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Modeling of storm runoff and pollutant wash off processes during storm event in rapidly urbanizing catchment

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Many urban catchments in developing countries are undergoing fast economic growth, population expansion and land use/cover change. Due to the mixture of agricultural/industrial/residential land use or different urbanization level as well as lack of historical monitoring data in the developing area, storm-water runoff pollution modeling is faced with challenges of considerable spatial variations and data insufficiency.

Shiyan Reservoir catchment is located in the rapidly urbanizing coastal region of Southeast China. It has six sub-catchments with largely different land use patterns and urbanization levels. A simple semi-distributed model was used to simulate the storm-water runoff pollution process during storm event in the catchment. The model adopted modified IHACRES model and exponential wash-off functions to describe storm-runoff and pollutant wash-off processes, respectively, in each of six sub-catchments. Temporary hydrological and water quality monitoring sites were set at the downstream section of each sub-catchment in Feb-May 2007, spanning non-rain and rain seasons. And the model was calibrated for storm-runoff and water quality data during two typical storm events with rainfall amount of 10mm/4hr and 73mm/5hr, respectively.

The results indicated that the Nash-Sutcliffe (NS) coefficients are greater than 0.65 and 0.55 respectively for storm-runoff model calibration and validation. However although NS coefficients can reach 0.7∼0.9 for pollutant wash-off model calibration based on measured data in each storm event, the simulation data can not fit well with the measured data in model validation. According to field survey observation, many litters and residuals were found to distribute in disorder in some sub-catchments or their drainage systems and to instantaneously wash off into the surface water when the rainfall amount and intensity are large enough. In order to improve storm-water runoff pollution simulation in the catchment, the variations of pollutant source and wash off processes in different storm intensity should be consider in future monitoring and model development.

Keywords: storm runoff; wash off; urbanization; catchment modeling; litter; residual