Application of a physically-based hydrological model on an alpine glacier

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The physically-based distributed hydrological model GEOtop 0.9375 has been applied to a glacier in order to obtain information about the glacier annual hydrological balance. The model evaluates the surface energy balance, including the glacier losses due to sublimation and melting, although it describes the flow dynamics inside the glacier in a lumped way. The vertical heat conduction equation is solved on a regular grid and it is driven by radiation fluxes dependent on the topography through shadowing, aspect, slope, and sky view factor, and on cloud cover. The convective heat transfer is based on the Monin-Obukhov stability theory. The liquid water content and the ice content in the glacier and in the snow cover are simulated as well, giving information about density and snow metamorphism. The model has here been applied to the Mandrone Glacier (Central Italian Alps) and has been forced with meteorological hourly data (precipitation, air temperature, relative humidity, wind velocity, solar radiation) measured in a limited number of stations around the glacier. The results of the model have then been compared to field data.