Statistics of porous media attributes and mixing processes state variables across scales

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Theme:
Heterogeneity of Underground Systems & Mathematical Challenges

Summary:
State variables of mixing processes and attributes (including, e.g., permeability, dispersivity, specific surface) of porous media vary across a wide range of spatial (and temporal) scales. Typical observations of these properties arise from a variety of experimental techniques, each of which has its own spatial resolution, associated uncertainty and cost. As an example, permeability can be evaluated through microfluidics experiments, core-flooding laboratory experiments, or field-scale well tests. These provide compelling evidence that the key statistics of parameters driving the physical processes vary across scales. A firm scientific foundation for the characterization of basic mechanisms associated with solute mixing in porous media therefore requires a robust understanding of all relevant processes and properties across the spectrum of relevant length and time scales. We develop a multiscale approach to allow fusion of realworld data. As a key objective, an original theoretical and computational framework will be developed to seamlessly assimilate data associated with diverse variables collected at a range of scales and combine these to provide predictions of solute dynamics along with a quantification of the associated uncertainties.
As an interdisciplinary project, we welcome applicants from a diverse range of backgrounds across engineering, the physical sciences and mathematics.

The successful applicant will be part of an interdisciplinary team, working to address challenges for heterogeneous porous material modelling using mathematical and computational techniques, and will collaborate internationally with academia and industry across the sciences and engineering.