Application of a Numerical Implicit Model to an Irrigation Canal

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ABSTRACT

A case study is presented regarding an application of a computational model to the unsteady flow in an irrigation canal, using an implicit numerical technique. The Saint-Venant equations of continuity and momentum for one-dimensional gradually varied flow were written in a finite-difference form. The system of equations was solved by the double-sweep algorithm. A computer program was written to solve the problem in which a discharge hydrograph is given at the upstream boundary of the canal and a time-dependent water level is specified at the downstream boundary. The model was validated by field tests. A sensitivity analysis was also made concerning the numerical weighting parameter value and the choice of the time step in order to improve the model accuracy. This model will be the basis for an improved canal management in the near future.

INTRODUCTION

The main objective of the management of the conveyance and distribution irrigation systems is to provide an optimized use of the water resource. This management is still mostly based on empirical procedures, often inducing rather important losses of water due to an inadequate prevision of consumptions, or to a non-efficient daily operation of the conveyance and distribution system, or to delivery rules that do not correspond to design conditions.

When daily large variability of the discharges are expected, the utilization of computer management methods assures the improvement of the conveyance and distribution performances and an appreciable economy of water.

The mathematical modelling, based on the numerical integration of the Saint-