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Discussions

Interactive comment on "Combined Simulation and Optimization Framework for Irrigation Scheduling in Agriculture Fields" *by* Mireia Fontanet et al.

Anonymous Referee #3

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The paper suggests a procedure for identifying the optimal irrigation schedule that maximize the net margin of the crop production. Irrigation scheduling is defined by

i) a threshold of the soil matric potential observed at a given depth (e.g. 20 cm in the sample case study);

ii) event irrigation depth (or irrigation duration with a predefined irrigation rate) .

The procedure exploits Hydrus-1D as soil water and solute transport model. Plan transpiration is modelled as fraction of the potential transpiration. The fraction is computed accounting for water and salinity stress.

The potential transpiration and evaporation are computed as fractions of the crop evapotranspiration under standard conditions (ETc), accounting for the soil canopy cover.

ETc is computed according to FAO-56 single crop coefficient approach.

Crop yield is assumed to be proportional to the ratio of the actual ET to ETc.

General Comments

Tabulated FAO 56 crop coefficients were proposed as a simple approach for assessing crop water requirements. The application of the single crop coefficient approach for estimating the crop evapotranspiration under standard conditions and the crop yield is too simplistic and not suited for the proposed optimization. By taking the tabulated crop coefficient in the proposed procedure is equivalent to assume that the crop is a stationary system, where phenology and water requirements are simply identified by the calendar days rather than the result of the crop response to the environmental conditions.

Similarly, Eq. 13 was proposed by FAO papers as a simple empirical equation for estimating crop yield.

However, crop biomass and yield development depend on the transpiration rate rather than on the evapotranspiration.

Even the most simple and conceptual agro-hydrological model, such as AquaCrop (which does not rely on the numerical solution of the Richards Equations) provides a comprehensive description of the crop dynamics and crop yield development and, thus, allows optimizing the irrigation scheduling accounting for the crop response to environmental stresses.

Indeed, an optimization procedure should consider that environmental stresses do not affect the yield uniformly across the entire growing cycle.

Overall, it is not clear the motivation of this study. How should this procedure be applied from an operational perspective? The optimization procedure seems to be designed for running in batch mode, i.e. it can be used to identify the optimal irrigation schedule for a reference climatic condition, but it cannot be used to adapt the irrigation schedule to the actual environmental conditions, in real-time.

Specific comments

Line 50 – The crop coefficient is designed for assessing crop water requirements and not for irrigation scheduling. The estimated crop water requirements should be then used for designing the irrigation scheduling.

Section 3.2 Model setup: Root depth is assumed to be constant in time, while it is highly variable in time, especially for crops like maize. A soil depth of 60 cm with free drainage as bottom boundary conditions does not seems to be realistic. Moreover, this seems even more improbable with crops like maize. The impact of the initial conditions can be high.

Lines 325 – The irrigation strategy presented as traditional does not seem to be realistic.

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