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Evaluation of the applicability of SWAT in the Nile Basin countries: a review

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A plethora of hydrological modeling codes are nowadays available and many applications of these tools have been reported in peer reviewed journal papers. The hypothesis that the model is appropriate for the case study and the purpose of the study is however very often not questioned. We aim here at critically reviewing the use of a widely used hydrological simulation tool, the Soil and Water Assessment Tool (SWAT) in the context of the modeling purpose and problem descriptions in the tropical highlands of the Nile Basin countries. Up to date, more than 20 peer reviewed papers describe the use of SWAT in this region for a variety of problems, such as erosion modeling, land use modeling, climate change impact modeling and water resources management. The majority of the studies are clustered in the tropical highlands in Ethiopia and around Lake Victoria. A number of criteria are used to evaluate the model set-up, the performance, the physical representation of the model parameters, and the representativeness of the hydrological model balance. Here we evaluate the applications of within the Nile basin. On the basis of performance indicators, the majority of the SWAT models were classified as giving satisfactory to very good results. Nevertheless, the hydrological mass balances as reported in several papers contained several losses that might not be justified. More worrying is that many papers lack this information. For that reason, it is difficult to give an overall positive evaluation to most of the reported SWAT models. An important gap is the lack of attention that is given to the vegetation and crop processes. None of the papers reported any adaptation to the crop parameters, or any crop related output such as leaf area index, biomass or crop yields. A proper simulation of the land cover is important for obtaining correct evapotranspiration and erosion computations. It is also found that a comparison of SWAT applications on the same or similar case study but by different research teams and/or model versions resulted in very different results. It is therefore recommended to try to find better methods to evaluate the representativeness of the distributed processes and parameters, especially when land use studies are envisaged. The main recommendation is that more details on the model set-up, the parameters and outputs should be provided in the journal papers in order to allow for a more stringent evaluation of these models.