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A thermo-mechanical model of frost heave

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When water is frozen within porous media, interactions between the ice and matrix surfaces produce a diverse array of behavior – including the growth of needle ice at the ground surface, periodic lensing and heave in unconsolidated sediments, the fracture of intact rock, and the incorporation of sediment bands into the basal reaches of glaciers. These phenomena are promoted by the influence of mineral surfaces on the phase behavior of ice, which causes them to be coated by premelted liquid films and results in the generation of substantial heaving pressures. We present a model for ice growth in porous media that rigorously incorporates the underlying microphysics within a continuum framework. We focus, in particular, on the manner in which the imposed environmental conditions produce the distinct regimes of behavior that are observed within a given soil.