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Impact of land use changes on the water cycle - hydrological modelling in a subtropical catchment area (Bahia, Brazil)

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The presented hydrological study has been carried out in the frame of the project ECOMAN (Decision Support System for Sustainable Ecosystem Management in Atlantic Rain Forest Rural Areas, funded by the European Union (EC, ICA4-2000-10279). The general aim of ECOMAN was to produce a management oriented decision support system on interdisciplinary basis to promote a sustainable development of rural areas situated in the tropical rain forests affected by intensive and growing human pressure. The decision support system was based on knowledge related both to local and to global levels to improve the socio-economic conditions by the use and protection of natural resources taking into account alternative income and the new market trends at regional and global levels. The research was developed in Brazil and Costa Rica, where the Atlantic Rain Forest represents one of the clearest examples of sensitive areas where the effects of the increasing anthropogenic pressures have a strong negative impact on ecosystem functionality and especially on the water cycle.

The catchment area of Rio Cachoeira is located in southern Bahia (Brazil) with a drainage surface of around 4600 km2, which encompasses twelve municipalities. Around 600000 inhabitants live in the area of the catchment. Until the middle of the 20th century the greatest part of the catchment were covered by Atlantic rain forest, today large parts are deforested, land use is dominated by cocoa production and cattle husbandry

In the present study the physically based hydrological model MIKE SHE coupled with the hydrodynamic model MIKE 11 is used. The river has mainly a water routing

function in this work because the overall objective from the modelling activity is to analyse the spatial and temporal water balance dynamic in the Cachoiera watershed. Although the river hydraulic is not of primarily interest, a correct exchange of water amount between the river and its environment must be simulated. Moreover the main terrestrial components of the water balance as well as the main runoff components are simulated: infiltration, evapotranspiration, recharge, channel flow, overland flow, interflow and baseflow. Calibration has been carried out done on the basis of 5 runoff gauging stations with time series of runoff data of a 16 years period. Input data where the actual situation of land use (determined by remote sensing), soil map, geological map and meteorological parameters. On the basis of the calibrated model the impact of land use scenarios on the water cycle components and the runoff generation procedures as well could developed, the impact of extreme situations like the period before deforestation and a theoretically total domination of pasture is presented in the study. The hydrological forecasts have been used as input for a DSS with socio-economic scenarios with the main aim to maximise profits and the rate of economic growth of the region taking into account ecologically sustainable land use activities.