SEMINAR IN HYDROLOGY – ZHYDRO SEMINAR 2015

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This year organized by WSL, Mountain Hydrology and Mass Movements, contact: manfred.staehli@wsl.ch

Time	Speaker	Title
09:00		Welcome and introduction
09:10	**Anna Sikorska** *(University Zürich, Department of Geography)*	Value of different precipitation data for predicting floods in an alpine catchment
09:25	**Jan Rajczak** *(ETH Zürich, IAC Climate and water cycle)*	Does quantile mapping of simulated precipitation correct for biases in transition probabilities?
09:55	**Benoit Guillod** *(ETH Zürich, IAC Land-climate dynamics)*	Reconciling spatial and temporal soil moisture effects on afternoon rainfall
10:10 – 10:45		Coffee break and posters
10:45	**Christian Möck** *(EAWAG, Department of Water Resources and Drinking Water)*	Constrained Monte Carlo analysis for flow and transport processes of a highly parameterized model
11:00	**Benedict Borer** *(ETH Zürich, Soil and Terrestrial Environmental Physics)*	Nutrient and oxygen diffusion fields shape spatial self-organisation of microbial populations in pore networks
11:15	**René Orth** *(ETH Zürich, IAC Land-climate dynamics)*	Soil moisture and sea surface temperatures similarly important for land climate in the warm season
11:30	**Maria Staudinger** *(University Zürich, Department of Geography)*	Drought recovery in Switzerland - first insights from scenario simulations
11:45	**Matteo Saletti** *(ETH Zürich, Institute of Environmental Engineering)*	Modeling sediment transport and bed morphology in step-pool streams with a reduced-complexity approach
12:15 – 13:30		Lunch and posters
13:30	**Maria V. Klepikova** *(Eng. Geology, ETH Zürich)*	Insights about subsurface heterogeneity in hydraulic properties and processes from thermal tracer tests
14:00	**James Kirchner** (*ETH Zürich, Physics of Environmental Systems)*	Isotopic indicators of threshold water ages, from months to millennia, in groundwater and streamflow
14:30 – 15:00		Coffee break and posters
15:00	**Milad Aminzadeh** *(ETH Zürich, Soil and Terrestrial Environmental Physics)*	Experimental and theoretical pore-scale study of thermal field responses to drying of porous surfaces
15:15	**Behnam Doulatyari** *(EAWAG, Department of Water Resources and Drinking Water)*	Point Wise Estimation of Flow Duration Curve Along the River Network: A Case Study of Thur Catchment
15:30	**Manuel Antonetti** *(WSL, Mountain Hydrology and Mass Movements)*	Runoff generation during flash floods: Verification of a process-based runoff generation module on the hillslope and small catchment scale
16:00	Closure	

SHORT TEASERS OF THE ORAL PRESENTATIONS:

1) Anna Sikorska (Univ. Zürich, Hydrology and Climate Group): **Value of different precipitation data for predicting floods in an alpine catchment**

The focus of this study is to investigate the information content of three precipitation datasets: point gauge networks (PGN), interpolated gridded data products (IGDP) and radar-measured precipitation fields (RMPF), for flood predictions in an alpine catchment, using Bayesian comparative analysis.

2) Jan Rajczak (ETH Zürich, IAC Climate and water cycle): **Does quantile mapping of simulated precipitation correct for biases in transition probabilities?**

The presented study compares the ability of (1) raw regional climate model (RCM) output, (2) bias-corrected RCM output, and (3) a conventional weather generator which has been calibrated to match observed transition probabilities of dry, wet and very wet days at a set of long-term weather stations across Switzerland.

3) Benoit Guillod (ETH Zürich, IAC Land-climate dynamics): **Reconciling spatial and temporal soil moisture effects on afternoon rainfall**

The sign of soil moisture-precipitation feedback has been heavily debated in the literature. Using remote-sensing based soil moisture and precipitation data, we show that afternoon rain tends to fall on days with wet soils but at the same time at locations with comparatively drier conditions, which reconciles previous studies that seemed contradictory.

4) Christian Möck (EAWAG, Department of Water Resources and Drinking Water): **Constrained Monte Carlo analysis for flow and transport processes of a highly parameterized model**

In our modelling exercise, different stochastic realizations of the hydraulic conductivity fields were generated for a study area in Switzerland. Our approach equips us with a powerful means to explore uncertainty within realistic stochastic calibration constraints and leads to a better assessment of the potential error of key model predictions.

5) Benedict Borer (ETH Zürich, Soil and Terrestrial Environmental Physics): **Nutrient and oxygen diffusion fields shape spatial self-organisation of microbial populations in pore networks**

We investigated basic principles and underlying mechanisms promoting the emergence of stable spatial patterns of bacterial communities in soil. As an exemplary system we have used glass micromodels to observe pore scale segregation of a bacterial community within artificial pore networks shaped primarily by oxygen and nutrient diffusional fields.

6) René Orth (ETH Zürich, IAC Land-climate dynamics): **Soil moisture and sea surface temperatures similarly important for land climate in the warm season**

Here we present a comprehensive comparison of soil moisture (SM) versus sea surface temperature (SST) impacts on land climate in the warm season. We perform ensemble experiments with the Community Earth System Model (CESM) where we prescribe SM or SSTs to median conditions. We find that SM is overall as important as SSTs for land climate, in the midlatitudes as well as in the tropics and subtropics.

7) Maria Staudinger (Univ. Zürich, Hydrology and Climate Group): **Drought recovery in Switzerland - first insights from scenario simulations**

We studied drought recovery for selected catchments with varying hydrogeology. Synthetic drought scenarios were constructed introducing changes in mean, seasonality and dynamic of observed temperature and precipitation. We show first insights of (1) the effect of changed climate input and (2) the role of antecedent conditions on drought recovery.

8) Matteo Saletti (ETH Zürich, Institute of Environmental Engineering): **Modeling sediment transport and bed morphology in step-pool streams with a reduced-complexity approach**

We model bed morphology and sediment transport in step-pool channels with a reduced-complexity (RC) approach. In our 2-D cellular-automaton sandpile-like model entrainment, transport and deposition of particles are modeled at the grain scale. Intuitive rules are implemented, based on physical principles applied in a stochastic way.

9) Maria V. Klepikova (ETH Zürich, Engineering Geology) : **Insights about subsurface heterogeneity in hydraulic properties and processes from thermal tracer tests**

This presentation will discuss the interest of using heat tracer tests for characterization of heterogeneous aquifers. Thermal tracer test was conducted in the alluvial aquifer of the Meuse River, Belgium and in fractured aquifer of Ploemeur, France.

10) James Kirchner (ETH Zürich, Physics of Environmental Systems) : **Isotopic indicators of threshold water ages, from months to millennia, in groundwater and streamflow**

Isotope data show that water younger than about two months comprises about one-third of global river discharge, but comes from a tiny (<0.1%) fraction of global groundwater storage. Surprisingly, streams in steeper landscapes have less of this young water, suggesting that they are more conducive to deep infiltration.

11) Milad Aminzadeh (ETH Zürich, Soil and Terrestrial Environmental Physics): **Experimental and theoretical pore-scale study of thermal field responses to drying of porous surfaces**

We investigated the coupling between surface temperature and evaporative flux from pores drilled into rough glass surfaces and sintered glass beads samples. Details of thermal fields around evaporating pores were observed and results were compared with model predictions providing links between pore emptying sequence and surface temperature dynamics.

12) Behnam Doulatyari (EAWAG, Department of Water Resources and Drinking Water): **Point Wise Estimation of Flow Duration Curve Along the River Network: A Case Study of Thur Catchment**

We present a framework that allows for estimation of streamflow probability distributions based on catchment-scale information about climate and landscape. We apply a physically-based analytic model combined with an existing water balance model and a geomorphological recession model to the river Thur.

13) Manuel Antonetti (WSL, Mountain Hydrology and Mass Movements): **Runoff generation during flash floods: Verification of a process-based runoff generation module on the hillslope and small catchment scale**

We present a process-based runoff generation module for a conceptual hydrological model. The new module is fully-distributed to take into account both the spatial variability of the rainfall data and the spatial distribution of dominant runoff processes. It was tested on two catchments on the Swiss Plateau.

POSTER PRESENTATIONS (IN ALPHABETICAL ORDER):

Álvaro Ayala (ETH Zürich, Institute of Environmental Engineering): **Energy and mass balance of glaciers in the Andes of north-central Chile: Semiarid conditions decrease the performance of an enhanced temperature-index model**

We show that the energy and mass balance at six glaciers in the semiarid Andes of north-central Chile (3127 to 5324 m) is dominated by melt below 4000 m and by sublimation above 5000 m. Additionally, we identify limitations on the performance of an enhanced temperature-index model and discuss how to account for sublimation processes on this type of models.

Stefano Basso (EAWAG, Department of Water Resources and Drinking Water): **River flow regimes and effective discharge for sediment transport**

The observed diversity of effective discharge in catchments is explained in terms of the underlying heterogeneity of river flow regimes (as resulting from climate and landscape attributes), and attributed to intrinsically different streamflow dynamics of persistent and erratic regimes.

Konrad Bogner (WSL, Mountain Hydrology and Mass Movements): **HEPS4Power - Extended-range Hydro-meteorological Ensemble Predictions for Improved Hydropower Operations and Revenues**

The objective of HEPS4POWER (NRP 70 project funded by the SNF) is to demonstrate the potential of extended-range hydro- meteorological forecasts (15-60 days) for optimizing the operations and the revenues of hydropower systems utilizing probabilistic forecasts derived from Ensemble Prediction Systems.

Manuela I. Brunner (Univ. Zürich, Hydrology and Climate Group; Université Grenoble-Alpes): **Estimation of flood volumes using synthetic design hydrographs**

In this study, we propose a statistical approach for the estimation of the design variables peak and volume by constructing a synthetic design hydrograph. Our approach is based on fitting probability density functions to observed flood hydrographs and takes the dependence between the two variables peak and volume into account. The method was developed and tested based on data from nine meso-scale catchments in Switzerland.

Ilaria Clemenzi (ETH Zürich, Institute of Environmental Engineering): **Investigating wind-snow interaction during the accumulation season in an Alpine glacierized catchment**

The interactions of wind with precipitation and deposited snow are recognized as factors determining the heterogeneity of snow accumulation in Alpine terrain. In this modelling study we investigate wind-induced transport processes in a glacierized catchment in the Swiss Alps for typical precipitation events, and evaluate the relevant contribution on snow deposition patterns.

Ali Ebrahimi (ETH Zürich, Soil and Terrestrial Environmental Physics): **Dynamics of microbial life in soil aggregates – upscaling biogeochemical fluxes across aggregate size distributions in soil profiles**

We developed a 3D pore network to quantify aerobic/anaerobic microbial communities and their related biogeochemical fluxes (CO2, N2O) in aggregates of different sizes. The gaseous fluxes are upscaled to soil profile and following the numerical method, a scalable analytical model for large scale hydrologic and climate applications is developed.

Benjamin Fischer (Univ. Zürich, Hydrology and Climate Group): **Contributing sources to baseflow in pre-alpine headwaters using spatial snapshot sampling**

In steep and wet headwaters it is unclear which landscape unit contributes what percentage to baseflow. We found a small spatial variability of isotopic-hydrochemical compositions and surprisingly deep groundwater from near the water divide as active source while large area of wetlands were only passive contributing to baseflow.

Marius Floriancic (Univ. Zürich, Hydrology and Climate Group): **Which landscapes contribute to discharge during low flow periods?**

A high resolution dataset of discharge measurements from various catchments in the Swiss midlands in the dry summer of 2015 is presented. We found substantial variation in the storage and drainage behavior of different landscape elements.

Vincent Humphrey (ETH Zürich, IAC Land-climate dynamics): **Global water storage variability measured from the GRACE satellites**

Changes in the Earth's gravity field can be used to derive anomalies in water storage on a global scale. Using data from the Gravity Recovery and Climate Experiment (GRACE) satellite mission launched in 2002, we provide a global overview on the variability of monthly total water storage, including seasonal cycles, long-term trends and short-term anomalies such as droughts and floods with a spatial resolution of 1°.

Nadav Peleg (ETH Zürich, Institute of Environmental Engineering): **Generation of very high resolution scenarios to investigate climate change impact on hydropower operation**

A new stochastic weather generator is being developed (AWE-GEN-2d) with the aim of formulating a high spatial and temporal resolution simulation tool for predicting key climate variables at local and catchment scales. It will allow to assess the impact of climate change on hydrologic systems for the mid- and- end of the 21st century downscaling the state of the art regional climate models and greenhouse gas scenario ensemble.

Sandra Pool (Univ. Zürich, Hydrology and Climate Group): **How many runoff measurements do we need to constrain a conceptual runoff model?**

This study investigates the value of individual runoff measurements for calibrating a conceptual runoff model (HBV) in ungauged catchments. Based on the assumption that a limited number of runoff measurements can be taken, we seek the optimal sampling strategy (i.e. when to measure the streamflow) for the most efficient calibration. Preliminary results with snow influenced catchments indicated the importance of combining peak flow conditions and recession periods.

Federica Remondi (ETH Zürich, Institute of Environmental Engineering): **Towards a Fully Distributed Characterization of Water Residence and Transit Time by coupled hydrology-transport modelling**

The temporal and spatial distribution of water residence and transit time is investigated by coupling a fully distributed process-based hydrological model with solute transport simulation. We present the integrated model concept and the results from the first testing in the Plynlimon watershed (UK).

Siul Ruiz (ETH Zürich, Soil and Terrestrial Environmental Physics): **Experimental Evaluation of Penetration-Cavity Expansion Models for Soil Bioturbation Using Cone Penetrometer analogs**

The study provides experimental confirmation to support energetic estimates of bioturbation as well as insights into quantitative soil bioturbation processes; expanding predictive capabilities of the mechanics and energetics of earthworm and root zone dynamics related to soil structure development.

Maarten Smoorenburg (ETH Zürich, Institute of Environmental Engineering): **Assessment of extreme floods in alpine catchments with new tools for mapping and modeling hillslope-scale dominant runoff processes**

Newly developed mapping and modeling tools for characterizing and simulating the dominant runoff processes were tested in three contrasting alpine catchments. The tests showed that the tools can substantially improve the assessment of extreme floods in alpine terrain.