The seasonal furrow irrigation model (FIM) comprises process-based simultaneous modelling of the 1D surface flow, the quasi-3D soil water transport, and the crop growth. The surface flow sub-model FAPS utilizes an analytical solution of the Zero-Inertia open-channel flow equations for modelling the non-uniform flow during both the advance and the early storage phase of an irrigation event (Schmitz et al., 1992). Process adequate simplifications are applied for the late storage phase, the depletion and the recession phase (Wöhling, 2005). The numerical code HYDRUS2 (Simunek et al., 1996) portrays both the two-dimensional infiltration from arbitrary shaped furrows and the soil water transport in a series of vertical planes along the furrow (Fig. 1). FAPS and HYDRUS2 are iteratively coupled by the infiltration rate and the flow depth. The set of non-linear partial differential equations of the coupled furrow irrigation advance model is solved by a space discretisation in combination with the Newton iteration method. This solution proved to be numerically stable, highly convergent and efficient as regards computational time (Wöhling et al., 2005). Model simulations of test data from laboratory runs and field experiments showed an excellent agreement in predicted and observed advance times (Wöhling, 2005).

The seasonal furrow irrigation model was developed by iteratively coupling a 1D surface flow model with a series of HYDRUS2 model parameterisations along a single furrow. HYDRUS2 simulates correctly the soil water transport during a growing season of corn at Montpellier (France) and provides detailed information about the quasi 3D water distribution in the soil. FIM estimates irrigation performance criteria, such as irrigation efficiency and distribution uniformity, more precisely than VBM. It can be applied for improving furrow irrigation design and management, for irrigation planning, for cost-benefit analysis, and for estimation of sustainability of furrow irrigation systems.

**References:**


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