Simulating the Effects of Land-Use Changes on Landscape-Scale Water Cycles in Alpine Landscapes

G. Leitinger, G. Wohlfahrt and U. Tappeiner

Institute of Ecology, University of Innsbruck, Austria (georg.leitinger@uibk.ac.at / Fax: +43 512 507 2975 / Phone: +43 512 507 5978)

Alpine areas are highly sensitive to land-use and climate changes and therefore demand particular attention. Effects on ecosystem services of vital importance are obvious, but detailed information on attached processes is still missing. The current study aims at the better understanding of the effects of land-use changes on the water budget and consequently river run-off and associated services (e.g. waterpower) or arising risks (e.g. floods).

To simulate landscape-scale water fluxes we focus on coupling the Topography-based hydrological model (TOPMODEL) with a state-of-the-art SVAT (soil-vegetation-atmosphere-transfer) surface scheme. The simplicity of TOPMODEL enables an easy adaptation to our $5km^2$ large research area, which is located in the Stubai Valley, Tyrol, Austria. The model structure allows also further extension of the model to meet certain conditions and area specific features. The digital terrain model (DTM) with a resolution of 5 meters and detailed spatial information about vegetation, soil and land-use as well as long-term measurements from four meteorological stations with rain gauges and five more stations with altitudinal transect measurements from 900m a.s.l. up to 2280m a.s.l. on air humidity and air temperature guarantee highest quality of the input data for our model.

The resulting model will be validated by eddy covariance measurements, chamber measurements, measurements of soil temperature and soil water content as well as discharge measurements. Subsequently, the model should be applied to a larger extent of the research area by taking also the forested area as well as glaciers into account.