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Hydrology and Earth System Sciences Discussions

Interactive comment on "Integration of vegetation indices into a water balance model to estimate evapotranspiration of wheat and corn" *by* F. L. M. Padilla et al.

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We would like to thank Reviewer #2 for the helpful comments on the submitted manuscript.

Specific comments 1) "In the 2009 campaign, the spectral data on wheat canopy have been acquired by ground field radiometry, simultaneously to those acquired in the same canopy by multispectral satellite data. No comparison is provided in the text between vegetation index derived from satellite and from field radiometry data. This comparison is relevant because it could provide valuable indications about the quality of the spectral

satellite and field radiometry data. If the spectral data, as it could be expected, were inter-comparable, I would suggest presenting figures 3(b) and 5(b) in only one figure, because both are describing the 2009 wheat campaign."

We agree with the reviewer on the advisability of including the comparison between a satellite-derived and ground-derived vegetation indices, and a new figure addressing this comparison have been added and commented in the text. Nevertheless, despite fig. 3(b) and 5 (b) are describing the same season, we have preferred to keep it separated, giving us the opportunity to evaluate each sensor separately.

2) "About the utilization of Landsat7-ETM+ imagery, it could be useful to specify in the text the procedure used to avoid the gaps from the scan-line corrector failure, in the areas of the study plots."

The SAVI equation results in zero when a pixel, affected by SLC-off issue, is labeled as NODATA in red and near-infrared bands. When some of this pixels fall within the experimental plots, its values can be easily ignored when calculating the statistics.

3) "Some comparison or comment about the relationship used here with other similar relationships referenced in the literature would be convenient, because it is needed to assess the reproducibility of the procedure. Is Eq. 4 crop dependent? Is it needed to know the value for SAVImax for each crop to apply the Eq. 4? Please, clarify."

- A revision of previous works using similar relationships in the same and different crops is presented in the introduction section (P 8634 L20-28). - SAVImax is crop dependent and this is clearly indicated now in the text. However, the authors have found almost constant values in field measurements (0.65-0.7) for irrigated field crop, such as cotton and sugarbeet (González-Dugo and Mateos, 2008), tomato, wheat and corn (Diaz et al., 2009). The same values have been confirmed by field measurements in this study over wheat and corn.

4) "The integration of vegetation indices in the water balance approach enables to

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estimate soil water content and water stress, which is one of the most valuable contributions of this paper. Nevertheless, it is well known that there is uncertainty associated to the value of parameters such as REW, TEW, root depth (maximum and minimum), which are shown in Table 1 and 2. Perhaps some comments about the weight in the results of the assumed values for these parameters could be expected by simulating with a range of values."

We have performed a sensitivity analysis, as suggested by the reviewer to address the importance of these parameters (TEW and maximum and minimum root depth) in final ET values. We have included the results of this analysis in the revised text. Briefly, these results indicate that for the magnitude of variation considered for inputs TEW and Zrmin, its effect seemed to be negligible on seasonal ET. On the contrary the effect of Zrmax was significant and therefore, its calibration deserves higher effort.

5) "Starting point of water balance (soil water content, starting date) must be described."

Information regarding the soil water content and starting date for water balance calculation has been included in the text, as suggested.

6) "For corn, some discrepancies are shown for root zone water deficit between measured and estimated in both campaigns, mainly at the end of the growing cycle, see Fig. 3a and 5a. Nevertheless, the wheat campaign exhibits good agreement between measured and modelled, as seen in figure 5b. Could you explain it?"

The discrepancies between modeled root-zone water deficit values and measured ones at the end of the corn growing season seems to indicate an overestimation of Kcb by the model in both years. This poor reproduction of senescent plant transpiration in corn is not observed in wheat plants and it points out the need for a more specific study on the vegetation index-Kcb relationship during crop senescence.

7) "Page 8644, line 1. I do not understand the sentence: "However the model's estima-

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tion ability is better under non irrigated conditions,:" Please, rewrite this sentence."

This sentence has been rewritten as follow: "the performance of the model was better under non-irrigated conditions, a simpler situation where the possibility of mismatches between model input and actual amounts of irrigated water due to low irrigation uniformity, may represent a source of error"

8) "The period of water stress on wheat is very interesting, and perhaps its description could be broadened. What is the relationship like between ET measured and modelled in this period? It could be interesting to introduce some comments about it. The used threshold value for p, eq. 9, must be mentioned, because the appearance of water stress is determined by this p value."

The interest of this water stress period is pointed out in the new discussion of the sensitivity analysis included in the corrected manuscript. Under these conditions, the influence of Zmax parameter over seasonal ET estimation is more pronounced. Estimations of ET for the period of water stress (67 days at the end of the season) were less accurate (an overestimation of 18 %) than the general figures observed for the whole season. We have added to the text information regarding the calculation of p parameter to complete the model description, including the tabulated value of p and the equation to adjust this value as a function of ETc.

9) "Page 8646, line 8. I do not understand the sentence "The 200 mm of water applied: : : (is it no rainfed wheat?), please rewrite it."

The comment referred to the calculated water amount required to avoid water stress in wheat crop, trying to highlight the opportunities arisen to estimate water requirements and assisting the improvement of water management al field scale. But we recognize the confusion that it introduces in a rainfed crop and it has been removed.

10) ""The units in the x-axis are "DAS". I suppose it is "Days After Seed", but no explanation is provide about it. In my opinion, it would be more convenient to use, in this

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figure 6, the units “DOY”, i.e. Day of the Year, instead of DAS, because DOY units are coherent with those used in previous table 3 and figures 3 and 5.””

The units in the x-axis of figures 3, 5 and 6 have been changed from DAS or DOY to DAE (day after emergency) following the suggestion of reviewer 1. In addition, DAE has been added to table 3. All x-axis units in the figures are now consistent with each other and with the units in table 3.

11) “No data about harvest date is provided in either crop.”

Harvest dates are now included in the text.

12) “Number of days with available measurements of ET for each campaign is not provided.”

Number of days with available measurements of ET for each campaign is now provided in the text.

13) “Pag 8638, line 2, add “as a consequence of water deficit””

This sentence has been added to the text.

14) “(Kustas and Norman, 1999) is not in the Reference list.”

The reference has been included.

15) “Table 1.- Please, could you explain the parameter “Maximum effective root coefficient”. I think could be a mistake.”

This mistake has been corrected. This parameter is “Maximum basal crop coefficient”.

References Díaz, A., González-Dugo, M.P., Escuin, S., Mateos, L., Cano, F., Cifuentes, V., Tirado, J. L., and Oyonarte, N.: Irrigation water use monitoring at watershed scale using series of high-resolution satellite images. In: C.M.U.Neale, A. Maltese (Eds). Remote Sensing for Agriculture, Ecosystems and Hidrology. Proc. SPIE. Vol. 7472. Pág. 74720E-1, 2009. González-Dugo, M.P. and Mateos, L.: Spectral vegetation

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