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Hydrology and Earth System Sciences Discussions

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

Anonymous Referee #1

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This study proposed a method to locate optimal irrigation schedules considering the soil water movement. The research question is interesting, but I am not sure if it is relevant within the scope of HESS. In addition, I found the complexity of modeling practices could be consistent and optimization methods could be improved so that the results could be more reliable and practical. For instance, the crop yield model looks too simple (only a function of ET), compared to that of the soil water model (HYDRUS-1D). There are more comprehensive crop models such as DSSAT and EPIC. The brute force method used when trying to locate the optimal scheduling could be fine if the authors wanted to see the relationship between two factors or objective functions, but it is not an efficient way to explore the multi-dimensional parameter space. Such a limita-

tion did not allow the authors to explicitly investigate the trade-off between the objective functions and develop a Pareto front in the study. Here are my specific comments:

Lines 49 to 50: I do not agree with this statement. The ET based method can provide information on irrigation water application timing when it is combined with soil water content accounting.

Equation 13: This model accounts only for the impacts of ET or soil water content on crop growth, and I think this is too simple compared to the complexity of using the soil water simulation model, HYDRUS-1D.

Line 221: Please briefly describe what these devices for.

Lines 256 to 257: Does this mean that the differences between them are not "statistically" significant? Please clarify it.

Line 266: I am not sure if we can say this. Please try to justify the evaluation using literature.

Lines 271 to 272: Please describe the weather conditions in detail.

Line 272: Please justify such selection of weather condition in terms of the reliability and applicability of the results. I think it is worth adding other weather conditions (e.g., most favorable and average) and comparing the efficiency of the proposed method.

Lines 292 to 293: I do not think the brute force sampling strategy can locate the global optimum.

Lines 293 to 294: Please provide examples of showing the detail insights about irrigation scheduling.

Lines 298 to 301: I do not think this is a "realistic" traditional irrigation scheduling method, which may determine daily (rather than weekly) irrigation timing and amount based on daily (rather than weekly) weather conditions.

Line 306: I expected to see a plot showing the trade-off between the objective functions (or a Pareto front), but Figure 5 does not show it.

Line 318 ("proposed method can increase the net margin by 7%"): Please describe how the amount of water irrigated and the corresponding cost can be improved (or reduced) by implementing the proposed method.

Lines 400 to 401: Considering the amount of uncertainty in the analysis and its results, I am not sure the 7% increase of the net margin is significant. Please try to quantify uncertainty of this analysis, as there are many assumptions and simplifications made in the analysis and modeling.

Lines 404 to 408: Considering these shortcomings of this method, I am not sure if agriculture stakeholders can use this method in practice. I wonder how the authors are going to make this tool available to the stakeholders.

Figure 3: The model underestimated soil water content at the 20 cm depth, which may lead to the overestimation of irrigation water.

Figure 6: The optimal scheduling requires to turn on and off the irrigation pump and system frequently, which may lead to increase in operation and maintenance costs. I am wondering if such additional potential costs can be considered in the optimization framework.

Table 4: RMSE values, 0.12 and 0.08 look substantial when considering the fact that the amount of available water content is around 0.35 from Figure 3. 0.12 and 0.08 correspond to 33% to 23%.

Table 4: How about the overall bias?

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