

**ON A COMPRESSIBLE EXTENSION  
OF TWO-PHASE MODEL OF WATER  
TRANSPORT IN PARTIALLY-MOLTEN ICE**

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**Abstract**

We present a two-phase model for thermo-mechanical evolution of partially molten ice and gravity-driven water extraction. The presented scale analysis and associated model reduction is relevant for conditions in the ice layers of moons of outer planets in the solar system (Europa, Enceladus). We focus on thermodynamic derivation of a compressible extension of the existing theory and we attempt to validate the theory in numerical simulations.