# Revision Notes (HESS2019656)

July 10, 2020

Dear Professor Alberto Guadagnini,

Thank you for allowing us to resubmit the minor changed manuscript Hess-2019-656 entitled "A FIELD VALIDATED SURROGATE CROP MODEL FOR PREDICTING ROOTZONE MOISTURE AND SALT CONTENT IN REGIONS WITH SHALLOW GROUNDWATER". Your latest evaluation of the manuscript was as follows:

> "While the reviewers are generally satisfied, the first Reviewer raises a few (very) minor technical issues (mostly related to grammar) and one technical point related to provide a clear distinction between surface irrigation (flooding) and surface & ground water sources used to supply irrigation water. I would encourage the Authors to take all of the points into account. Once this is accomplished, I will then be in a position to make a final decision."

Below we have replied to the comments of reviewer point by point. In our response and in the revised manuscript we show in blue the changed text.

We are grateful to you and the reviewers for the comments and your time. We are looking forward to hearing from you whether additional changes are needed.

With high regard

Zalin Huo, Tammo Steenhuis and Zhongyi Liu

**Responses to the comments of Reviewer #2:**

**Page2. Number1**: In light of the many uses for the word performance, perhaps "optimum management of irrigated crops" would be more straightforward.

**Response:** Thank you for your suggestion. In the revised manuscript, the sentence was revised as "Optimum management of irrigated crops in regions with shallow saline groundwater requires a careful balance between application of irrigation water and upward movement of salinity from the groundwater." in line 23-25.

**Page3. Number1**: Page 3: Actual evporation

**Response:** Apologizes for the spelling mistake. In the revised manuscript, it was revised as "Actual evaporation".

**Page 4. Number1**: This is repetitive of the previous sentence.

**Response:** Thank you for your suggestion and this sentence was deleted in the revised manuscript.

**Page 4. Number 2**: In my previous comments, I mentioned that it would help some readers if surface irrigation was distinguished from irrigation supplied from surface water sources (as opposed to groundwater sources). Although the authors have clarified that this research was conducted in flood irrigated fields, I think this is still pertinent in this introduction to differentiate the irrigation methods from the source water when using the term "surface irrigation". This is especially relevant here because saline groundwater complicate the management salinity, regardless of irrigation technique (flood/surface, sprinkler, sub, or drip).

**Response:** We are grateful for your suggestion. In the revised manuscript, it was revised as "In arid and semi-arid areas where people divert surface water for flood irrigation and have poor drainage infrastructures, the groundwater table is close to the surface because more water has been applied than crop evapotranspiration" in line 53-55.

**Page 4. Number 3:** format problem

**Response:** Apologizes for the format mistake. Please see our response to the comment of Page 4, Number 2 above.

**Page 4. Number 4:** deeding

**Response:** Apologizes for the spelling mistake. It should be "seeding" and in the revised manuscript, the sentence was revised as "In north China, the fields are commonly irrigated in the autumn before soil freezing to leach salts and provide water for first growth after seeding in the following year (Feng et al., 2005)" in line 63-65.

**Page 6. Number 1: "**Detailed spatially**"**

**Response:** Thanks for your reminder and the sentence was revised as "Detailed spatial input of soil hydrological properties and crop growth are required to take advantage of the model complexity (Flint et al., 2002; Rosa et al., 2012)" in line 95-97 in the revised manuscript.

**Page 8. Number 1:** "staring"

**Response:** Apologizes for the spelling mistake. In the revised manuscript, the sentence was revised as "This is followed by detailed description of the two-year field experiments started in 2017 in the Hetao irrigation district where maize and sunflower were irrigated by flooding the field" in line 144-146.

**Page 9. Number 1:** "The model was a proof of concept with calibrated values for evapotranspiration and soil salinity and was not simulated."

**Response:** In the revised manuscript, the sentence was revised as "The model was a proof of concept with calibrated values for evapotranspiration and soil salinity which was not simulated" in line 156-157.

**Page 9. Number 2:** This acronym is applied inconsistently throughout the text. See lines 219-220. Since your model acronym (EPICS) is very similar, I suggest that you ensure that this is correct and consistent to help the reader keep it all straight.

**Response:** Apologizes for the inconsistent acronym. For consistency of this acronym in the paper, we revised it as "Erosion Productivity Impact Calculator". The sentence was revised as "The new model that combines parts of the EPIC (Erosion Productivity Impact Calculator, Williams et al., 1989) with Shallow Vadose Groundwater model is called the *Evaluation of the Performance of Irrigated Crops and Soils* (EPICS)" in line 160-163.

**Page 12. Number 1:** This acronym is defined inconsistently here and above. This is the correct attribution from Williams et al., 1989. See line 162.

**Response:** Please see our response to the comment of Page 9, Number 2 above.

**Page 15. Number 1:** For modeling the daily soil moisture content and groundwater depth, first we need calculate the soil moisture content at field capacity and the drainable porosity based on the soil moisture characteristic curve.

**Response:** In the revised manuscript, the sentence was revised as "For modeling the daily soil moisture content and groundwater depth, first we need to calculate the soil moisture content at field capacity and the drainable porosity based on the soil moisture characteristic curve" in line 279-281.

**Page 16. Number 1:** Grammatical errors: Besides, considering the water and salt movement is different when there have irrigation and/or precipitation, we simulate the daily soil moisture content and salt with downward flux or upward flux.

**Response:** We are grateful for your reminder. In the revised manuscript, the sentence was revised as "Besides, we assume that the water and salt moves downward on rainy and/or irrigation days, while the water and salt moves upward on days without rain and/or irrigation**"** in line 281-283.

**Page 16. Number 2:** Lines 271-275: Both of these sentences have multiple grammatical errors, and should be reviewed to ensure that the authors' intented meaning is correctly stated.

**Response:** Apologizes for the grammatical errors. Please see our responses to the comment of Page 15, Number 1 and Page 16, Number 1 above.

**Page 18. Number 1:** This sentence has multiple grammatical errors.

**Response:** Thanks for your reminder. The sentence was revised, as "During the downward flux period, the upward water flux from groundwater is zero. Under this condition, the model can output the daily soil moisture content of different soil layers, the percolation from each soil layer to the soil layer beneath, the discharge from soil water to groundwater, the salt concentration of groundwater and of soil water in each soil layer, and the groundwater depth" in line 340-344.

**Page 21. Number 1:** As in the section above, please fix grammatical errors in this sentence.

**Response:** Thanks for your reminder. It was revised as "Under this condition, the model can output the daily soil moisture content of different soil layers, the upward groundwater flux, the groundwater depth, and the salt concentration of groundwater and of soil water in each soil layer." in line 395-397.

**Page 23. Number 1:** Does salinity of this source water change seasonally?

**Response:** We measured the salinity of the irrigation water that diverted from the Yellow River three times during crop growth period and the change was small. The mean salinity of the irrigation water is only around 100 mg/L. In the revised manuscript, it was revised as "… Irrigation water originates from the Yellow River. The change of the irrigation water salinity is small and can be ignored during the crop growth period. The area has an arid continental climate…" in line 449-450.

**Page 25. Number 1:** Was the salinity of the irrigation source water measured? Was the actual salinity of the irrigation water used in the mass balance (equation 18 of the model)?

**Response:** Yes, the salinity of the irrigation source water was measured three times during crop growth period and the change of the salinity was small. The mean measured salinity of the irrigation water was used in the mass balance. And we

assumed it is unchanged during the crop growth period. In the revised manuscript, it was revised as "… The fields were irrigated by flooding the field ranging from two to five times during the growing season (Table 1). The salinity of the irrigation source water was measured three times during crop growth period and the mean value was used in the mass balance. The salinity of the irrigation source water is assumed unchanged" in line 472-474.

**Page 32. Number 1:** As noted in the previous revision, it is difficult to distinguish between the blue dot markers that are in the legend from those that represent data. In five of these panels above (Figure 5), the legend lies within the data range. Possibly it would be better to use only one legend for all six panels and have it located outside the domain of the data. The same problem is observable in figure 6.

**Response:** Thank you for your suggestion. The legend and figures were revised as follows:

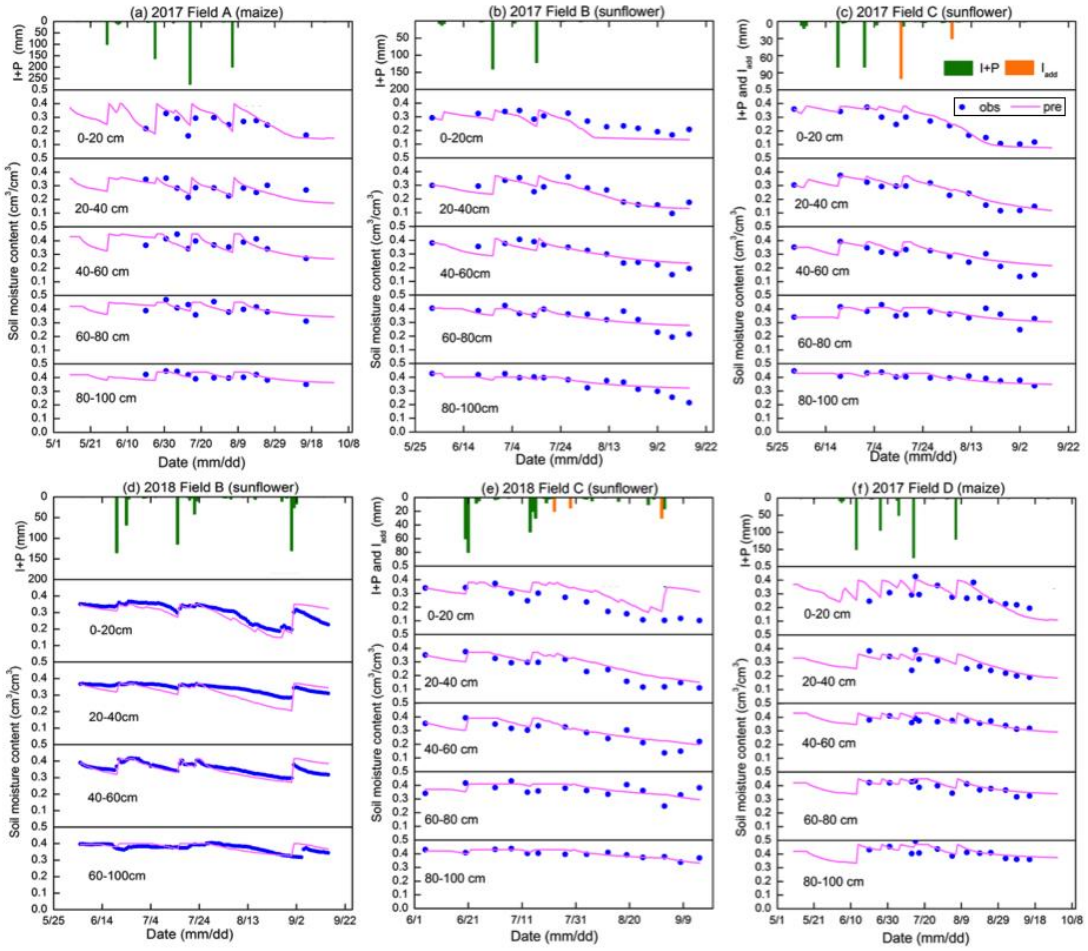


Fig. 5 Observed (blue dots) and simulated soil moisture content of the Shahaoqu experimental fields during model calibration (a,b,c) and validation (d,e,f)

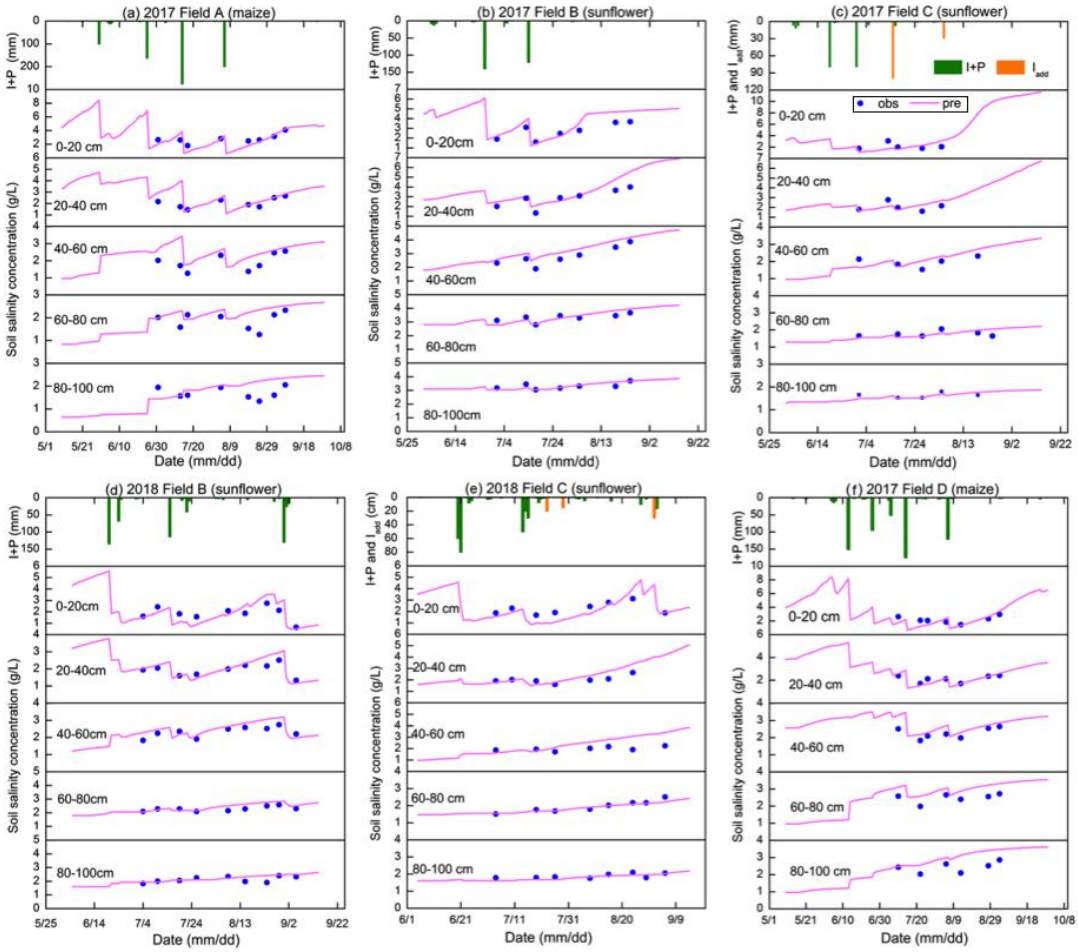


Fig. 6 Observed (blue dots) and simulated soil salinity concentration of the experimental fields in Shahaoqu during model calibration (a,b,c) and validation (d,e,f).

**Page 49. Number 1:** Although dilution of salinity during irrigation events seems evident in the observed data, I would still recommend adding that future refinement of the model would be served by measuring the salinity of irrigation source water. This would be more important if this model was implemented for irrigation that depends on groundwater sources, especially hydrologically closed basins.

**Response:** Thank you for your suggestion. As we explained before, the mean salinity of the irrigation water from the Yellow River is around 100 mg/L according to the measured data and the change of the salinity can be ignored during the crop growth period. Thus we didn't consider the change of salinity of the irrigation water in this study. However, as the reviewer commented, the salinity of irrigation source water would be more important if this model was implemented for irrigation that depends on groundwater sources, especially hydrological closed basins. Therefore, we add this in the revised manuscript as follows:

"To obtain more accurate results in the future, the upward capillary flux from

groundwater needs to be improved. Also, future refinement of the model would be served by measuring the salinity of irrigation source water. This would be more important if this model was implemented for irrigation that depends on groundwater sources, especially hydrologically closed basins. In addition…" in line 862-865.