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Are distributed models able to predict the hydrological impacts of land use change?

Distributed models have become a standard approach in land use change impact studies, and the Soil and Water Assessment Tool has become popular because the model combines crop and agricultural processes, hence the land use processes, with catchment hydrology. Of course, the model predictions rely on a proper representation of the distributed parameters and inputs. One of the important changes on the water resources under land use change scenarios, are due to changed evapotranspiration. We analysed the hydrological results and the spatial representation of the evapotranspiration processes by comparison with remote sensing data within the tropical highlands of the upper Nile basin. From the analysis it became clear that:

(1) The leaf area index obtained from SWAT and the remote sensing data are within the same range
(2) SWAT, MODIS/LANDSAT and SPOT VEGETATION satellite data often show similar seasonal dynamics of LAI for different land cover/crop uses after inclusion of proper land management information.

The comparison also showed different and contradicting results that are indications of gaps and limitations in our capability to compute evapotranspiration, leading to the following concerns:
(1) The conceptual framework (eg. curve number versus water balance) has a very strong impact on the hydrological components, giving opposite spatial distributions of the runoff generation processes, very distinct baseflow factors but also very different evapotranspiration (after White et al., 2009). But neither of these concepts seemed to give realistic patterns of evapotranspiration when the results are plotted on maps since shapes of the sub-basins became often visible which is a result of the lumped input of weather data at sub-basin scale and/or the calibrations of parameters at the outlet of the sub-basins that try to match the water balance: ET~P-Q. However, the data quality of P and/or Q may not always justify this approach and may lead to wrong mass balances.
(2) SWAT seems to strongly underestimate the evapotranspiration of the forest land covers, which leads to questionable results eg. evapotranspiration is increased after deforestation.

It is concluded that whatever concept is used, SWAT gave often unrealistic results for evapotranspiration. Since evapotranspiration depends on the weather/soil processes/agricultural management processes, all of them often being correlated to altitudes, any hydrological model will be challenged to isolate the role of the crop and land management processes on evapotranspiration if they want to provide reliable predictions of the hydrological impacts due to land use change. Only interdisciplinary research in the field of eco-hydrology or agro-hydrology can lead to the necessary progress in our modeling capabilities to predict hydrological impacts land use changes.