FLUID TRANSPORT THROUGH SEA ICE

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Sea ice in the polar regions forms a boundary layer between the ocean and the atmosphere, and transport of brine though this medium facilitates a wide range of geophysical, oceanographic, and biological processes. However, measurements of the fluid permeability $K$ are difficult to come by, and little is known theoretically. Characterization of this effective property of sea ice in the dynamic “critical” temperature regime was investigated using continuum percolation theory and critical path analysis. The investigation revealed that in this regime the behavior of $K$ can be described by a universal exponent valid for lattice models. While percolation theory captures the behavior of $K$ in the critical region, we have characterized this parameter over the entire environmental temperature range of sea ice using hierarchical models which correspond closely to Arctic field data.