Authors' 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 Referee #1,

Thank you for your valuable comments and suggestions on our manuscript. We have provided our responses directly below the comments:

Response to Referee #1:

1.) Uncertainties in input variables and output variables considered in the study are described as range around a mean +- 2SD representing the 95% confidence interval (e.g. see page 144, lines 5-14). This assumes a normal distribution of the frequency of variable values. Was this tested and if so, which test was used?

Response #1: The normal distribution of uncertainties (random errors) in ET_0, PR and K_c were not tested but are based on assumptions as stated on Page143, lines5-8. The assumptions were made by following several studies (Ahn, 2007; Xu et al., 2006; Droogers and Allen, 2002; Meyer et al., 1989; Troutman, 1985). We will include these references and improve the text in the revised paper.

2.) Uncertainties in spatial data are scale dependent. Often positive deviations in some regions level out by negative deviations in other regions so that typically, uncertainty declines with growing extent of the considered study region. Consequently, uncertainties for a whole basin or country differ from the uncertainties at grid cell level. The method used here assumes however, that in each model run a similar deviation (e.g. 5% more evapotranspiration than in the standard model run) occurs in all grid cells on all days of the year at the same time. This is quite unlikely and only realistic when assuming systematic biases in measured values. For this paper, this limitation could just be mentioned in the discussion section. However, it limits the applicability of the method for analyses at larger or even global scale, which may be the intention of the authors.

Response #2: We also acknowledged this limitation of the current study, as discussed on page151, line20: "Finally, uncertainty studies will need to be extended ……to other regions and at different spatial and temporal scales…." Our study is carried out for the whole basin level. This limitation will be highlighted in the discussion of the revised paper.

3.) The method to compute crop yields (equation 9) assumes that crop yields are

limited by soil moisture availability only while other limitations like nutrient availability and other biotic and abiotic stressors are neglected. There are many studies in the literature showing that crop water productivity or water use efficiency (both are computed as the reciprocal of the water footprint, Y/CWU) vary a lot in response to fertilizer application rates, plant protection and other measures of crop management. Therefore the uncertainty of the variable yields (and consequently also of the water footprint) may be underestimated in the present study.

Response #3: Thank you for the valid comments. We agree that the current study cannot show the complete picture of the uncertainty in crop water footprint accounting, and is valid only for the tested model. We have highlighted this fact on Page151, lines11-12. We will discuss this limitation in more detail in the revised paper.

Specific comments:

1) Page 144, line 10: Are the 24 meteorological stations, used to compare station specific ET to the CRU-ET, different from the stations used by CRU to generate the ET dataset? CRU lists the stations used to compile the global dataset on their website so that it is possible to check it. The information is useful for the readers because they can better understand the reason of the differences between station data and CRU data.

Response: The locations of the 24 stations used in the study are different from the stations used by CRU (see Figure1). It is apparently one of the reasons for the differences between station and CRU data. We will state the useful information in the revised paper.

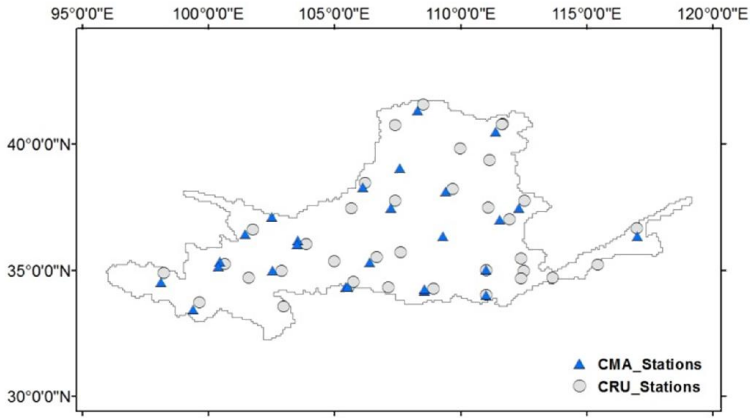

Figure1. The station locations for CMA data and CRU data.

We accept the other technical comments and will address them in the revised paper.

References:

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Troutman, B. M.: Errors and Parameter Estimation in Precipitation-Runoff Modeling: 1. Theory. Water Resour. Res., 21, 1195-1213, 1985.

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