

Interactive comment on “Multi-criteria assessment of the Representative Elementary Watershed approach on the Donga catchment (Benin) using a downward approach of model complexity” by N. Varado et al.

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Received and published: 1 March 2006

Sub-REW scale variability

One of the objectives of the study was to go from a simple simulation to, little by little, increase the complexity of the simulation. This is why we first work on homogeneous REW. But for sure, one of the next steps of this study will be to take the sub-REW variability into account, with for instance overlying various layers of information concerning land-use, geology, etc. This will allow the specification of the variability of parameters within a REW.

Introduce a subsurface layer into the model structure accounting for perched

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water tables

When we started the study, we had very little knowledge on the ground structure and it was thought that deep groundwater was the main contribution to the flow. It justified the use of the REW model in its early version. Since then, more observations are available which modified the perceptual model of the catchment (see also general comment in answer to G. Zhang). Now, we know that the wells are drilled in the alterite horizons and that perched watertables appears near the soil surface. The first objective of the study was to use the model as such. But now that we have more information on the soil structure, we would probably aim at modifying the model structure in order to better take into account the hydrological compartment evidenced by the observation.

Uncertainty in precipitation/evaporation

I did not work directly on the uncertainty on rainfall and evaporation. But, what I did during my PhD work can answer this question. I did not want to present all this in the manuscript as it would be too long and hard to read. I compared the annual rainfall determined at the catchment scale with the ones determined at the REW scale. It appears that, in 2002, when a denser rainfall network became available, the spatialization of rainfall leads to a reduction of -9% (94mm) or a increase of 12% (125mm) in annual rainfall, depending on the REW, with an average of 4% for the annual amount. Thus the spatialization can be seen as an attempt to quantify the rainfall uncertainty. And we found from the simulation results that it did not affect tremendously the discharge at the outlet and at intermediary stations, probably because the model structure is not able to use this detailed information properly. Nevertheless, more can be said on rainfall uncertainty. As the number of rain gauges increased in 2002, I looked at the difference in determining the rainfall at the REW scale, with the old network or with the new one. On the annual amount, the differences have a mean of 100mm and the maximum can reach 228mm, i.e. 20% of the annual rainfall (for REW 50, 2nd Stralher order). So the real uncertainty is probably higher than the one captured in the comparison between homogeneous and spatialized rainfall. A more complete uncertainty analysis should be addresses as a next step in the simulation work when study on the spatio-temporal

structure of the rainfall will have progressed.

I also made a sensitivity analysis of the discharge simulation with respect to the potential evapotranspiration, by multiplying the evaporation by a factor ranging from 1 to 2.5. We can see that it affects largely the efficiencies in all station and any time step. Nevertheless, a validation of such a factor may be carried out only with knowledge of actual evaporation. This is part of the new measurements that will be carried out in the AMMA project. I also used various station of the Upper Oueme catchment, as the one in Djougou has been available only since 2002. The station of Parakou is about 130 km west of the catchment. The use of Djougou data or Parakou data in 2002 does not affect the efficiency of the simulation.

Scale problems in comparing point scale measures and REW-average values.

For sure, the comparison between point scale measures and REW-average values is a risky exercise. Concerning the soil moisture content, we have only one station and no data for the simulated year. So the measured data are only used here to illustrate what could be the yearly dynamics of the soil water content. About the groundwater level, we did not want to compare a REW-average value to only one point measure. We had the opportunity to compare it to several wells that are close to each other. No attempt of extrapolation or averaging of the measured values was conducted because these watertables are thought to be disconnected.

The various spelling and style corrections suggested by referee#4 were made in the revised version of the manuscript.

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 2349, 2005.

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