

Roles of snow, infiltration and saturation excess processes in runoff generation over the Yellow River basin

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Abstract The YHyM (University of Yamanashi Hydrological Model; Japan) is reformulated to include the runoff generation processes of snow packing and melting, infiltration- and saturation-excess, respectively, using the degree-day method, the Green-Ampt equation and TOPMODEL concepts. The surface soil freeze/thaw processes are simulated by comparing the weekly moving-average air temperature with a set of threshold temperatures. The potential evaporation/transpiration is estimated in the Shuttleworth-Wallace model, accounting for vegetation diversity and development stages. The runoff is routed using an adaptive Muskingum-Cunge method. In the application of YHyM, the large basin is divided into a number of blocks or sub-basins. Most of the model parameters are set by referring to the literature. The remainder are first calibrated automatically based on Nash-Sutcliffe efficiency, then tuned manually for water balances. Daily simulation is compared over the Guide and Lushi catchments of the upper and middle Yellow River basin. The role of each runoff component is analysed. The YHyM provides a flexible framework able to include many processes and efficiently use different data sources, and is applicable at the global scale, essentially to both data-poor and ungauged large basins.

Key words distributed hydrological model; infiltration and saturation excess; snow packing and melting; soil freezing and thawing; Yellow River basin
