

The determination of the snowmelt rate and the meltwater outflow from a snowpack for modelling river runoff generation

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Abstract

Two procedures to estimate the area-averaged snowmelt and meltwater outflow from a snowpack were compared for a river basin in the south part of European Russia. Both methods are based on the same model of melting snow but use two different methods for computing the snowmelt rate at the surface of the snowpack, the degree-day method and the Kuzmin method. For averaging, the spatial change in the meteorological inputs and the statistical distribution of the premelting snow water equivalent before melt are taken into account. The calculated basin-averaged meltwater outflow is checked against the snowmelt input obtained from the measured runoff hydrograph by solving the inverse problem for a runoff generation model. It also gives opportunities to calibrate the basin-averaged degree-day factor, coefficients of the heat component dependences, or dependences for parameters of spatial statistical distribution of snow characteristics. The procedure based on the Kuzmin method gave better results than that based on the degree-day method, both in the case of a priori assigned parameters and in the case of parameter calibration.

1. Introduction

Most efforts in the development of models of snowmelt runoff processes have been devoted to the description of snow cover formation and of snowmelt at a point or over uniform areas (Anderson, 1976; Morris and Godfrey, 1978; Male and Gray, 1981; Kuusisto, 1984; Motovilov, 1986), perhaps reflecting the availability of experimental measurement and the relative simplicity of point processes. However, to estimate the snowmelt as an input to a runoff generation model for a real river

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