BASIC INFORMATION ON SUB-PROJECT

NAME OF PROGRAMME/FUND	Scholarship Fund - Sciex NMS^{ch}
RESEARCH FIELD AND OTHER RESEARCH FIELDS INVOLVED (if applicable)	Environmental Sciences, Earth Sciences
TITLE OF THE SUB-PROJECT	Snowmelt runoff modelling in mountain environments under changing climate conditions (SnowClim)
REGION OF THE CZECH REPUBLIC (according to the location of the home institution)	Prague
GRANT AMOUNT SPENT	48 151,80 CHF
INTERMEDIATE BODY	Swissuniversities
HOME INSTITUTION	Charles University in Prague, Faculty of Science
HOST INSTITUTION	University of Zurich, Department of Geography

NAME OF THE FELLOW	Michal Jeníček
ABSTRACT OF THE SUB-PROJECT	Rain-on-snow events with combined snow melting and rainfall is a frequent cause of floods in Europe. Reflecting possible long-term changes in climate conditions, there is the question of climate change impacts on the runoff regime at the regional and local scale. An important part of the research in mountain areas is therefore the issue of possible future changes in snow and glacier melt regimes. The main objective of this project is to contribute to research on processes connected with snow accumulation and melting as a factor of flood risk in the context of changing environment and climate change. The main focus will be possible future changes in snowpack using regional climate models (RCM) and impacts on runoff regime of mountainous basins. The project solution will lean on up-to-date hydrological and geoinformation methods and tools, which are presently applied for modelling the runoff from melting snow. The research will be carried out in selected middle-large basins in Switzerland and in the Czech Republic. Modelling the evolution of the snowpack (snow cover area, snow water equivalent, snowpack duration etc.) will be made by means of energy balance and temperature-index modelling techniques. Simulations using results from RCMs models will be made in order to simulate possible future changes of above mentioned snowpack characteristics and runoff.

MAIN RESULTS

Starting points and goals

The project realisation was obviously influenced by the SCIEX committee decision to change the project duration from 12 to 6 months. Therefore, the project aims had to be modified to new conditions and timetable. Luckily, the post-doc stay at the University of Zurich was extended until December 2013 (not within frame of SCIEX supoort).

We were focused on two main topics: 1) The effect of vegetation and topography on snow accumulation and ablation in small mountain catchments and 2) The importance of maximum snow accumulation for summer low flows in humid catchments

Main results: The effect of vegetation and topography on snow accumulation and ablation in small mountain catchments (Czech Republic)

The study was focused on vegetation and topography effects on snow accumulation and ablation, with special interest in the role of the forest affected by the bark beetle. We selected eight predictors related to winter meteorological conditions and the character of specific localities. The vegetation structure was described using parameters calculated from hemispherical photographs. The degree-day approach was used to calculate melt factors for sites with different vegetation and aspects. Multiple regression and cluster analysis were further applied using snow depth and snow water equivalent data measured at 47 localities in winter seasons from 2010 to 2014. The SWE in forest sites was by 32% lower than in open areas. The snow ablation in large openings was on average more than two times faster compared to forest sites. Snow ablation was by 33% faster after forest defoliation (due to the bark beetle) and we expect even faster ablation in case of complete forest decline. The results indicated that topography is more important predictor for open areas, while leaf area index is more important for forest sites. Despite the significance of the correlations found, parameters applied in this study could only partly explain the snowpack variability.

Main results: Importance of maximum snow accumulation for summer low flows in humid catchments (Switzerland)

The expected increase of air temperature will increase the ratio of liquid to solid precipitation during the cold season and, thus decrease the amount of snow storage, especially in mid-elevation mountain ranges across Europe. The decrease of snow will affect soil and groundwater storages during spring and might cause low streamflow values in the subsequent warm season. To evaluate these potential climate change impacts, we investigated the effects of inter-annual variations in snow accumulation on summer low flow. We worked towards 1) quantifying how long snowmelt affects runoff after melt-out and 2) estimating the sensitivity of catchments with different elevation ranges to changes in snowpack. To find suitable predictors of summer low flow we used long time series from 14 alpine and pre-alpine catchments in Switzerland and computed different variables quantifying winter and spring snow conditions. In general, the results indicated that maximum winter snow water equivalent (SWE) influenced summer low flow, but could expectedly only partly explain the observed inter-annual variations. On average, every

DATE OF REALISATION OF THE FELLOWSHIP	1.9.2012 - 28.2.2013
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