# Bivariate Mapping as tool for classification, visualization and evaluation of spatially explicit hydrological simulations

Matthias Speich (1), Luzi Bernhard (1), Adriaan Teuling (2), and Massimiliano Zappa (1)

(1) Swiss Federal Research Institute WSL, Birmensdorf, Switzerland (massimiliano.zappa@wsl.ch), (2) Wageningen University, Hydrology and Quantitative Water Management, Wageningen, Netherlands

In this study the application of bivariate color mapping to hydrology is investigated. The aims of our effort are: A) the classification of hydrologically similar regions based on two variables only, and B) to investigate how bivariate mapping can be used to represent hydrological data in a meaningful way, including visualization and evaluation of predicted changes and of uncertainty.

Bivariate maps of different pairs of hydrological variables ("discharge/snowmelt" and "potential ET/precipitation") were produced for the all the contributing areas draining through Switzerland at 200x200 m resolution. The variables are represented using a two-dimensional color key similar to a scatter plot. The colors were selected so that they represent a continuous surface within a color space, in order to provide a clear visual logic.

Three possible uses for bivariate mapping in hydrology were found. The first consists in dividing the map into regions with similar characteristics. Another use of bivariate mapping is to highlight regions of special interest, which deviate from the overall relationship between the variables, such as glaciers and urban areas. Finally, bivariate maps can be used to show predicted changes together with a measure of uncertainty. These three applications require different properties of the color scheme.

All basic data originate from a simulation experiment completed with the hydrological model PREVAH. Average yearly surfaces for current climate (1980-2009) and several future periods (including also different emission scenarios and GCMs) are available. We quantify the change in the frequency and distribution of bivariate categories for a high-resolution regional assessment of hydrological impacts of climate change. Furthermore we compare compare the bivariate with the classical classifications of hydrological regimes based on the Parde coefficient.

Bivarite Mapping might be a solution in order to present hydrological similarity in the era of distributed model applications, taking the role that Parde coefficients had in the characterization of hydrological response of river basins in the era of lumped models.