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Sensitivity analysis of soils parameters and their influences on streamflow simulation in a small watershed, Northwest RJ, Brazil

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Abstract

The physical and hydraulic properties of soils in the watershed vary temporally and spatially, having a direct relationship with the amount of water that infiltrates, flows and reaches to the river channel, influencing stream flow responses. The knowledge of input parameters in a hydrological model and its sensitivity is beneficial to understand how hydrological processes are estimated. The soils parameters adjustments in the SWAT model aims to improve the performance of processes simulations, reducing uncertainty and leading to a better representation of hydrological processes in reality. A simple approach to assess how and what parameters influence the response of the flow was proposed and applied in a small watershed (6km²), with a predominance of Ultisols and hilly relief, in the northwest of Rio de Janeiro state. The methodology was divided into three stages: at first, the parameters have been listed in order of sensitivity; subsequently, the most sensitive parameters had their values changed individually while the less sensitivity parameters values were maintained. Finally, we assessed the influence of each parameter in flow simulation by SWAT model. The sensitivity analysis showed that parameters related to soil water content and hydraulic conductivity affect the generation of overland flow, consequently, the maximum flows in the main channel. The capacity of available soil water (SOL_AWC) had their values increased in 30%, and were adjusted according to land use. The Curve Number parameter (CN2) had their values reduced in 10%. The value of hydraulic conductivity of the soil (SOL_K) had their value increased 50%. Those changes increased the infiltration and water storage in soil, decreasing overland flow. With calibration values of NS = 0.75, PBIAS = 12.7% and R² = 0.51 and validation values of NS = 0.5, PBIAS = 13.02% and R² = 0.73, the good results obtained with the soil parameter values adjusted could be observed through graphical and statistical analysis.