Modelling the Hydrological Balance in the Zou Catchment at Atcherigbe Outlet (Bénin Republic): Contribution to the Sustainable Use of Water Resources

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Abstract

A modelling study of the hydrological balance was conducted in the Zou catchment at Atcherigbe outlet, stretching over a total area of approximately 6980 km^2 in the centre of Benin. The objective is to contribute to the sustainable use of water resources in the Zou basin through the assessment of the availability and the annual renewal of the resource.

Thus, the agro-hydrological, physically based model SWAT has been calibrated and validated for this watershed.

The Hydrologic Response Units (HRU), which are homogeneous areas at point of view of soil physical properties and landuse, generated by the model are the units space where the water balance components and the amount of eroded sediment were evaluated before being aggregated. This procedure enhances the accuracy of model's prediction. The runoff was estimated by the SCS curve number procedure. The soil water has been assessed according to the soil moisture (saturated or unsaturated) by using storage routing methodology. The actual evapotranspiration was assessed by Penman's method. As for the erosion, the modified version of the Universal Soil Loss Equation of Williams was used.

The main data used were the DEM of the region, soil characteristics, vegetation cover, climate and cultivation practices.

The adjusted water balance shows a coefficient of surface runoff of 7 %, a total of groundwater recharge (shallow and depth aquifer) of about 18 % and an actual evapotranspiration of 72 % of annual precipitations. Regarding erosion in the basin, the average annual losses are in the order of 5 t ha^{-1} and presents disparities depending on the type of land cover: approximately 17 t ha^{-1} per year in the agricultural HRUs and about 0.6 tons ha^{-1} per year in the classified forests and woodlands.

These results have led to propose strategies for sustainable exploitation of the basin's water as follows:

- building reservoirs to store water (earthen dam, drilling and wells, ponds,. . .),
- constructing works to fight erosion (hedges, Cordon stony. . .),
- implementation of intensive politics of mobilisation and training of peasant populations concerned.

Keywords: Erosion, hydrological balance, modelling, SWAT, watershed

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