

Development of Coupled Snow-frozen Soil Models for Cold Region

Study

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Snow and frozen ground surface, which exist separately or coexists in cold region very often, play important role in climate system. In this report, the model quantitatively describing the processes in frozen soil region, snow layer and their coexistence are developed. For the part of frozen soil, new numerical scheme is developed in which total enthalpy and total water mass are use as predicted variables to replace soil temperature and volumetric liquid content in the soil. For the part of snow body, a layer model with maximum layers 6 is designed in which the enthalpy and total mass are also used as predicted variables. Accordingly efficient numerical methods are designed to solve the highly nonlinear numerical system for the two parts, respectively. Then the two parts are coupled together to serve as tool to simulate the processes in snow-frozen soil coexistence. Several observation data are used to validate the models for the two parts and their couple.