

## ***Interactive comment on “Sensitivity and uncertainty in crop water footprint accounting: a case study for the Yellow River Basin” by L. Zhuo et al.***

**Anonymous Referee #1**

Received and published: 27 February 2014

The paper describes a sensitivity and uncertainty analysis of green and blue water footprints for the crops maize, soybean, rice and wheat performed for the Yellow River Basin and period 1996-2005. The manuscript is well written, interesting and well structured. The methods used by the authors for uncertainty and sensitivity analysis are not new. However, water footprint data are increasingly used and many readers will find it interesting to learn about the uncertainties related to these estimates. The content of the paper fits certainly to the scope of the journal. Nevertheless there are some parts of the manuscripts that need to be improved or should be explained more precise before the manuscript can be recommended for publication in HESS:

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1.) Uncertainties in input variables and output variables considered in the study are described as range around a mean  $\pm$  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?

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.

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.

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

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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.

2) Page 145, line 24: "... a relatively significant underestimation ...". Please use the term "significant" in scientific articles only when relationships were proofed with statistical tests for significance.

3) Please improve the captions of Table 3 and 4. Readers need to check the main text to know about the units of the values reported in the Table 3 or to understand "2 SD for the probability distribution" mentioned in the title of Table 4.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 135, 2014.