Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-301-RC2, 2020

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Projection of irrigation water demand based on the simulation of synthetic crop coefficients and climate change" *by* Michel Le Page et al.

Anonymous Referee #2

Received and published: 16 September 2020

This manuscript describes an enhanced approach to estimate crop coefficients, using corrected linear and tuned multilinear regression equations, to project future irrigated crop water demands, under two given climate scenarios for an irrigated region in Morocco.

Overall the paper is nicely written, and an adequate number of background studies and references are offered throughout the paper. The final results presented seem somewhat sufficient to support their approach and methods described. However, not many results are shown or addressed that support the title of the paper, and how the climate scenarios have any real impact on the irrigation water demand. The paper is

organized somewhat well, but some key details and background seem to be missing or making connections between each of the sections, especially in the Results and Discussions section. Some suggestions are offered below to hopefully help improve and further clarify the results of this paper. Finally, a couple of key conclusions are offered towards the end, however, one of the limitations of this study is that the approach was only applied for a small region in Morocco and not much discussion is given in how it may be applied to other regions, crop types, etc.

Major comments:

The introduction seems somewhat disconnected in how the authors present their case, hypothesis, background, and approaches. Also, more detailed connections should be drawn between each of the paragraphs to help with the flow and motivation more than simply introducing some key concepts.

Page 8, lines 225-230: This summary paragraph of the results related to Figure 4 refer to calibrated and validated years. However, in the previous paragraph in Section 4.1, the authors describe in the second sentence that the plots include calibration "over the entire time series". Then there is Figure 5, which is never mentioned or hardly discussed in the results discussion, though some of the statistical results are discussed, e.g., such as the last sentence on page 8 (lines 230-231), for the 1/3 test. Please make sure to address these issues in a future submission, and that results are well described and figures are discussed appropriately.

Minor comments:

Abstract: The abstract text seems to skip critical information when relating the future climate scenarios and the use of the derived synthetic crop coefficients. For example, on line 19, the authors mention "loss of performance . . . is to be expected for two time periods after the observations (2050)". How does "2050" relate here to the "two time periods"? What are they? Then the authors mention "This flexible system of equations" – what system of equations? The authors have room to increase the content of the ab-

stract to help the summary make sense for readers potentially interested in reading the article. However, it is hard to follow the summary of results and methods introduced by the current way it is written. Also, what are the "two agricultural scenarios" mentioned on line 22? Again, it would be useful to at least provide some introduction or link back to early in the abstract the ties when such references are made.

Page 2 – Lines 33-34: Please clarify a bit more here what is defined by "dynamics of irrigated areas is strong". What dynamics are specifically referring to, e.g., overexploitation of groundwater, changing climatic conditions, etc.?

Page 3 – Lines 65-69: Please more fully describe and support with previous studies the types of approaches (i.e., "classic approach" vs. "a curve fitting" one) that are mentioned here. The language used here is somewhat vague on the background of the different approaches.

Page 3 – Line 79: Add either a comma, or more appropriately a semicolon, and the word "and" between "climate change" and "3) an alternative scenario. . ."

Page 3 – Line 86: The figure referenced here, "Figure 3", should be "Figure 1".

Page 3-4, Lines 94-102: This last part of the paragraph (Section 2.1) seems more appropriate in the Introduction section as part of the motivation in conducting this study. Authors may want to consider moving part or most of this description to the Introduction.

Page 4, Lines 114-115: Which station surface network data were used to evaluation the GSWP3 forcing fields? Or are you citing values from another published reference here? Please further specify the source for this GSWP3 validation and results.

Page 4, Line 117 (last sentence here): Which "meteorological dataset extends from 2000 to 2050", e.g., the downscaled RCP fields? Please further clarify this statement or move to a different location within this paragraph to accompany the appropriate data set description.

Page 4, Line 118: Please spell out the full acronyms for "MODIS" and "NDVI".

Page 5, Line 132: "small rainfalls" should simply be "small rainfall events . . .".

Page 7, Line 179: "GCMs" is referred to here, but nowhere in the paper is this mentioned. Did the authors mean to refer to the "RCMs" or "RCPs"?

Page 7, Lines 181-188: The authors indicate the years selected for calibration and validation, however, only the calibration years are noted here and how they are grouped. How are the validation years then selected separate from the calibration years? Please describe in more detail and clarify why the use of the different calibration year set groupings were selected.

Pages 7-8, lines 195-205: Please provide a bit more detail in how the upper limit of the crop-cover expansion is used to "bend the curve" and derivation of the coefficient, bc, is estimated.

Page 8, line 236: Why would Kc values "plummet in the rare wet years" and only for the Mejjat region? Wouldn't more rain simply mean less irrigated water demand but Kc values remain up? Please explain further why this occurs.

Page 8, line 238: "XX century" – do the authors mean at the beginning of the 21st Century, starting around 2000? Please check what was is intended here.

Page 9 + Figure 6: The results described here in relation to Figure 6 make many assumptions about how future crop coefficient values and irrigated scenarios play out under the different climatic scenarios and alternative Kc approach. The authors describe some of the results, but there appears to be some issue with how a value approaches certain constant values, such as for Ourika, that it makes it somewhat difficult to understand the results fully. The authors may want to revisit whether these results are actually robust and update their description here, as needed.

Page 9, line 240: Change "feed" to "fed".

Figure 2: Make sure “NDVI” is consistently used throughout the figure. For example, noticed “Ndvi” in the “Empirical Relationships” container should be capitalized. Also, in the caption, “parenthesis” should be changed to “parentheses”.

Figure 3, title and caption: It would be helpful if details of which irrigated area, crop type, and month were highlighted in this example figure and caption.

Figure 4: Do these plots reflect the simulated Kc values of Equation 9? Authors may want to specify that here in the caption.

Figure 6: It is difficult to distinguish the four grey lines from each other in this plot and what is conveyed in the legend. It might be better to switch or replace some of the time series with colored lines.

Figure 8: “gravitary”? Did the authors intend to indicate “gravity” irrigation type? Authors might want to indicate that the graphic is showing “cumulative” IWR and rainfall for the two year period.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-301, 2020.