

Additional response to Interactive comments on “Sensitivity and uncertainty in crop water footprint accounting: a case study for the Yellow River Basin”

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Dear Dr. Tuomas Mattila,

We appreciate your very valuable and helpful comments and suggestions concerning our manuscript. Given enough time, we studied comments #2 and #3 carefully again and improved our responses as follows:

Response #2: We accept your comments and the editor’s recommendation to include the sensitivity analysis of S_{max} , K_y and Y_m . Here we show the result of the sensitivity analysis of WF estimation to variability in S_{max} and K_y for maize, as an example, in Fig. 1. Both CWU and Y decreased with larger S_{max} . Increased S_{max} means higher water stress in crop growth, resulting decreased K_s and total ET (Eq. 8), then less Y (Eq. 9). The reduction in crop yield is larger than green CWU leading to larger green and total WF per unit mass of maize. Only yield estimation is sensitive to changes in K_y . Yield simulations decreased with increased value of K_y (-5.7% and 7.9% change of maize Y to +/-20% in K_y , respectively), which leads to a same order of magnitude of over-/under-estimation of the WFs (6.1% and -7.3% change in maize WFs to +/-20% in K_y , respectively). The sensitivity of crop WF to changes in Y_m is linear: 20% increase in Y_m results 20% increase in Y and 20% decrease in the WFs. The complete sensitivity analysis of the three parameters for four crops will be presented in the revised paper.

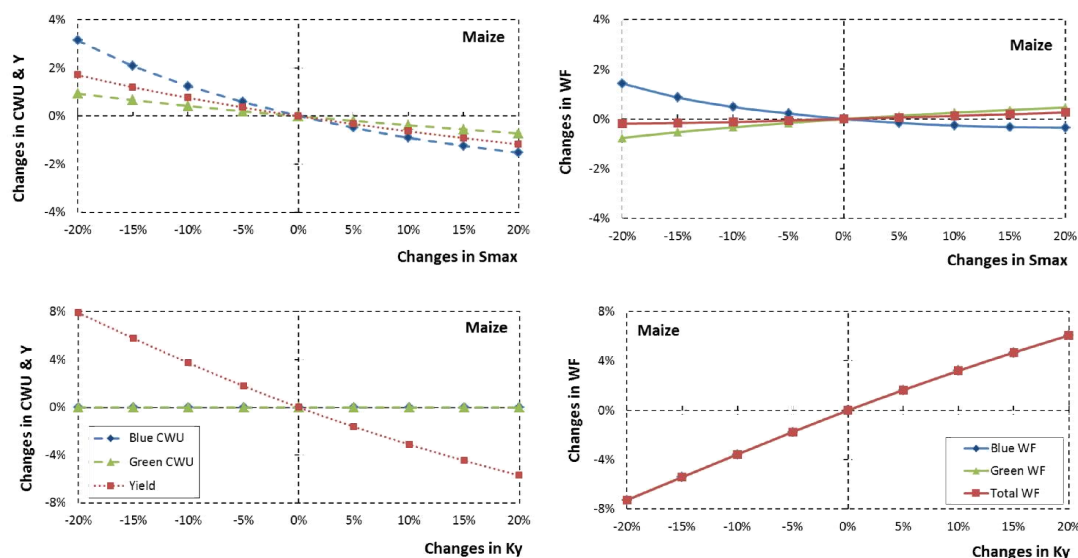


Figure 1. Sensitivity of CWU, Y and WF of maize to changes in the maximum available water content (S_{max}) and yield response factor (K_y), 1996-2005.

We acknowledge the referee's valuable comment regarding discussion of the use of stored rainwater (through organic matter) to increase water holding capacity of the soil. We will add a discussion accordingly in the revised paper.

Response #3: A sub-model for crop growth would definitely improve the quality of the final modelling results. However, the model we tested, also called as a 'crop water model', has been widely used in WF estimation with a daily vertical soil water balance mode as described in 3.1 (Page139, lines15-20). For this reason we will not be able to implement the suggestion for the current study. But it will be considered in our future study on crop WF assessment.

The suggestion on making the GDD as constant when analyzing the sensitivities to crop planting date is very valid. We carried out the sensitivity analysis by shifting crop-planting date with constant GDD. The new results show a significant change in response direction of blue CWU for soybean and green CWU for wheat to late planting (Fig.2), compared to the results shown in Fig. 5 of the discussion paper. The reason for larger blue CWU of soybean with late planting was due to the extension of the growing period till November which has insufficient rainfall to meet the crop water requirement, therefore, requiring additional irrigation water at the irrigated fields. However, since there is not enough soil moisture on the rain-fed fields, the total CWU and WF were smaller. On the other hand, the growing period of wheat got shorter with late planting giving rise to a decrease in both green and blue CWU. However, the conclusion that the total WF of maize, rice and soybean reduce with late planting is still valid. We will update accordingly the sensitivity and uncertainty analysis to changes in crop planting date by considering the GDD concepts in the revised paper.

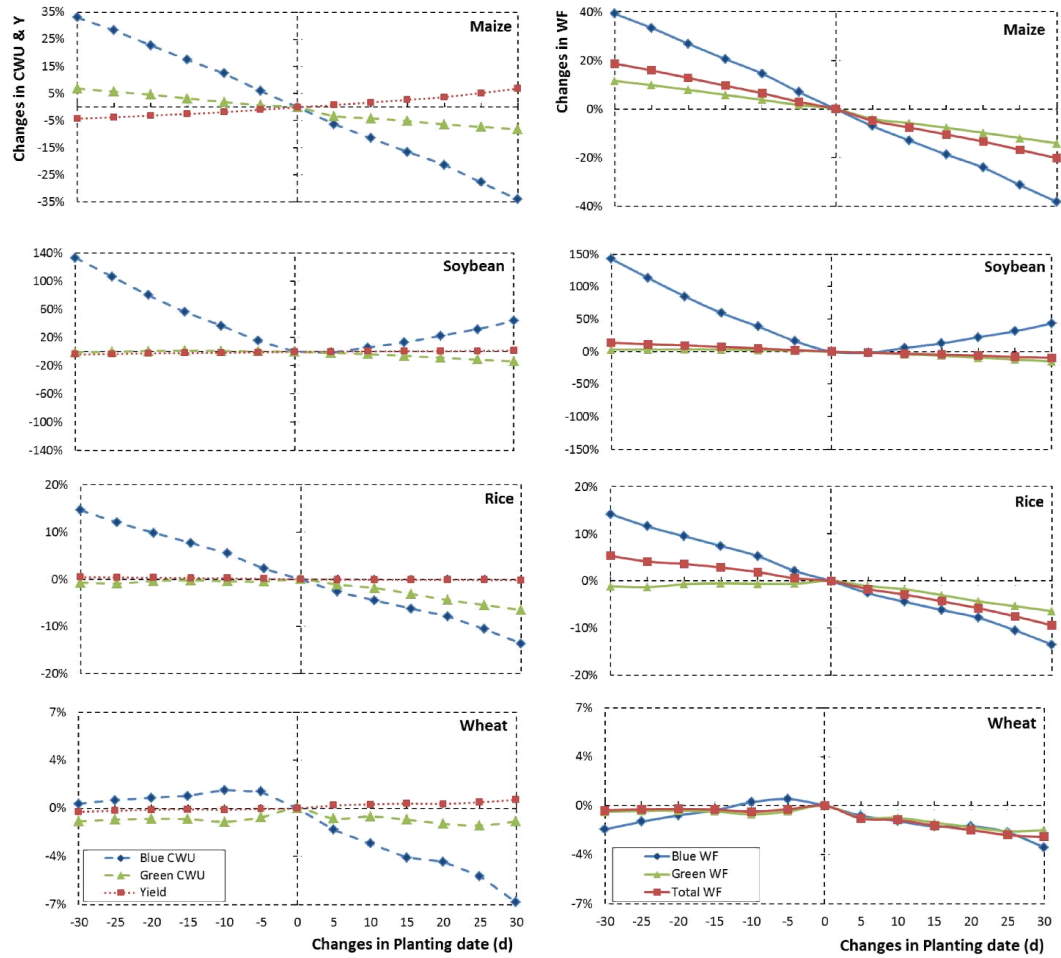


Figure 2. Sensitivity of CWU, Y and WF to changes in crop planting date, 1996-2005.