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Modelling Cerebral Blood Flow and Temperature Using a Vascular Porous Model STEPHEN BLOWERS, Institute of Materials and Processes, University of Edinburgh, MICHAEL THRIPPLETON , IAN MARSHALL, Neuroimaging Sciences, Centre for Clinical Brain Sciences, University of Edinburgh, BRIDGET HARRIS, PETER ANDREWS, Critical Care Unit, NHS Lothian, Centre for Clinical Brain Sciences, University of Edinburgh, PRASHANT VALLURI, Institute of Materials and Processes, University of Edinburgh — Macro-modelling of cerebral blood flow can assist in determining the impact of temperature intervention to reduce permanent tissue damage during instances of brain trauma. Here we present a 3D two phase fluid-porous model for simulating blood flow through the capillary region linked to intersecting 1D arterial and venous vessel trees. This combined vasculature porous (VaPor) model simulates both flow and energy balances, including heat from metabolism, using a vasculature extracted from MRI data which are expanded upon using a tree generation algorithm. Validation of temperature balance has been achieved using rodent brain data. Direct flow validation is not as straight forward due to the method used in determining regional cerebral blood flow (rCBF). In-vivo measurements are achieved using a tracer, which disagree with direct measurements of simulated flow. However, by modelling a virtual tracer, rCBF values are obtained that agree with those found in literature. Temperature profiles generated with the VaPor model show a reduction in core brain temperature after cooling the scalp not seen previously in other models.

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