Geophysical Research Abstracts
Vol. 15, EGU2013-7286-1, 2013
EGU General Assembly 2013

Assessing the effect of soil diversity on the hydrology of a complex landscape - a case study in Gordon Gulch Valley, Colorado Front Range of the Rocky Mountains.

Sanne Diek (1), Arnaud Temme (2), and Adriaan Teuling (2)

(1) Wageningen University, Wageningen, Netherlands (sanne.diek@wur.nl), (2) Wageningen University, Wageningen, Netherlands

Around 40% of the global population lives in the watersheds of rivers originating in the planet's different mountain ranges. Water resources available from these ranges are becoming scarcer while demands rise. This is especially the case in semi-arid areas, where a clear understanding of key hydrological processes is necessary for effective water resource management to provide year-round water availability.

Soil plays a key role in hydrology since its properties are important hydrological determinants. Nevertheless soil information is rarely explicitly included in hydrological analysis. Our objective was to determine how easy to measure soil properties and their variation over space can be used to determine hydrological characteristics of a mountainous watershed.

Fieldwork was done on 100 locations in the Critical Zone Observatory in Gordon Gulch Valley in the Colorado Front Range of the Rocky Mountains. Fieldwork and subsequent laboratory measurements resulted in a dataset describing the soil and landscape characteristics of these locations. This dataset is shown to reflect a wide variety of soil properties in different landscape locations – wider than accounted for in recent literature of the area.

For all these locations, and for different soil horizons, soil hydraulic parameters were estimated based on measured texture percentages and bulk density using pedotransfer functions. With available meteorological data, the soil dataset and the estimated hydraulic parameters as input, the hydrological model SWAP was used to model hydrological behaviour of the 100 points and by implication of the watershed. These characteristics were correlated to landscape position.

We show results of the spatial variation of both the soil and hydrological characteristics. Gordon Gulch Valley is categorised in four characterising areas with each their own properties, (i) the north facing and (ii) the south facing slopes, (iii) a flatter and smoother area at the west side of the valley and (iv) the Gordon Gulch river and its small terraces. Furthermore the area is characterised by exposed bedrock, areas influenced by overland flow and areas influenced by infiltration. Both the soil and hydrological characteristics show a clear variation between these areas.

We discuss the processes that may be responsible for the spatial variation in soil properties and hydrological characteristics and discuss the implications of our work for hydrological assessments that only distinguish between north facing and south facing slopes.