The physically based distributed hydrological model GEOTop (Rigon et al., 2005) has been preliminarily applied to a glacier so as to obtain information about its water balance. The model has so far been applied to small mountain catchments, and estimates not only the discharges, but also the local values and the spatial distribution of several hydro-meteorological variables, such as snow cover, soil moisture, temperature, radiative fluxes, turbulent heat fluxes and heat fluxes in the soil, taking into account the topography effects (slope and aspect), the solar radiation dependence on snow cover, soil moisture, surface temperature, radiative fluxes, turbulent heat fluxes and heat fluxes in the soil. The model has so far been applied to small mountain catchments, and estimates not only the discharges, but also the local values and the spatial distribution of several hydro-meteorological variables, such as snow cover, soil moisture, temperature, radiative fluxes, turbulent heat fluxes and heat fluxes in the soil. The model has so far been applied to small mountain catchments, and estimates not only the discharges, but also the local values and the spatial distribution of several hydro-meteorological variables, such as snow cover, soil moisture, temperature, radiative fluxes, turbulent heat fluxes and heat fluxes in the soil.

The glacier is now for the first time included in GEOTop. It is located in the Tropics. As opposed to Alpine glaciers it is not subject to distinct accumulation and ablation seasons. It was chosen because a lot of data were available (meteorological data, radiation, snow precipitation and snow depth). A more complex modeling of the snow system drainage as in Arnold (1998) could be used, but a detailed knowledge of the moulin distribution would be necessary.

Here an application on the Zongo glacier (Bolivia) is presented. It is quite a small glacier (about 2 km²) and it is located in the Tropics. As opposed to Alpine glaciers it is not subject to distinct accumulation and ablation seasons. It was chosen because a lot of data were available (meteorological data, radiation, snow data, and discharges), as it has been monitored regularly since 1991 within the GREAT-ICE project of RRD (Institut de Recherche pour le Développement, Grenoble, France). The water balance of the glacier during the hydrological year 1 Sep-2000-31 Aug 2001 has been studied.

The glaciology of the Zongo glacier is light blue. Its surface is about 2 km², and its elevation ranges from 4800 m a.s.l. to 6100 m a.s.l. The model uses distributed atmospheric forcings as input, so the spatialization of the variables measured in a meteorological station is needed. Temperature and relative humidity are normally extrapolated from the measured data, precipitation is interpolated through gridding techniques, but for so far wind velocity is kept constant. Some form of coupling with meteorological models is therefore needed.

For the soil, the energy and the mass balance equations are solved in a coupled way. For the energy equation the lateral fluxes are neglected, while the mass equation is solved in a fully 3D form and takes into account the topographic effects (slope and aspect), the solar radiation dependence on snow cover, soil moisture, surface temperature, radiative fluxes, turbulent heat fluxes and heat fluxes in the soil. The model uses distributed atmospheric forcings as input, so the spatialization of the variables measured in a meteorological station is needed. Temperature and relative humidity are normally extrapolated from the measured data, precipitation is interpolated through gridding techniques, but so far wind velocity is kept constant. Some form of coupling with meteorological models is therefore needed.