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An interdisciplinary open-air laboratory to study Alpine ecohydrological systems under environmental and anthropogenic change

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Global change phenomena as land use change and temperature increase are well proved to have significant impacts on biodiversity, water budget and ecosystem functioning of mountain regions. However, many studies act as isolated investigations within a complex, multidimensional space and are thus limited in their significance. Hence, it is rather essential to combine experimental and numerical eco-hydrological investigation methods in order to obtain an integrated comprehension of the highly interlinked ecological processes in such vulnerable mountain ecosystems under rapid under environmental and anthropogenic change.

To address those issues, since 2008 a Long Term Ecological Research (LTER) area has been established in the Matsch/Mazia area, located in the Venosta/Vinschgau valley in the European Alps.
The area covers an altitudinal transect from 1000 up to more 3000 m a.s.l., including the most representative alpine ecosystems. With increasing measuring infrastructure and data availability, the study site has become more and more interesting for local as well as international research. This infrastructure includes a dense micro-meteorological network, continuous soil moisture, discharge, biomass production monitoring, water energy fluxes and carbon budget, remote sensing campaigns, land cover and soil surveys.
Within this project an interdisciplinary approach is followed, where ecological measurements, manipulative experiments and modeling activities are strongly linked together in order to quantify land use and climatic change impacts on an Alpine catchment. All activities are aimed to cover both the spatial dimension from plot to landscape scale as well as the temporal component considering past, present and future.

In this contribution, we want to give an overview of the hydrological and ecological monitoring activities performed in the last five years in the Mazia area and present an application of the hydrological GEOtop model in simulating biomass production, evapotranspiration, soil moisture, and snow cover for this region.

Results highlight the role of the experimental observations for a multi-scale and multi-process evaluation of the model. Plot scale observations of biomass production, evapotranspiration, soil moisture and snow cover, combined with remote sensing observations, help to discriminate between uncertainties in input data and model parameterization. Moreover, we want to show how, when the model is used in combination with detailed experimental campaigns, a more coherent and accurate estimation of coupled ecohydrological processes is possible with respect to the one that is possible with simpler lumped models.