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Upscaling rural livelihood interventions: towards a comprehensive spreadsheet-based water resources model

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Abstract

A number of hydroclimatic and institutional factors converge to emphasise the need for investment in water management and water resources modelling in southern Africa. In average years, water demand (principally from agriculture and urban areas) is in a precarious balance with available water resources, with major deficits recorded during droughts. Furthermore, a number of climate change models predict that southern Africa shall experience significantly reduced precipitation and runoff over the next fifty years. At the same time, water demand continues to rise, as urban areas expand and as agricultural water demand must rise to meet the millennium development food security goals. Changes in rural livelihood strategies, especially as regards water management in rainfed agriculture and land use changes, whilst not necessarily exhibiting high blue water demand, can exert a strong influence on runoff generation. In this context, there is a clear requirement for water resources modelling to support integrated water resources management planning in order to balance food security, other economic needs and the needs of the environment in the allocation and development of blue water flows.

In this study, a coupled, spreadsheet-based model is used to assess the hydrological and climatic limitations to the possible upscaling of a variety of livelihood interventions, such as drip kits, small reservoirs, irrigation from alluvial aquifers, soil-water conservation, supplementary irrigation and integrated crop-livestock management. The study covers the Mzingwane Catchment of the Limpopo Basin. The model used integrates the HBV light rainfall-runoff model with WAFLEX, as a catchment level water-resources model. WAFLEX is adapted with a new, simple groundwater balance module and HBV with a new interception storage and flux pre-processor. Both models are run via visual basic macros in a spreadsheet. Spreadsheet-based models are simple and user-friendly, and run without the purchase of additional modelling software. This makes them appropriate technology: suitable for water management institutions faced with financial and human resource constraints and inadequate data.

Keywords: IWRM, livelihoods, Limpopo Basin, upscaling, water resources modelling.

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