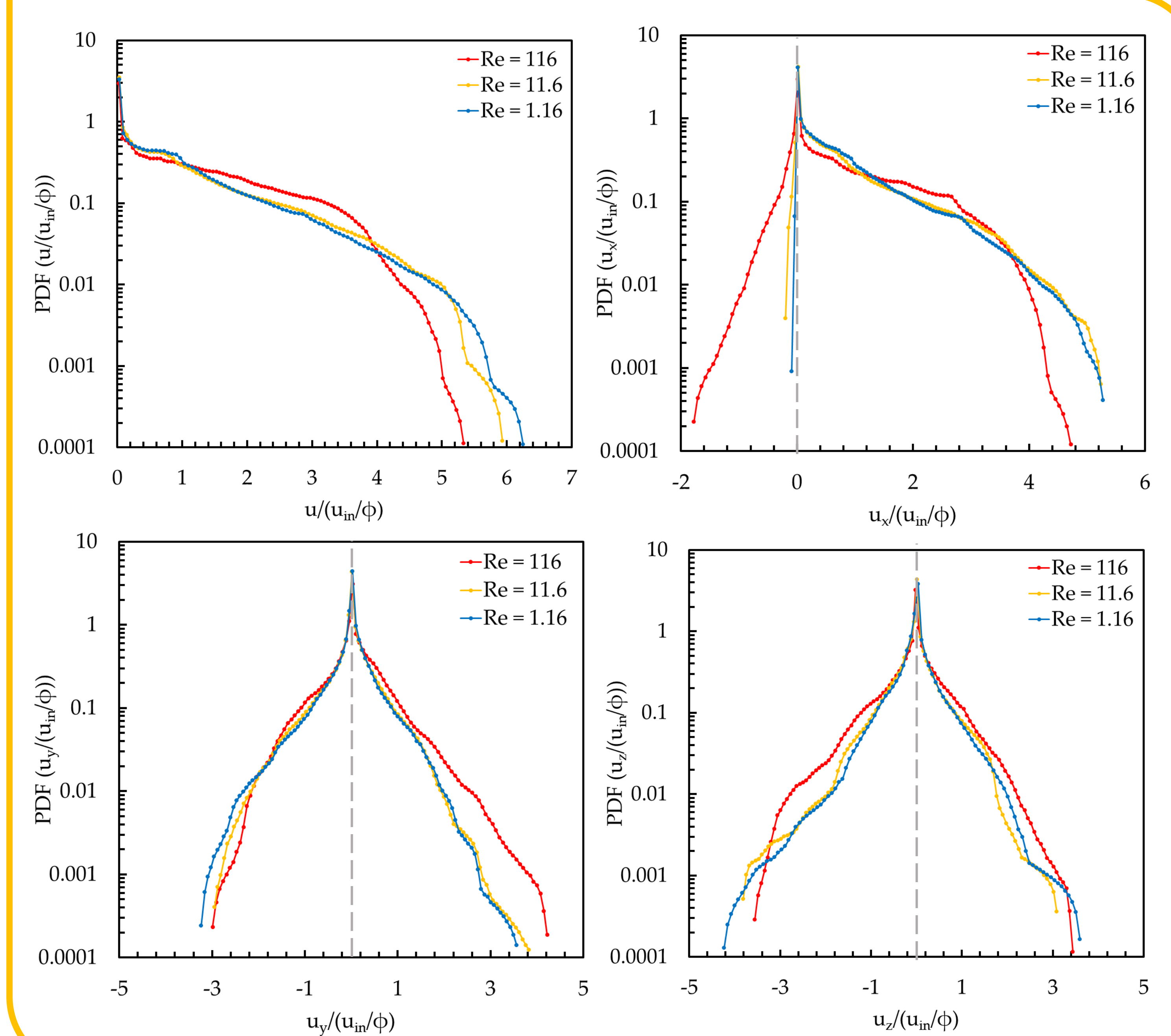


Pore space of (a) SC-packed and (b) randomly-packed porous media. The imposed flow direction is aligned to the x-axis.

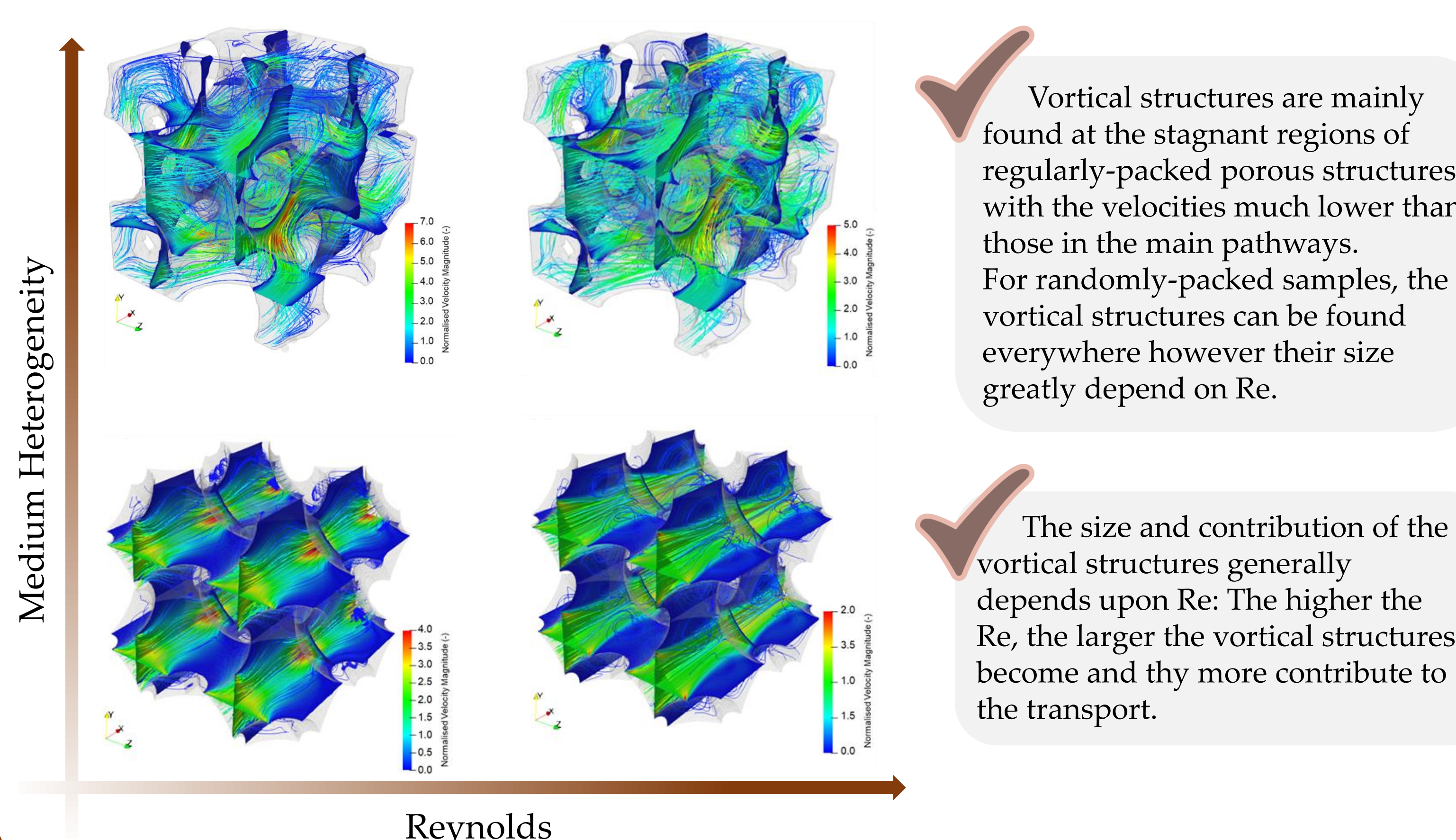
Flow Characteristics in SC-packed Porous Media



Flow Characteristics in Randomly-packed Porous Media



Where to find vortices?



Conclusions and Impacts

- ✓ The results confirm that the local flow characteristics in porous media are highly influenced by the flow rate as well as the geometry of the pore space. This strong dependence implies that the mechanisms realised to understand transport phenomena associated with fluid flow in porous media such as solute transport and sorption phenomena might be unrealistic if regular and simple configurations of packed particles are used as porous media in both experimental and numerical study.
- ✓ The outcome of this study can be used in the following area of research:
 - ✓ Fluid-porous interface at hyporheic zone
 - ✓ Pebble bed reactors
 - ✓ Heat transfer operations in packed beds

Contact Info



Mehrdad.Vasheghani-Farahani@warwick.ac.uk



@mehrdadvf1991



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