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Modeling annual cycle of heat/water exchange in the system soil - vegetation - atmosphere with advanced parameterization of snow cover

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A model of energy/water transfer in the soil-vegetation-atmosphere system is used for evaluation of snow seasonal evolution and soil thermal regime at several sites of North Eurasia. The model includes full cycle of energy and water transformations in the system and calculates main physical characteristics such as soil temperature, its water content in liquid and solid phases, etc. Time step of the model is several hours. Number of soil layers in the model is specified according to available data on soil parameters along the vertical profile. In the current version, the model is combined with new parameterization scheme of snow cover. The scheme allows one, depending on weather variations, to reproduce seasonal cycle of snow cover evolution, including transformations of snow crystals, densening and/or loosening of snow in each layer, heat transfer through the snow, evaporation and melting of the snow, etc. Thermal conductivity of snow cover, thus, is evaluated as a function of entire seasonal evolution of the snow. Soil water in the model is presented by amount of liquid and solid water content in each soil layer at each time step. Heat conductivity of soil is a function of its water content at each time step. The model was tested against the data observed at several sites located in different natural conditions of North Eurasia (Tien Shan mountains, Slovakia, Finlandia, Valdai in Central Russia, etc.). The snow water equivalent seasonal variations are calculated with rather good accuracy. Role of snow cover and its vertical structure in ground temperature variations is estimated. In certain situations (thick depth hoar layer, presence of crusts, etc.) the snow cover can play critical role in the soil thermal regime. Dependence of the snow characteristics on soil parameters (such as water holding capacity) and other effects determines directions for future

research.