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Understanding the effect of watershed characteristic on the runoff using SCS curve number

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Runoff modeling is a key component in watershed management. The temporal course and amount of runoff is a complex function of a multitude of parameters such as climate, soil, topography, land use, and water management. Against the background of the current rapid environmental change, which is due to both i) man-made changes (e.g. urban development, land use change, water management) as well as ii) changes in the natural systems (e.g. climate change), understanding and predicting the impacts of these changes upon the runoff is very important and affects the wellbeing of many people living in the watershed. A main tool for predictions is hydrologic models. Particularly process based models are the method of choice to assess the impact of land use and climate change. However, many regions which experience large changes in the watersheds can be described as rather data poor, which limits the applicability of such models. This is particularly also true for the Telomoyo Watershed (545 km^2) which is located in southern part of Central Java province. The average annual rainfall of the study area reaches 2971 mm. Irrigated paddy field are the dominating land use (35%), followed by built-up area and dry land agriculture. The only available soil map is the FAO soil digital map of the world, which provides rather general soil information. A field survey accompanied by a lab analysis 65 soil samples of was carried out to provide more detailed soil texture information. The soil texture map is a key input in the SCS method to define hydrological soil groups.

In the frame of our study on "Integrated Analysis on Flood Risk of Telomoyo Watershed in Response to the Climate and Land Use Change" funded by the German Academic Exchange service (DAAD) we analyzed the sensitivity of the modeled runoff upon the choice of the method to estimate the CN values using the SCS-CN method. The goal of this study is to analyze the impact of different data sources on the curve numbers and the estimated runoff. CN values were estimated using the field measurements of soil textures for different combinations of land use and topography. To transfer the local soil texture measurements to the watershed domain a statistical analysis using the frequency distribution of the measured soil textures is applied and used to derive the effective CN value for a given land use, topography and soil texture combination. Since the curve numbers change as a function of parameter combinations, the effect of different methods to estimate the curve number upon the runoff is analyzed and compared to the straight forward method of using the data from the FAO soil map.