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COUPLED PROCESSES MODEL FOR PARTIALLY FROZEN SOILS

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ABSTRACT

Coupled Thermo-hydro-mechanical models have received great attention in recent years due to its wide range applicability including high-level radioactive waste disposal, geothermal energy, carbon sequestration and oil production. The simultaneous existence of frozen and unfrozen water under dynamic equilibrium adds another level of complexity that could only be resolved through coupled thermo-hydro-mechanical models. Frozen soil is typically stronger than unfrozen soil or ice. The strength of partially frozen soil can be considered as consisting of the cohesion of the ice matrix and the frictional resistance of the soil particles. The plastic strength and deformation characteristics of partially frozen soil may be attributed largely to the presence of the ice matrix and cementation bonds. We develop effective stress based coupled thermo-hydro-mechanical model for partially frozen soil. The developed model will allow the soil to undergo elastic and plastic deformation. The yield surface is allowed to evolve with temperature, suction pressure and soil characteristic hardening parameter. Here we discuss the constitutive modeling of partially frozen unsaturated soils and finite volume based numerical algorithm to solve the associated boundary value problem.