

A catchment-scale irrigation systems model for sugarcane

Part 1: Model development

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Abstract

In South Africa, the demand for water exceeds available supplies in many catchments. In order to justify existing water requirements and to budget and plan in the context of growing uncertainty regarding water availability, a model to assist in the assessment and management of catchment water supply and demand interactions, and the associated impacts on the profitability of irrigated sugarcane, has been developed. The model, *ACRUCane*, operates as a submodel within the *ACRU* agrohydrological model and simulates the water budget of a field of irrigated sugarcane. The water budget is based on the integration of several widely accepted algorithms and concepts, accounts for different irrigation system types performing at different levels of uniformity and different water management strategies. Furthermore, it can simulate a wide variety of water availability scenarios and constraints through its link with *ACRU* simulated hydrology. The crop yield algorithms used in the model were verified using data from three different irrigation trials with widely varying irrigation treatments, where the model was shown to adequately distinguish the impacts of different watering strategies on crop yields. A description of the model algorithms and results from verification studies are presented in this paper. Application of the model is presented in a companion paper.

Keywords: *ACRUCane*, irrigation systems, water management, crop modelling, hydrology, water resources, sugarcane