1116-76-1898 **David W Rees Jones*** (david.reesjones@physics.ox.ac.uk), AOPP, Clarendon Laboratory, Parks Road, University of Oxford, Oxford, OX1 3PU, United Kingdom, and **Grae Worster**, Centre for Mathematical Sciences, Wilberforce Road, University of Cambridge, Cambridge, CB3 0WA, United Kingdom. *From sea ice to water: on the thermodynamic boundary conditions of a solidifying mushy layer with outflow.*

Sea ice is a type of reactive porous medium called a mushy layer, and fluid flows between sea ice and water occur in a variety of contexts. The boundary conditions between a fully liquid region and a mushy layer must respect both thermodynamic and fluid dynamical considerations. Schulze and Worster (2005) derived a thermodynamic boundary condition of 'marginal equilibrium' for a solidifying mushy layer with outflow, which requires that streamlines are tangent to isotherms at the interface. We develop a steady, two-dimensional forced-flow configuration to investigate the fluid dynamical aspects of this boundary condition by extending Stokes equations in a narrow 'transition region' within the mushy layer. We show that the tangential fluid velocity changes rapidly in the transition region to satisfy marginal equilibrium. In sea ice, a buoyancy gradient near liquid brine channels or an external shear flow can drive such tangential flow. We use asymptotic analysis in the limit of small Darcy number to derive a regime diagram for the existence of steady solutions. Thus we demonstrate the robustness of the marginal equilibrium boundary condition and its relevance to fluid flows from mushy sea ice to fully liquid water. (Received September 21, 2015)