# Seasonal Freeze-Thaw Modelling for Short Duration and Midwinter Melt events in Mineral Soils

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## Abstract

Over winter freeze-thaw events are notoriously difficult to represent in hydrologic models and have serious implications for the hydrologic function of intermittently freezing regions. With changing climate leading to higher variability in observed weather patterns, it is anticipated that mid-winter thaw events may become more numerous, especially in cold regions. Midwinter thaw events are often the cause of flooding due to the coupled impact of rain-on-snow, and limited soil infiltrability. A numerically efficient, semi-analytical coupled thermal and mass transport model is presented that is capable of representing the ice content of near-surface soil. This model allows for rapid and stable prediction of the ice content of frozen or partially frozen soil without having to solve a discrete form of the coupled partial differential equations. The model tracks pore ice formation and soil cold content in terms of enthalpy. It is tested against data collected in Southern Saskatchewan and is shown to reproduce field observations. This model is efficient enough to be incorporated as a module into existing regional hydrologic models and is expected to improve predictions of over-winter streamflow and flooding potential.

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`Seasonal_Interface_Model-FloatFigures.pdf` available at https://authorea.com/users/411992/articles/520829-seasonal-freeze-thaw-modelling-for-short-duration-and-midwinter-melt-events-in-mineral-soils