

Two-Dimensional Modeling of Seasonal Freeze and Thaw in an Idealized River Bank

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Abstract : Freeze and thaw occurs seasonally in river banks in northern countries. Little is known on how the riverbank soil temperature responds to air temperature changes and how freeze and thaw develops in a river bank seasonally. This study presents a two-dimensional heat conduction model for numerical investigations of seasonal freeze and thaw processes in an idealized river bank. The model uses the finite difference method and it is convenient for applications. The model is validated with an analytical solution and a field case with soil temperature distributions. It is then applied to the idealized river bank in terms of partially and fully saturated conditions with or without ice cover influence. Simulated results illustrate the response processes of the river bank to seasonal air temperature variations. It promotes the understanding of freeze and thaw processes in river banks and prepares for further investigation of frost and thaw impacts on riverbank stability.

Keywords : freeze and thaw, riverbanks, 2D model, heat conduction

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